# CMDR COE PROCEEDING 2016




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***Dear Readers,***

***Opening the second issue of the CMDR COE Proceeding I am pleased of our common efforts. We all are aware that Crisis Management is one of the core tasks for NATO and EU. Therefore, we have to develop common understanding and capabilities to train, prepare, mitigate and respond in case of emergency. I am sure the present edition of our Proceeding will contribute to the knowledge of effective preparedness and prevention and will be a useful tool for crisis and emergency management.***

***During the last decades the world has changed dramatically. We have seen that the contemporary crises in Europe, Middle East and North Africa have caused enormous amount of casualties. All this affect Euro-Atlantic security environment in a unique manner and require unique measures and preparation to respond as well.***

***Preparing for and handling emergencies, managing crises and responding disasters are an immense task – not only for national governments and EU entities but also for the world community. Crises and disasters normally demand a response that brings together the common effort of a variety of actors and stakeholders.***

***Based on our activities in the last year and the CMDR COE Annual Conference the new edition of our Proceeding focuses attention to factors and implications that insist interactions in response of disasters and crises.***

***Vassil ROUSSINOV,***
***CMDR COE Director***

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## TABLE OF CONTENTS

# GOOD COP, BAD COP: CLIMATE CHANGE AFTER PARIS

***Maria Ivanova***

*The Paris Agreement surprised many, but it was only a first, albeit important, step. Along with the Sustainable Development Goals (SDGs), it could provide the impetus for the United Nations to Deliver as One. Future UN Development System supports and helps accelerate change in the UN development system to increase effective responses to global development challenges – especially in relation to the 2030 Agenda for Sustainable Development. Recognizing the many frustrations that have accompanied UN reform efforts, FUNDS envisages a multi-year process designed to help build consensus around necessary changes. Financial support currently comes from the governments of Denmark, Norway, Sweden, and Switzerland, and UNDP.*

The twenty-first Conference of the Parties (COP21) to the UN Framework Convention on Climate Change (UNFCCC) in Paris was a good COP. It demonstrated unprecedented global collaboration when divisions were deep and stakes were high. Since 1995, when COP1 met in Berlin, governments have been assembling annually in an effort to create a path toward the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."[1] The Kyoto Protocol was agreed at COP3 in 1997; and while it was envisioned as the first step toward emission reductions and did bend the emissions curve for many developed countries, it also launched a heated debate about who is responsible and affected, and who should act. Political consensus eroded and technical negotiations stalled over the years; and COP15 in Copenhagen in 2009 became "the low-point in the history of the climate regime,"[2] or the bad COP. Member states left the Danish capital with an outcome that was not adopted but rather "taken note of."

Six years later, 195 parties unanimously adopted the ambitious Paris Agreement, which set a long-term goal of keeping temperatures "well below 2 degrees C," articulated the intent to reduce that to 1.5 degrees, and committed countries to net zero emissions in the second half of this century. Paris was hailed as a monumental achievement and a game changer.[3] Many tensions remain, however, and success will be measured by what happens in the next three to five years. What led to the shift from a bad to a good COP? What are the threats and opportunities as the world moves from making commitments to implementation?

## Outcomes exceed expectations

Despite structural and political obstacles, the Paris outcome was successful beyond expectations. The agreement is ambitious and universal; it possesses a binding, yet flexible legal nature, clear procedures for accountability, and a credible financial structure.[4] The Paris Agreement is the first document to articulate a clear global temperature goal, which is operationalized by stating that countries aim to peak their emissions as soon as possible and to reach global zero emissions after 2050.[5] It is also universal, with developed and developing countries alike supposed to act. The agreement features binding commitments "to prepare, communicate, and maintain successive NDCs […] and pursue domestic mitigation measures with the aim of achieving the objective of such contributions"(Art. 4.2) and to submit a revised NDC [Nationally Determined Contributions] every five years, which would be informed by a global stock-taking initiative (Art. 4.9). Setting emission targets, however, is left up to every individual country and is therefore considered non-binding. Yet, 188 countries made climate commitments, and the agreement encourages them to become more ambitious every five years.

It also established a legally binding system for measuring, monitoring and reporting progress "with in-built flexibility, which takes into account Parties' different capacities and builds upon collective experience" (Art. 13.1). This transparency creates methodological consistency across national plans and reporting requirements (decision paragraph 95) and sets out to facilitate rather than punish (Art. 13.3), which means that it could serve as a system of early warning and best practices. Importantly, the agreement creates a new capacity-building initiative to enable developing countries to participate more effectively[6] with a regular review of progress toward global goals.

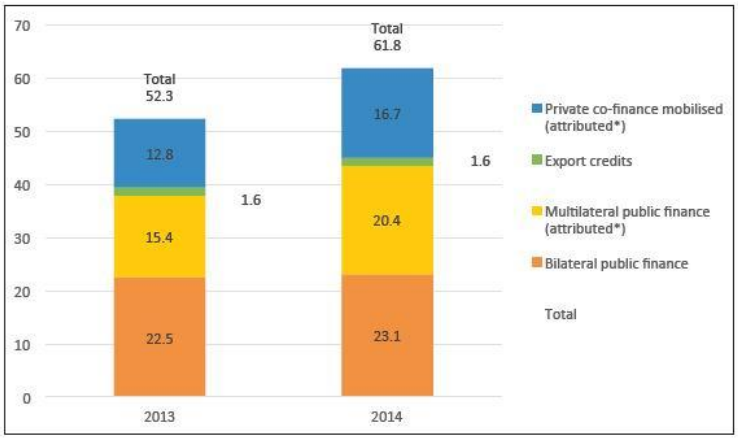



Figure 1: Funds Mobilized for Climate Finance in 2013 and 2014 by Source (US$ billion)

*Source: Susanne Dröge, The Paris Agreement 2015: Turning Point for the International Climate Regime, SWP Research Paper 4 (Stiftung Wissenschaft und Politik German Institute for International and Security Affairs), February 2016, Berlin*

The Paris Agreement also reaffirmed the commitment articulated in Copenhagen to provide $100 billion per year by 2020 to developing countries. Figure 1 shows progress toward that goal. COP21 provided the opportunity to include foreign direct investment, and numerous commitments from institutional investors, banks, and companies have helped. It also established the $100 billion goal as a floor for developed countries' efforts on financial mobilization and

mandated that a new target be decided in 2025. Most importantly, the agreement noted that the shift to low-emission, resilient economies would require a broad and deep transition within the financial sector from high-carbon investments to low-carbon alternatives. By including an overarching financial objective to "[make] finance flows consistent with a pathway towards low greenhouse gas emissions and climate resilient development" (Art 2.1), the agreement confirmed a universal commitment to a low-carbon future.

The successful Paris outcome came together as countries gathered in the French capital just days after the devastating terrorist attacks. Five reasons for success stand out. First, over the last few years, the narrative around climate change changed from a story of sacrifice to one of opportunity. Christiana Figueres, UNFCCC executive secretary, worked relentlessly. "We, as a humanity," she affirmed continuously, "will be able to address this challenge… [countries] can see that this actually gives them much better air quality. It gives them better transportation. It gives them better food security, water security because they are understanding that we can no longer continue down the path of increasing the risk of non-action."[7] Clearer science and more compelling economics led cities, states, companies, and countries to seek an economic transformation that they saw as desirable, inevitable, and irrevocable.[8]

Second, the plight of vulnerable people and communities resonated, and this moral imperative triggered higher ambitions. Small island developing states reminded delegates that they needed "1.5 to stay alive." The High Ambition Coalition led by the Foreign Minister of the Marshall Islands, Tony De Brum, gained momentum and "shook up the dynamics of the developing nation negotiation bloc"[9] when the United States, Canada, Australia, and Brazil joined. Third, a changed narrative, growing number of champions, and shifting political blocs, mounted ever-greater pressure on governments. "All of a sudden, the debate was not about developed versus developing," the EU climate commissioner noted. "It was about the willing versus the unwilling. And no one wanted to be seen as the unwilling."[10] By the end of Paris, 188 countries accounting for 98 percent of the world's population and 95 percent of global emissions filed their NDCs.[11] A similar peer dynamic resulted for institutional investors, universities, businesses, cities, and civil society groups. They launched a portfolio de-carbonization coalition that surpassed a $600 billion target in just days; universities announced divestment from fossil fuels; and 15 of the world's 20 largest banks—totaling close to $2 trillion in market value—made climate commitments.

Fourth, the host government, the UNFCCC secretariat, and the UN Secretary-General offered unprecedented leadership. President François Hollande and Foreign Affairs Minister Laurent Fabius engaged in intense bilateral and multilateral diplomatic legwork with a forward-looking strategy focused on results. UN leadership was essential—from UN climate chief Figueres and Secretary-General Ban Ki-moon.

Fifth, governments created a new political imperative for action. Only two months earlier, they had unanimously adopted the SDGs, a universal set of global goals, which had been negotiated outside of the usual political blocs. A change in the procedural order of the conference shifted the political dynamics and catalyzed ambition. Arriving on opening day rather than the last day of the conference, some 150 heads of state laid out an imperative for action and asked technical staff to craft a plan to get there. The venue, Le Bourget, had the capacity to host all participants, and the spaces for governments and civil society also featured good food and lighting, an atmosphere conducive to casual talks and interactions among negotiators working around the clock.

## The road from Paris: threats and opportunities

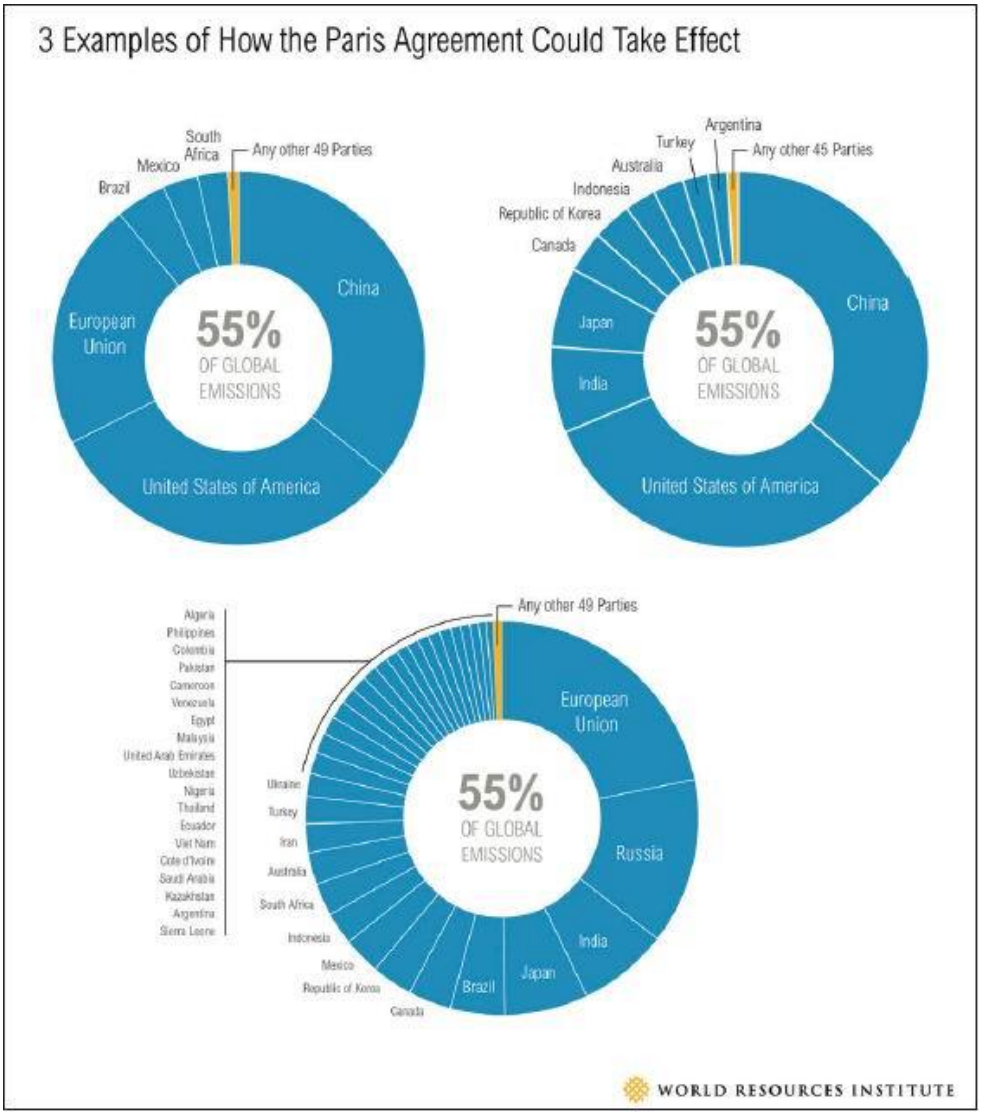
Ultimately, the Paris Agreement is just that—an agreement. It does not ensure that goals will be met; and there are no mechanisms at the international level – legal or otherwise, for climate or other global concerns – to enforce the implementation of obligations. The universal agreement is only the first step. Next stages will include adoption and ratification by national governments and parliaments; implementation of the various provisions; and review and upgrade of the commitments. Throughout, investments will need to grow.

Three core tensions had beleaguered the climate regime from the outset: tension between responsibility for causing and solving the problem; too modest emission reduction goals; and a top-down, rigid legal architecture. In the absence of political and personal leadership, these concerns caused stalemate and resulted in multiple COP failures. The convergence of the five factors partially overcame this but did not eliminate future shortcomings. As countries begin to move from the agreement adoption to investment, implementation, review, and upgrade, they will encounter a number of threats and opportunities.

## Adoption

The Paris Agreement will enter into force when 55 Parties accounting for over 55 percent of global greenhouse gas emissions ratify[12] (as the Kyoto Protocol). A two-stage process of signature and indication of consent to join and be bound by the agreement is necessary to become a party. Domestic approval may entail the notification and introduction to parliament, as in Australia, or the consent of the Senate, as in Mexico. Fiji was the first country to ratify on 12 March 2016, when its parliament unanimously agreed to ratify even before the official signing ceremony on 22 April 22.[13]

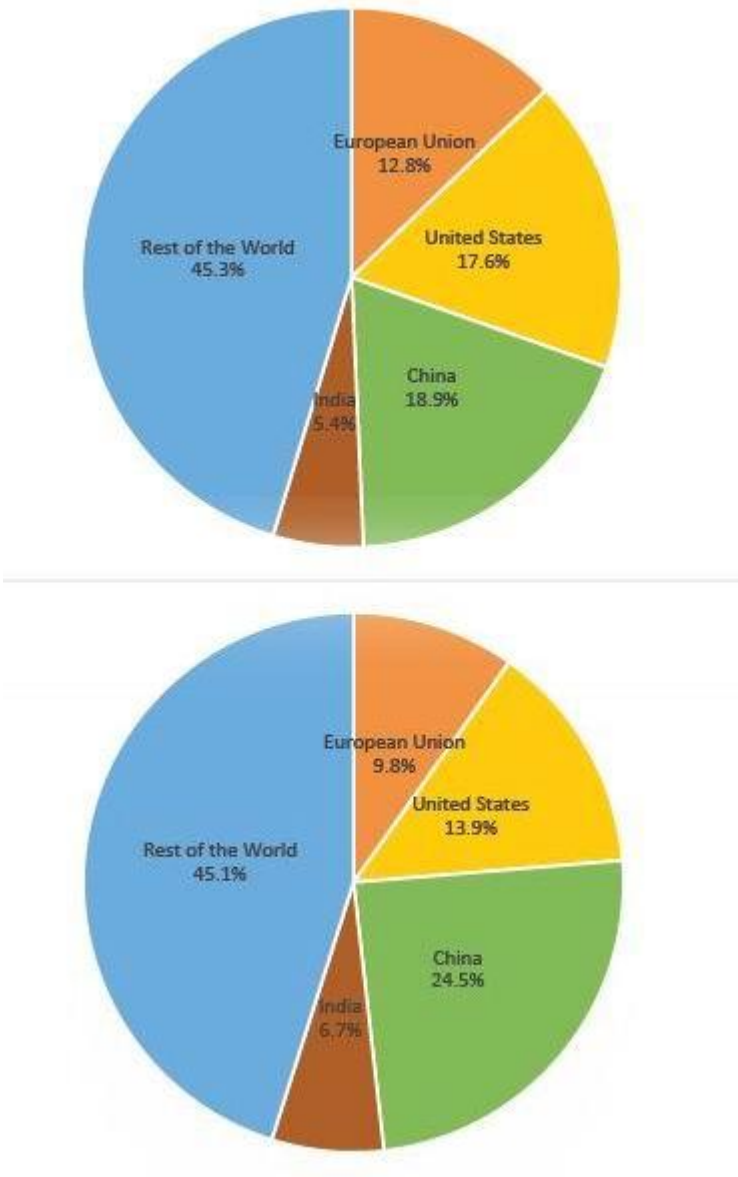
Figure 2. Scenarios for Paris Agreement coming into force




*Source: Eliza Northrop and Katherine Ross, "After COP21: What Needs to Happen for the Paris Agreement to Take Effect?" World Resources Institute. http://www.wri.org/blog/2016/01/after-cop21-what-needs-happen-paris-agreement-take-effect*

Figure 2 depicts several scenarios for ratifications. The Kyoto Protocol took eight years, but the hope for Paris is a faster entry into force. However, the threat of significant delay is real. China and the United States are responsible for about 40 percent of global emissions (Figure 3), and their ratification will be critical to reach the 55 percent target. Indeed, the hybrid Paris Agreement – combining binding and voluntary elements – was designed to enable the United States to adopt the agreement through executive action rather than formal US Senate approval. The European Union has led in climate policy and action and will be essential for the adoption of the Paris Agreement. Political, economic, and security problems in Europe have recently forced attention to other concerns, and some of the 28 member states may delay ratification.

Figure 3: Share of Global GHG emissions in 2005 and 2012




*Source: Susanne Dröge, The Paris Agreement 2015: Turning Point for the International Climate Regime, SWP Research Paper 4 (Stiftung Wissenschaft und Politik German Institute for International and Security Affairs), February 2016, Berlin.*

## Investment

Paris catalyzed unprecedented commitments for low-carbon investment. The agreement presented many of the market signals investors need to accelerate the transition to a cleaner energy economy. As Abyd Karmali, managing director for climate finance at Bank of America Merrill Lynch, noted "The global market for low carbon goods and services is already worth $5.5 trillion a year and this deal will turbocharge the amount of capital

chasing new low carbon investment opportunities."[14] Indeed, 409 investors representing more than $24 trillion in assets committed to increasing low carbon and climate resilient investments.[15]

Business has been arguing for a global carbon price, but governments could not agree on its inclusion in Paris. China, however, plans to create a national carbon market by 2017, an economy-wide reform putting a price on carbon and encouraging large polluters to generate energy from non-polluting sources. Carbon-trading pilots have already been working across seven Chinese provinces and cities. When scaled up, China's carbon market will be the world's largest. A key problem, however, is the lack of basic statistical data about the number of permits issued, and the amount of emissions across sources, making carbon pricing difficult.

The recent decrease in oil prices has raised concerns about reverting to fossil fuels given the existence of supporting infrastructure and favorable prices. A shift to renewables, however, has begun. Moreover, investments in energy are path dependent and difficult and costly to reverse. In 2015, electricity generated by renewables accounted for 90 percent of new electricity generation, as IEA data from March 2016 illustrated in Figure 4. Nine out of 10 new power plants in 2015 were renewable – and five out of 10 were wind.[16] As a result, economic growth and emissions have been decoupled as a growing world economy and flat CO2 emissions over the past two years demonstrate. The Paris commitments sought to amplify this dynamic by boosting clean-energy investments. The International Solar Alliance engages 120 governments in providing conditions for $1 trillion of investment in 1 terawatt of solar energy by 2030.

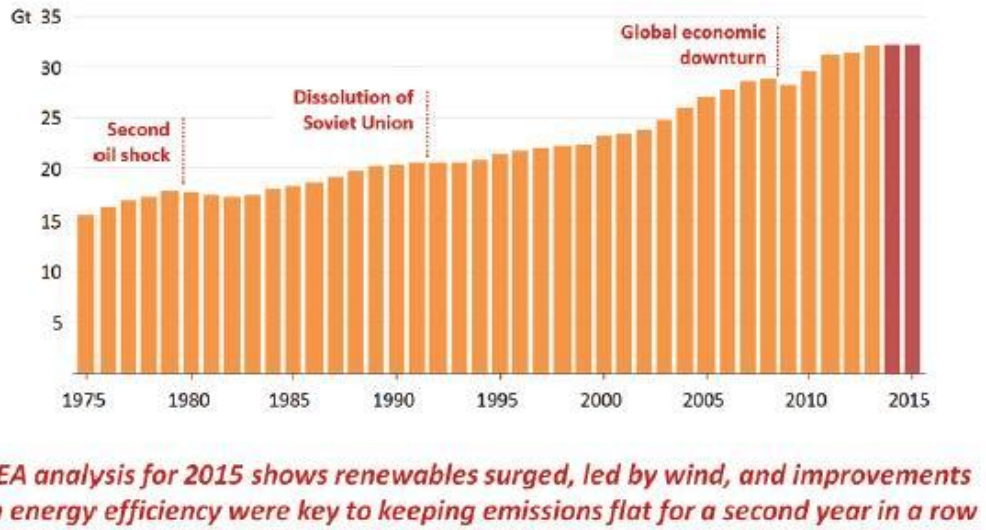
Mission Innovation committed 20 countries to doubling their clean-energy research and development investment by 2020. The Breakthrough Energy Coalition, a global group of 28 investors from 10 countries, committed to funding early stage technology innovation in Mission Innovation countries. As such initiatives intensify; lower oil prices are less likely to shift economies back into dependence on cheap oil.

## Implementation

Reaching the more ambitious goal of stabilizing temperature change at 1.5 degrees would require countries to achieve full decarbonization of their economies by 2050 and net negative emissions in the second half of the century.[17] The cost trajectory of solutions, the availability and affordability of new technologies, and a favorable regulatory climate will be important. The US Supreme Court decision to issue a stay and delay the Clean Power Plan illustrated the risk of delayed implementation and increased litigation. It is unlikely that the United States will be able to fulfill its INDC commitments without the Clean Power Plan, which aims to reduce emissions by 2030 from existing power plants 30 percent

below 2005 levels. The projected reduction had been 10 percent below 2005 levels by 2025.

Figure 4: Global Energy-related CO2 Emissions




*Source: http://www.iea.org/newsroomandevents/pressreleases/2016/march/decoupling-ofglobal-emissions-and-economic-growth-confirmed.html*

While New England states participating in the Regional Greenhouse Gas Initiative have already met the requirements of the Clean Power Plan, others oppose regulation. The court's decision called into question Washington's reliability as a negotiating partner.

## Review and Upgrade

Climate challenge depends not only on countries but also UN organizations. To this end, the UN system should engage in more collaboration to enable countries to implement their current commitments and increase them. Systems for assessing, reviewing, and learning cannot be created by any one country but are the product of an integrated effort. Only then can integrative country strategies be created that combine the SDGs and climate commitments. Engaging a wide array of non-state actors in assessments could lead to greater accountability for state and non-state actors alike. The Paris Agreement and the SDGs could provide the impetus for the United Nations to Deliver as One.

Ultimately, COP21 was accessible and collaborative, characterized by "political will and a spirit of unity"[18] and the resulting Paris Agreement universal, dynamic, credible, and, hopefully, enduring. It offers possibilities for imagining and implementing solutions to reduce emissions and raise resilience across countries by engaging innovatively with ecosystems, by improving efficiency, and by developing new technologies. The December

2015 UN conference in Paris has a place in history as the good COP; it sealed the deal that Copenhagen could not. Being a successful COP, however, will necessitate ambitious government implementation and UN monitoring.

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[1] UN Framework Convention on Climate Change, *United Nations Framework Convention On Climate Change* FCCC/INFORMAL/84 GE.05-62220 (E) 200705 (Bonn, Germany: UNFCCC, 1992), available at unfccc.int/resource/docs/convkp/conveng.pdf.

[2] Annalisa Savaresi, "The Paris Agreement: A new beginning?" Journal of Energy & Natural Resources Law 1, n. 11 (2016).

[3] See Coral Davenport, "Nations Approve Landmark Climate Accord in Paris," New York Times, 12 December 2015, http://www.nytimes.com/2015/12/13/world/europe/climatechange-accord-paris.html; and Fiona Harvey, "World Bank president celebrates 'game changer' Paris talks," The Guardian, 13 December 2015.

[4] Ibid. See also Institute for Sustainable Development and International Relations (IDDRI), "Judging the Paris Agreement: A comparison with IDDRI's 10 criteria for success," 29 January 2016, http://www.blog-iddri.org/2016/01/29/judging-the-paris-agreementa-comparison-with-iddris-10-criteria-for-success/. Ban Ki-moon, "The Paris Climate Challenge," Boston Globe, 25 November 2015.

[5] UN Framework Convention on Climate Change, Paris Agreement, FCCC/CP/2015/L.9/ Rev.1 (Paris: UNFCCC, 12 December 2015), available at http://unfccc.int/files/home/application/pdf/paris_agreement.pdf, Article 4.2.

[6] Elizabeth Burleson, "Paris Agreement and Consensus to Address Climate Challenge," ASIL Insight (forthcoming), January 2016, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2710076. p.12.

[7] NPR, "U.N. Chief: Paris Convention Represents 'Turning Point' In Climate Policy," NPR All Things Considered, 23 November 2015, http://www.npr.org/2015/11/23/457139688/u-nchief-paris-convention-represents-turning-point-in-climate-policy.

[8] David Henry, "White House says climate deal will stand the test of time," The Hill, 14 December 2015.

[9] Burleson, "Paris Agreement," 10.

[10] Miguel Arias Cañete, "Historic climate deal in Paris," http://europa.eu/rapid/press-release_SPEECH-15-6320_en.pdf.

[11] A further 3 percent of global emissions come from international aviation and maritime transport and almost 1 percent of global emissions are covered by countries that are not Parties to the UNFCCC. See Climate Action Tracker, http://climateactiontracker.org/indcs.html.

[12] UN Framework Convention on Climate Change, *Paris Agreement*, Article 21.1.

[13] The country's commitments under Paris are ambitious. The national climate action plan pledges to generate 100 percent of the island's electricity from renewable sources by 2030 and to cut emissions from the energy sector by 30 percent by 2030 compared to business-as-usual, conditional on receiving climate finance.

[14] Michael Stothard and Kiran Stacey, "COP21: Big polluters see no short-term change," Financial Times, December 13, 2015.

[15] Global Investor Statement on Climate Change, http://investorsonclimatechange.org/wpcontent/uploads/2015/12/11DecemberGISCC.pdf.

[16] Global Investor Statement on Climate Change, http://investorsonclimatechange.org/wpcontent/uploads/2015/12/11DecemberGISCC.pdf.

[17] Joeri Rogelj, Michiel Schaeffer, Niklas Roming, Fabio Sferra, Bill Hare, and Olivia Serdeczny, "Feasibility of limiting warming to 1.5 and 2°C," Climate Analytics, November 2015. http://climateanalytics.org/publications/2015/feasibility-of-limiting-warming-to-1-5-and-2c.

[18] Harvey, “World Bank.”

# HARNESSING THE DATA REVOLUTION FOR DISASTER RESPONSE: A CASE STUDY ON THE 2015 HINDU KUSH EARTHQUAKE

***Marc van den Homberg, Data4Resilience***

*Natural disasters are complex events, where both military and humanitarian responders need accurate, reliable and timely information for adequate decision making. Information management is essential to collect, collate, analyze and disseminate data meeting those information needs. Even more so in our digital age, where people and things get hyperconnected and new data -such as social media, captured, sensor and transaction data- emerges at a fast-paced rate. This paper assesses the added value of new data for improving response and describes its implications for information management and coordination by analyzing three case studies of sudden onset natural disasters with different response levels and data poverty contexts: the 2015 earthquake in Pakistan/Nepal, the 2014 floods in North West Bangladesh and the 2013 Typhoon Haiyan in The Philippines. The cases show the importance of data preparedness. Information needs at local, national and international level have to be determined so that all available data from multiple stakeholders can be collected, collated and integrated, for example to establish a baseline on livelihoods and vulnerabilities beforehand, and so that information gaps can be quickly identified once the disaster unfolds. The multitude of crisis impact assessments pinpoints a lack in harmonization and data sharing, especially between the local and international responding organizations. The –often local governmental- paper based assessments led to data granularity loss. New geospatial platforms as well as mobile technologies to digitize the last mile data collection offer potentially ways to improve data sharing, increase timeliness and avoid the granularity loss. Social media conversations did not directly reflect the voices of the most vulnerable due to lack of access to technology. However, decision makers could use social media networks of politicians, gatekeepers and trusted users to improve information management and coordination. In order to benefit from new data, new capabilities such as how to analyze and govern the vast volume of data, have to be developed both by the local, given the importance of linguistic and cultural analysis, and international community.*

*Keywords:* disaster management, information management, coordination, big data, digital volunteers, data revolution.

## Introduction data for disaster management

Natural disasters and complex emergencies are complex events, where both military and humanitarian responders need accurate, reliable and timely data for their response. This

data should cover needs in the area of Crisis Impact (Baseline, Damage and needs, Disaster situation data) and Operational Environment (Coordination, Capacity, Service locations and Security and access)[1]. A strong match between information needs and available data leads to an enhanced situational awareness, improves sensemaking and enables adequate decision making when deciding on response activities. This information management process is challenging given the by definition chaotic and disrupted situation, where decision makers face compressed timelines and high levels of uncertainty. Getting the right and comprehensive data is a highly iterative rather than a linear process, where especially right after the disaster decision makers face an information gap. This gap is widest in regions with a high data poverty index[2]. In the case of the 2014 river floods in Bangladesh the working group on Disaster Emergency Response stated right after floods arrived: "*Based on the information that was available for review it is difficult to get an overview of the flooding situation across the country because of the quality of information available and because of the differences in the collection, presentation and content of the information. In addition, most of the information is several weeks old*."[3]. The heterogeneity in data sets is a consequence of the multitude of procedures and stakeholders involved in a response. During the Typhoon Haiyan in the Philippines in 2013 over 100 responding NGOs and IOs assisted in the on-site emergency operations and about 800 assessments were done[4]. Harmonizing and coordinating the different assessments among organizations is difficult and issues in the data sets that come out of the assessments are most commonly unavoidable. Another reason for the information gap is that all too often communities are insufficiently involved whereas they should be considered as the most important stakeholders; all too often data is collected "on" them, rather than "with" them. Furthermore, the process of collecting information for the "last mile" towards hard to reach communities is often still paper-based. Many governments in developing countries have damage and needs assessment processes that are to some degree based on verbal communication or paper based at the lower administrative levels. One of the key findings from the Nethope Report on Information and Communication Technology Usage in the 2010 Pakistan Floods was for example that seventy-five per cent of information shared with the Pakistan Government was through verbal communication (40 per cent) or paper (35 per cent)[5]. During the Bangladesh 2014 floods the Project Implementation Officers phoned representatives from different wards (the lowest administrative level) and aggregated the data they got into a consolidated format for their upazila (a sub-unit of a district). The way the data was aggregated did not allow to go back to the lower level and led to data granularity loss. Also national and local NGOs have still many paper based processes. Participatory community risk assessments are therefore usually not available when a disaster happens, whereas they could have provided valuable baseline data to responders[6].

## Introduction data revolution

However, we have now entered a digital age. By the end of 2015, there were more than seven billion mobile cellular subscriptions, corresponding to a penetration rate of 97% (ITU). Devices, cars and buildings can form -via sensors, software and networked connectivity- an Internet of Things. People and things get hyperconnected and big data emerges -streaming or in batches- at a fast-paced rate. This new or big data is characterized often by 4V's, i.e. Volume (scale of data), Variety (different forms of data), Velocity (rapid generation, streaming data), and Veracity (uncertainty of data). It ranges from transactional data, captured data (where one can "opt-in" or "opt-out"), social media, sensor data up to biological and public records[7]. In fact, digital traces are left behind in almost any transaction and more and more citizens generate their own on-line content. The Independent Expert Advisory Group for the UN Secretary General on a Data Revolution for Sustainable Development[8] summarizes these developments as follows: "*New technologies are leading to an exponential increase in the volume and types of data available, creating unprecedented possibilities for informing and transforming society and protecting the environment. Governments, companies, researchers and citizen groups are in a ferment of experimentation, innovation and adaptation to the new world of data, a world in which data are bigger, faster and more detailed than ever before. This is* ***the data revolution***."

## Objective

The data revolution seems to offer great opportunities and challenges not only for sustainable development but also for humanitarian aid. However, have some of the least developed countries, affected by conflict and disasters, really entered the digital age? Is there not a great difference in access to data between the developed and the developing world as well as a growing inequality in capabilities to deal with it? This essay aims to assess the true potential of the data revolution for improving disaster response in data-poor regions. It describes the opportunities and challenges of new data for bridging the information gap in general and zooms in on a case study of a sudden onset natural disaster in an area with high data poverty: the 2015 earthquake in Pakistan/Nepal. The essay summarizes the lessons learned and investigates the implications for information management and coordination.

## Opportunities and new players

Mobile phone penetration has even in the least developed countries increased considerably, with penetration grades often between 60 and 80%. In many cases the percentage of people having access to a mobile phone is even higher, given that for example in families a mobile phone is shared among the different family members. Mobile technologies offer various ways to bridge the last mile. Mobile services will give currently

often unconnected vulnerable groups access to information and knowledge empowering them to take action themselves. The mobile phone unlocks SMS-based services such as access to agricultural information and mobile banking. In case of floods, early warning messages can be sent via SMS or voice SMS (to reach also illiterate people) and -vice versa- affected people can text or call specific flood related hotlines to express their needs and send valuable locally collected data such as water levels.

In addition, basic smartphones become more and more affordable and form -in most developing countries- the main device for accessing the internet. Although internet via mobile broadband is still lagging considerably behind as compared to 2G mobile, projections are that this gap will narrow in the coming five years. The smartphone allows a more extensive bidirectional communication and engagement between affected communities and responding professionals. Community volunteers can use apps to do surveys and map their villages. Social media enables affected people to voice directly their needs and concerns. Responders have an additional communication channel to engage. More and more humanitarian actors acknowledge the added value that using social media and monitoring and analyzing social media based feeds could bring[9]. Social media can enhance real-time situational awareness immediately after a disaster or complex emergency as well as in the preparedness phase. Microblogs, i.e. Twitter, have proven to be very useful and are widely used in countries such as in Indonesia and The Philippines, often called the selfie and texting capital of the world. Existing organizations are transforming and adapting to seize these opportunities and to mitigate the risks involved by developing innovative services. UN OCHA has developed the Humanitarian Data Exchange (HDX) to aggregate, store and transform data for the humanitarian community. GeoDASH is the geo-spatial data storing and sharing platform of Bangladesh, where The World Bank played an important role in launching this initiative. GeoDASH is not specifically aimed at disaster management but does contain several related data sets. Social and private enterprises have entered the arena such as (e.g. Ushahidi, Google Crisis Response and Microsoft Disaster Response) and Data-NGOs (MapAction, Humanity Road, Nethope Crisis Informatics) offer Humanitarian to Humanitarian (H2H) services. An important development is the widespread development of digital volunteers offering their time and expertise for microtasks and micromapping in order to analyze big data, such as social media posts and satellite images. The digital volunteers are active through a large variety of Volunteer and Technical Communities (VT&C) such as Humanitarian OpenStreetMap Team (HOT), GISCorps and also through some of the data-NGOs mentioned before. In the Missing Maps initiative both remote and local volunteers work together to map the most vulnerable places in the developing world.[10] UN OCHA has co-created an umbrella organization that tries to bring all these volunteer organizations together so that they can be more easily activated, i.e. through the Digital Humanitarian Network (DHN).

In terms of sensor data, satellite imagery has been important for humanitarian response already for a while through The International Charter Space and Major Disasters, where usually large commercial aerospace companies release costly satellite imagery quickly after a disaster hits for use by responders. Cheaper (nano)satellites and UAVs have the potential to democratize earth observation, since they enable more and more organizations and individuals to create openly licensed imagery. However, access to this kind of imagery is still difficult and limited. OpenAerialMap[11] (OAM) addresses this issue by providing a simple way to search, share and use open imagery.

## Challenges

Clearly the data revolution brings along many challenges. First of all, it might widen the digital divide between developing and developed countries, as discussed already in our objective, but also within a country. A recent study by PewResearchCenter showed for the USA that those with higher education levels and household income are more likely to use social media. Similarly, only the digital literate people know how to protect their data privacy, given that we are living in an "opt-out" online world. Digital inclusion is a strategic cornerstone for many donors. USAID promotes in their programming that an individual has the ability to afford mobile services, is aware of which services exist, values them, and has the ability to use them.

The second challenge is how to analyze the enormous volumes of data and get only the relevant and trustworthy data out of it. Twitter has over 400 million tweets a day and five billion crisis-related tweets since 2011. How to make sense of this enormous haystack of postings? How to understand the context from which postings are written? On top of this, the social media landscape changes continuously and -although Twitter and Facebook remain leading for the time being- different user groups discover and use new social media, with a tendency towards more closed groups applications like WhatsApp[12]. Also there are differences between countries, where for example in Russia VK is more popular than Facebook. Social media analysis tools can usually only analyze the mainstream social media. Another challenge is formed by the fact that it is not possible to get access to all content. The "Twitter Streaming API" releases only 1% of all the tweets produced on Twitter within a certain search window[13] [14]. If one wants access to the full so-called Twitter firehose than one has to pay. Similarly, satellite imagery, especially at high resolution, is only available at high cost and requires highly specialized expertise and/or artificial intelligence in combination with crowd sourcing to make sense of it.

The third challenge is how to avoid data harms. Data harm is the potential for negative impact on individuals, groups and organizations when sensitive data gets disclosed or corrupted. What if Personable Identifiable Information (resulting from the social media data or a combination thereof with other data sets) falls into the wrong hands? How to

avoid negative impacts on individuals or certain community groups? One can think of damage to earning power or even direct physical damage especially in case of complex emergencies.

## Case study

### Context earthquake

Now that the opportunities and challenges are described in a more general way, it is time to look at a specific case. On the 26th of October 2015 a 7.5 magnitude earthquake hit the Hindu Kush mountains and resulted in a death toll of 280 people in Pakistan, 115 in Afghanistan and 4 in India. A complicating factor for the response was that the remote North-East Afghanistan area was affected by Taliban-led insurgency. In terms of the digital landscape[15], both Afghanistan and Pakistan have relatively low mobile penetration at just over 60%, well below Asia's regional average of 82%. Percentage of individuals using the internet is at about 10% in Pakistan and only 5% in Afghanistan. Barriers for internet usage are lack of electricity, education and capacity, no internet connection and cultural restrictions especially for women. In Pakistan only 4% of the population uses facebook, where 53% of these are in the top 10% households by income. Facebook is by far the most popular social media platform in both countries. Only 4% of the social media users in Afghanistan use Twitter compared to about 25 % in Pakistan. In both countries mainly the men have social media profiles and are the ones actively using social media. In Afghanistan 76% of the social media users uses smartphones for access, in Pakistan 30% use a smartphone to access the internet.

### Case study methodology

In our case study we used desk research, interviews and social media analytics. In terms of big data we focused on satellite and aerial imagery and social media. We did not come across the availability and use of other big data sources such as call detail records or financial transaction data during the response. Despite the low social media penetration in the earthquake affected area, we wanted to monitor and analyze social media to see how it was used. We used the SCRAAWL tool[16] to analyze the twitter stream right after the earthquake hit. SCRAAWL can only be used to analyze Twitter, so we could not include public facebook postings. The Twitter API is more open and accessible compared to other social media platforms and Twitter makes it easy to find and follow conversations (i.e., by both its search feature and by tweets appearing in Google search results). Twitter is also fast-moving, meaning that up-to-date information is often available faster on Twitter than through other mediums. We collected 100.000 tweets in around six days and used a search window consisting of event hashtags (such as #AfghanQuake, #AfghanistanEarthquake, #AfghanEarthquake, #quake, #afpakquake, #Earthquakeinafghanistan) and geographical names of the affected area. Shortly after the

earthquake hit, a search job with generic terms (like earthquake, Pakistan) results in tweets largely in relation to the search objective. Later on the search results get "diluted" with other events not in relation to the earthquake.

## Results

### Organizations involved in data collection and collation

Right after the earthquake, a multitude of organisations disclosed situational overviews and initial assessments of the affected areas at a regular, often daily, interval on their websites and through their social media outlets. The National Disaster Management Authority of Pakistan also issued precautionary SMS Alerts in the areas of Shangla, Upper Dir, Chitral and Bajaur through the Pakistan Telecommunications Authority (PTA)[17]. The non-exhaustive list below gives an impression of the many organizations involved in providing response related information:

- National organisations from the countries affected: (NDMAs) and several other ministries.
- International organisations: UN OCHA[18], UNITAR-UNOSAT, IOM, Global Disaster Alert and Coordination System (GDACS), EU Joint Research Centre (JRC).
- National organisations outside the countries affected: USAID, USGS.
- International NGOs: ACAPS, Humanity Road, iMMAP.
- Red Cross and Red Crescent family: IFRC, The Afghan Red Crescent Society (ARCS), Indian Red Cross Society (IRCS), and Pakistan Red Crescent (PRC).
- Digital volunteers: HOT, Google crisis maps.

Some of these organizations collected data themselves, such as the USGS and JRC with their own sensors. Government agencies also collected data directly, although it was not clearly stated on which sources assessments were based, probably local governmental offficials and there was also mention of helicopters being sent to get an overview. Other organizations focused on collating and analyzing data sources, such as ACAPS. With the days the information got more detailed and accurate. "*Badakhshan is a remote, mountainous province, where access is often a challenge*," said IOM Humanitarian Assistance Program Manager Gul Mohammed Ahmadi[19]. "*It may take some time before a full picture of the damage emerges*."

### Satellite and aerial imagery

UNITAR-UNOSAT on behalf of UN OCHA requested a charter activation from The International Charter Space and Major Disasters. The activation was accepted roughly eight hours later on the day of the earthquake and satellite data became available from Digital Globe's Worldview-1, 2 and 3 satellites[20]. The geodata became also available through the HDX[21]. The Pakistan Air Force Aerial carried out an aerial photography survey

and the Pakistan Space and Upper Atmosphere Research Commission (SUPARCO)[20] provided satellite imagery. In none of the situational reports reference was made to the use of UAVs. It is not clear at the time of writing whether or how (directly/indirectly) the national authorities made use of the satellite data that became available through the International Charter. The Humanitarian OpenStreetMap team started right after the disaster annotating satellite imagery from DigitalGlobe, provided to them via MapBox[22]. The Activation for the earthquake on the Afghanistan and Pakistan border[23] was not a typical response as HOT neither had much of a local community[24], although an HOT Member is original from Afghanistan and was assisting in connecting with local organizations, nor did HOT receive specific information needs from responding organizations. The HOT Activation Working Group members determined as their first priority -given the lack of baseline OSM data- to map the road network towards remote and mountainous areas and to identify residential areas polygons (in relation to identifying populated places). The HOT team did not map the affected area in Pakistan, because there were concerns as to whether Pakistani Open Street Map (OSM) volunteers would be compliant with Pakistani regulation and laws. 50% of the affected area in Afghanistan was mapped by remote volunteers. Since there was no local OSM community to help with ground verification and mapping priority, it was difficult to hold the attention of the remote mapping community for very long. There is another, also OSM based volunteer mapping initiative in Pakistan, i.e. MapGive-Pakistan, but they did not seem to be involved in mapping activities for the earthquake response. MapGive is a global initiative of the U.S. Department of State's Humanitarian Information Unit with chapters in a number of countries.

## Social media

The Twitter analysis showed that top mentions and retweets come from politicians, celebrities and official accounts. These are all accounts with many followers. The Indian premier Narendra Modi tweeted "*We stand ready for assistance where required, including Afghanistan & Pakistan*" and received more than 3500 retweets. Prominent Pakistani politicians from across the spectrum have joined Twitter as well[25] although Pakistan Prime Minister Nawaz Sharif does not have a twitter account. His daughter did however tweet in reaction to the earthquake. Imran Khan, the former cricket star who now heads the Tehreek-e-Insaf (PTI) party, boasts nearly 300,000 followers. He created a trending hashtag to express his compassion with the earthquake victims #IkstandsWithEQvictims. Other important accounts were from the Khyber Pakhtunkhwa province where PTI rules. A celebrity who received many followers was the cricket player Shahid Afridi. Tweets were coming mostly from Pakistan and UK; most likely related to the large number of Pakistani migrants in the UK. Tweets referred mostly to url's from Western news sources.

Humanity Road had already a list of Twitter accounts of interest prepared before the disaster happened. It consisted of accounts from well-informed journalists, police,

government and international agencies. Confusingly, the Pakistan NDMA had two twitter handles: @ndmapk and @PakistanNDMA, with the latter counting 160 tweets since 2010. There is no Twitter account from the Afghanistan NDMA (ANDMA). Following the tweets from these professional accounts was very beneficial in getting quick updates about for example also when new situation reports became available.

We did not identify tweets from people directly affected by the earthquake. Many reasons can be the cause of this. Most importantly, as we stated before, the low twitter penetration. Another reason might be the linguistic limitations where the social media analytics tooling only allowed for those languages that google translate can handle, which meant no Pashto and Dari. Main languages of the tweets analyzed were English, than Urdi and Indonesian. Lastly, to find tweets from people affected one needs to increase the signal to noise ratio and find ways to get rid of the accounts with many followers. Their tweets will otherwise prevail, since affected people have usually not many followers/tweets. In some cases, it might also help to add very local hashtags and to specifically monitor local civil society organizations.

## Conclusions and recommendations

The data revolution brings disaster responders a whole new spectrum of data of which the full potential still has to be discovered and exploited. It is beyond doubt that the role that data plays in humanitarian policy and operational response needs to be strengthened and accelerated so that aid can be better targeted and create higher impact.

The information needs of disaster responders should be leading in this endeavor. Information needs at local, national and international level have to be determined so that all available data from multiple stakeholders can be collected, collated and integrated, for example to establish a baseline on livelihoods and vulnerabilities beforehand, and so that any remaining information gaps can be quickly identified once the disaster unfolds. The multitude of crisis impact assessments pinpoints a lack in harmonization and data sharing, especially between the local and international responding organizations. Identifying the information needs beforehand could also assist in tailoring the assessments further and in minimizing the amount of data that is going to be collected.

For data poor contexts in developing countries it will be important to find a right balance in using resources to obtain and analyze these new data sources versus focusing on getting local data collection processes, now often paper-based, digitized and more granular. It will also be a matter of finding a right balance between human and digital proximity. Too much focus on the digital part might lead to a misleading notion of having solid data whereas a large group of the affected population might not be represented in the dataset. Also social media conversations can never yield an in-depth understanding of local sentiments and cultural issues as face-to-face communications can do. However

digital technologies are very powerful in providing a fast and increased reach to remote and before unconnected communities and areas.

To this end, professional responders, whether international NGOs from the Global North or national and local organizations from the Global South, should develop a coherent data strategy, a digital roadmap of how to include big data into the disaster management cycle but also into their internal processes. NDMAs could play a key role in developing such a comprehensive digital strategy in order to benefit from the data revolution to the fullest and play a key role in developing and capacity building an ecosystem of relevant stakeholders in their country involved in disaster response that have sufficient digital literacy.

We found initial evidence that there is still a collaboration gap between well-meant international data initiatives and national and local realities. Digital Humanitarian Networks is a framework between international formal responders (such as UN agencies, IFRC and large NGOs) and digital volunteers, however there does not seem to be such a framework between national governmental responders and the international community specifically in terms of data preparedness. Creating strategic partnerships and building relationships between national and international organizations is a protracted process that requires patience and perseverance. This matches not too well with often short term response activities, where for example remote digital volunteers can only devote their free time usually in specific bursts. Local ownership is in the end key for data initiatives to become sustainable and used to their fullest extent and can also lead to a better definition of the information needs.

The big data technologies can be very beneficial in closing the collaboration and information gaps. Geospatial platforms offer potentially a way to make humanitarian data easy to access, share and use. Mobile devices can be used to digitize the last mile data collection, increase timeliness and avoid the granularity loss. Social media conversations did not directly reflect the voices of the most vulnerable due to lack of access to technology. However, decision makers could use social media networks of politicians, gatekeepers and trusted users to improve information management and coordination. It will be important to already beforehand establish a baseline, gather a list of important @accounts and #hashtags and run analyses to get a feel for the volume of tweets and trends on these accounts and hashtags. National authorities can also promote the use of standards in social media, such as The Filipino Government's Official Strategy on Crisis Hashtags. UN OCHA promoted standardized hashtags in the Ebola response[26]. In addition, humanitarian data can be standardized -to a certain degree- by using the Humanitarian Exchange Language[27]. In order to benefit from new data, new capabilities such as how to analyze and govern the vast volume of data, have to be developed both by the local, given the importance of linguistic and cultural analysis, and international

community. Twitter analysis run by locals will most likely give additional key information, given that they have more direct access to the twitter firehose of tweets from their region, can search in local languages and do cross analysis with other local media channels. Local mappers are also key for analyzing satellite imagery. However, without local mappers there is no 'life' to OpenStreetMap, people are needed who care and are passionate about making sure their town or region is represented on the map, kept up-to-date and ready before disaster happens.

All in all, we recommend a strong focus on data preparedness through capacity building, regular multi-institutional mapping of data sets on information needs, creating close partnerships to close collaboration gaps, especially between the Global South and the Global North and standardization.

## Acknowledgements

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# List of Figures

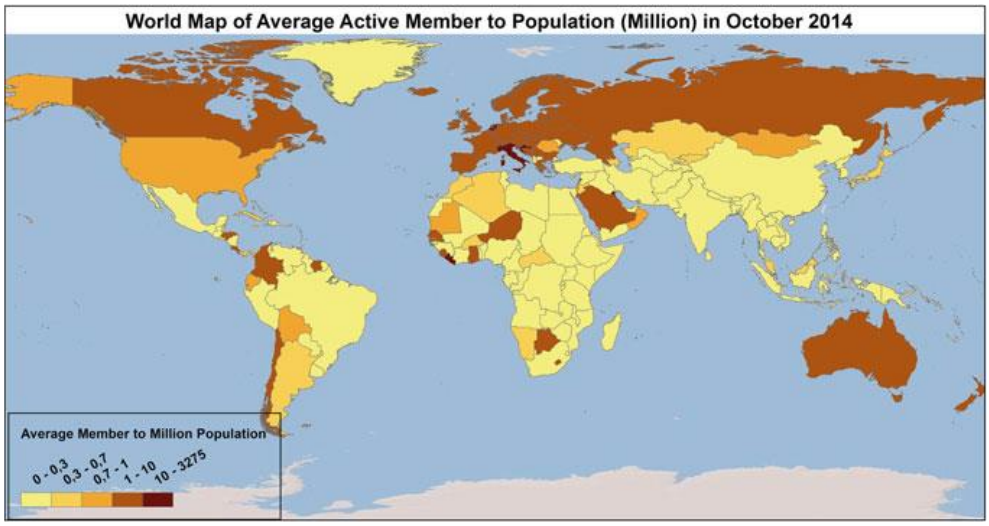



Figure 1 A world map of average number of active members to population (million) in October 2014. (An Introduction to OpenStreetMap in Geographic Information Science: Experiences, Research, and Applications Jamal Jokar Arsanjani, Alexander Zipf, Peter Mooney and Marco Helbich, Springer International Publishing Switzerland 2015, J. Jokar Arsanjani et al. (eds.), OpenStreetMap in GIScience, Lecture Notes in Geoinformation and Cartography)

Figure 2 Residents walk past the rubble of a house after it was damaged by an earthquake in Mingora, Swat, Pakistan, October 26, 2015.
*(REUTERS/Hazrat Ali Bacha)*

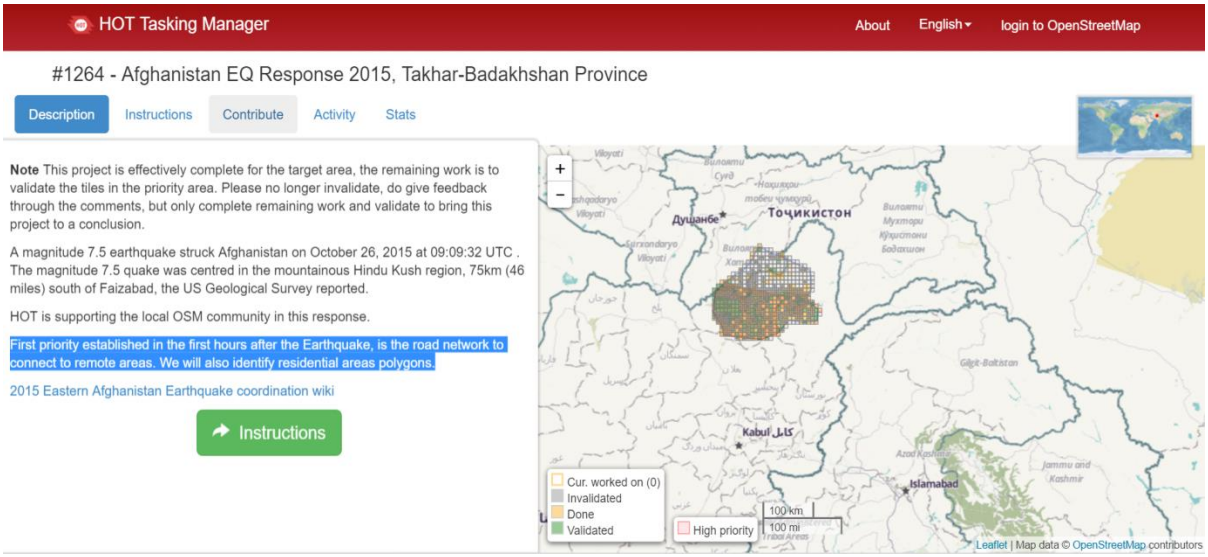
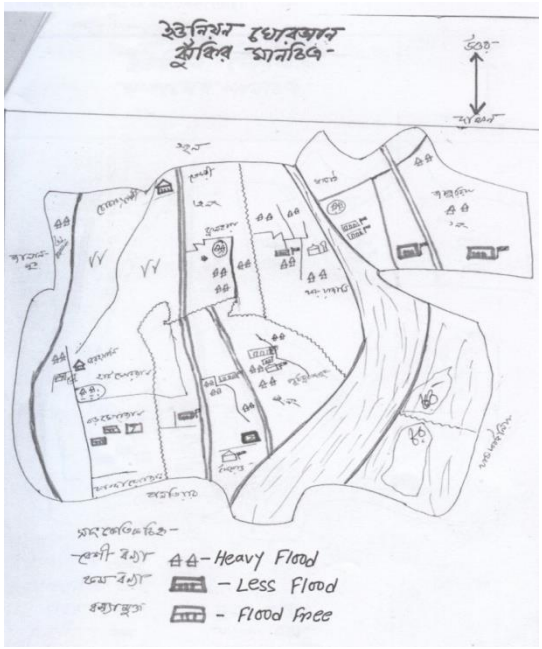



Figure 3 Humanitarian OpenStreetMap Tasking Manager opened right after the earthquake.


Figure 4 Examples of Participatory Community Risk Assessments in India.



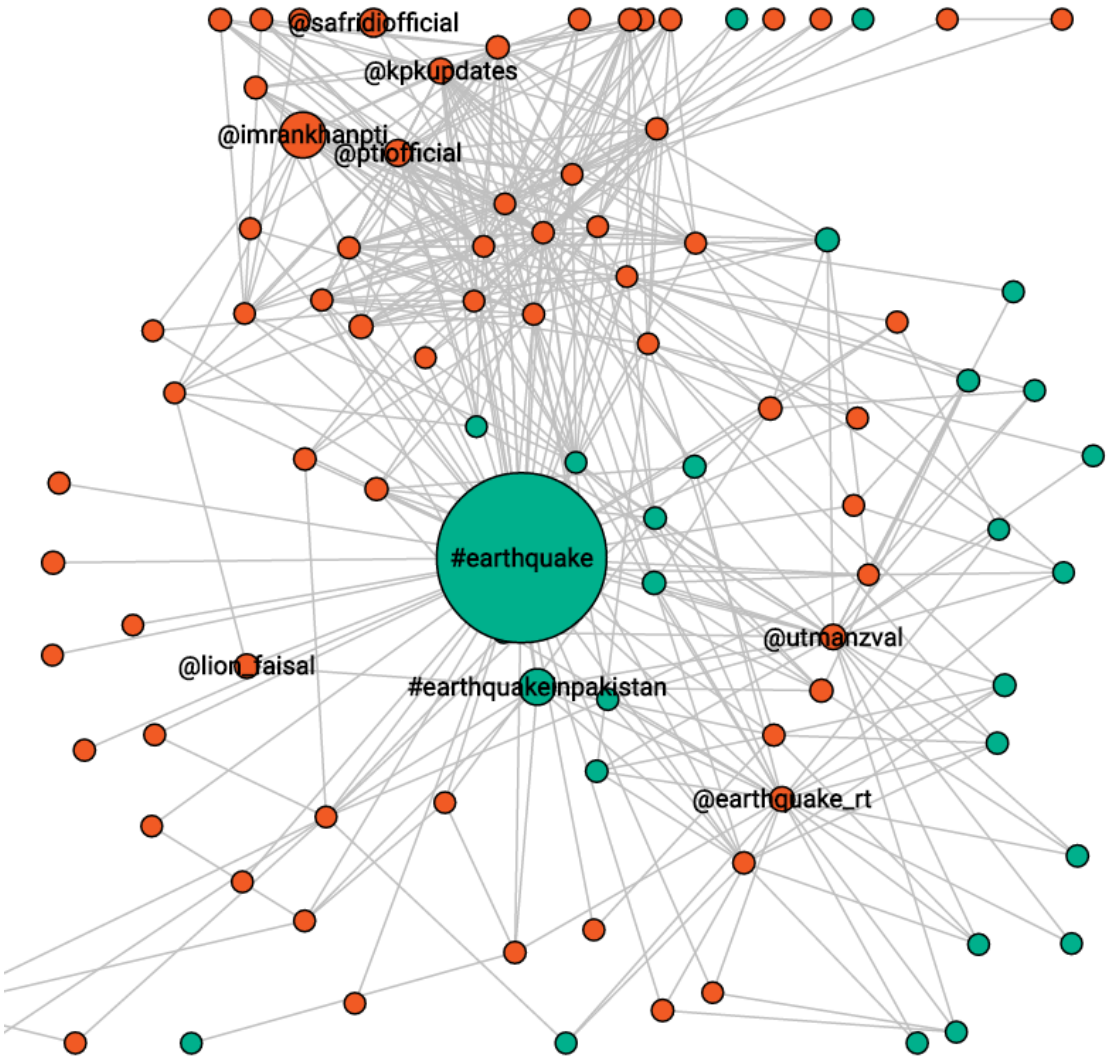



Figure 5 Social graph obtained from using the social media analytics tool SCRAAWL. The graph is a visualization of the social interactions of the conversations around the earthquake. Nodes in this graph are either users (red circle) or hashtags (green circle). Nodes are connected by links if the user or a hashtag was mentioned in the conversation.

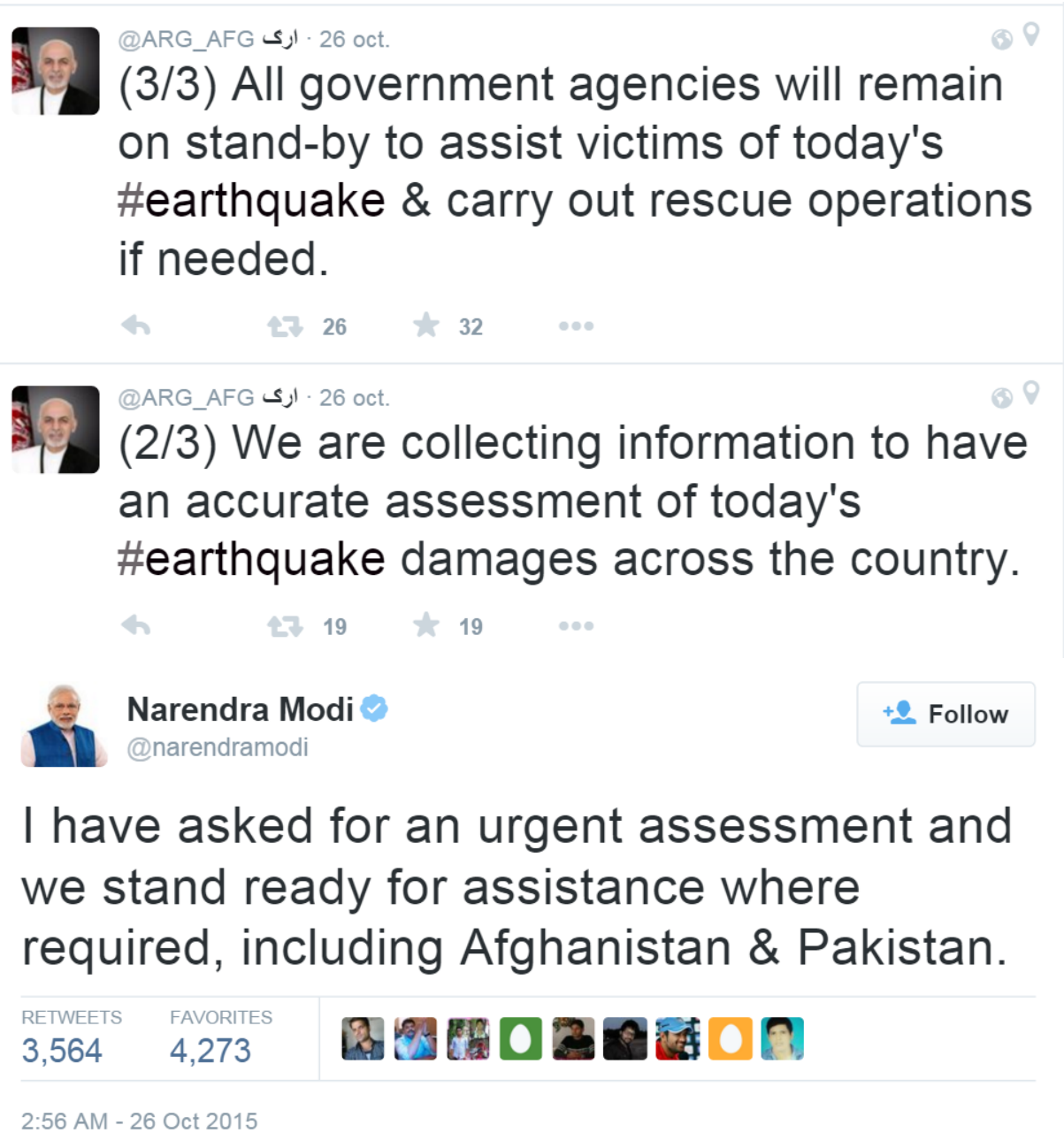



Figure 6 Examples of the tweets posted right after the earthquake by the president of Afghanistan and India.

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# DISASTER MEDICAL SUPPORT LESSONS IDENTIFIED

***Rostislav Kostadinov***

*Disaster could be defined as situations or events, which overwhelms local capacity, necessitating a request to national or international level for external assistance. Disaster medical support management also has to respond to overwhelming healthcare capacities number and types of casualties and/or environmental pollution that is posing imminent threat to the population and always with widespread stress reactions and post stress disorders.*

*The aim of this study is to present some of the medical support lessons identified during disasters associated with natural hazards and man-made disasters consequence management and to discuss some requirements for changes into disaster medicine education*

*Material and Methods By the means of descriptive and comparative analyses the main shortfalls of disaster medical support throughout last two decades in Bulgaria and during some of the greatest disasters with significant impact on the affected population and countries main lessons have been explored and results presented for withdrawing the plausible activities for increasing medical assistance to the casualties capabilities.*

*As a conclusion of the performed study could be noted that the healthcare providers disaster medical support knowledge and skills have to be enhanced in both undergraduate and postgraduate levels in order to prepare the medics for adequate medical assistance provision in case of calamities - man-made ore associated to natural hazards.*

*Keywords*: Disasters, Disaster Medical Support, Lessons Identified, Disaster Medicine, Disaster Medical Education and Training

The World Health Organization in its Glossary of Humanitarian Terms (1) defines Disaster "as an event that can be defined spatially and geographically, but that demands observation to produce evidence. It implies the interaction of an external stressor with a human community and it carries the implicit concept of non-manageability. It is a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected

community or society to cope using its own resources. Situation or event, which overwhelms local capacity, necessitating a request to national or international level for external assistance."

The definition clearly states that in case of disastrous event there are always challenges to the managers requiring external assistance. Disaster medical support management also has to respond to overwhelming healthcare capacities number and types of casualties and/or environmental pollution that is posing imminent threat to the population and always with widespread stress reactions and post stress disorders. Unfortunately, there are still disaster managers who are neglecting the disaster medical support, thinking about the medical assistance as something that is granted and will be present whenever and wherever is required. The disaster management records from past decades are evidence that notwithstanding the huge leap that has been made by the medicine in its development, medical assistance provision to the affected by disasters population is still pending for better and more adequate to the demands solutions. Within the medical community widely is accepted the following definition for disaster – an event leading to sharp disparity between the required and available medical means and capabilities for provision of life, limb and eye sight saving medical aid that requires external assistance.

Great majority of society could argue that disasters are rare events and there is no need to lose time and efforts in analysis and planning for something that could even never occur. The profound analyses have led to fully opposing findings, expressed in the 2005 Secretary-General Report “Relief to Development” (2), where the expression “natural disasters” was purposedly not used. The experts have realized that assumption describing disasters occurring as a result of natural hazards as wholly “natural”, and therefore inevitable and outside human control is mistaken. Nowadays it is widely recognized that so called "natural disasters" are the result of the way individuals and societies relate to threats originating from natural hazards. As the nature and scale of threats inherent in hazards vary, the risks and potential for disasters associated with the different natural hazards are largely shaped by prevailing levels of vulnerability and measures taken to prevent, mitigate and prepare for disasters. Thus, disasters are, to a great extent, determined by human action, or lack thereof. Therefore, the Hyogo Framework for Action adopted at the World Conference on Disaster Reduction held in January 2005 in Kobe (Hyogo, Japan) proposed expression “disasters associated with natural hazards” instead of the used natural disasters. (3)

More than ten years have passed since this conclusion was made, but as a result we are observing that the recorded into last three decades steady trend in

- Increase in the disasters’ frequency (fig 1);
- Increase in the disasters’ exposure;

- Increase in the disasters' vulnerability, leading to increased disasters' consequences severity (fig. 2) is still present.

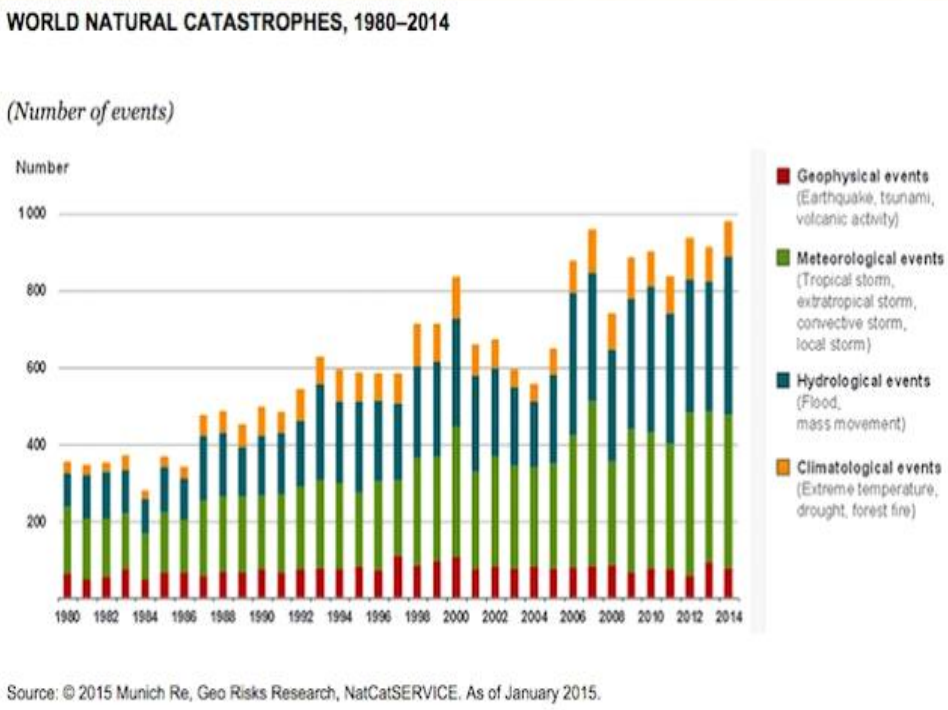


Figure 1 Disasters associated with natural hazards frequency

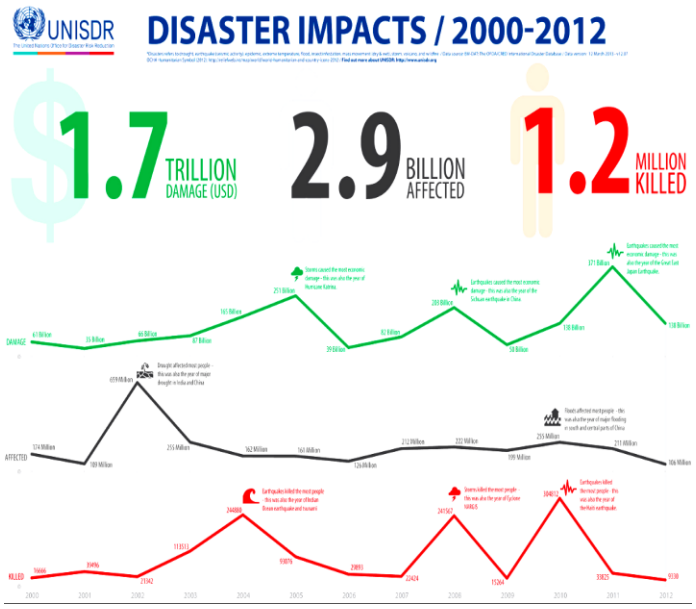


Figure 2 Disasters impact

The recorded data of disasters is undoubting proof for this trend. It is obvious the 2.5 times increase in the frequency only of natural disasters in the last 34 years. What is more the increase is predominately because of the increase of meteorological and hydrological disasters, while the geophysical ones remain steady in number On figure 3 are presented the most frequent disasters related to the climate change.

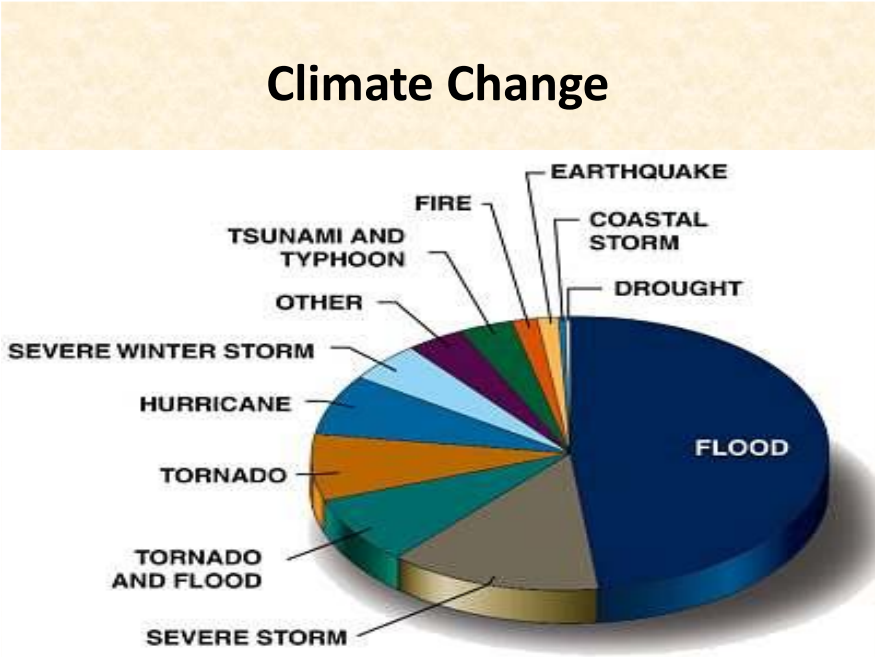


Figure 3 Disasters related to the climate change

Unfortunately the causes of the climate change will continue not only to be present, but is highly likely to increase their impact on the natural phenomena

one summary of the disasters consequences. The reasons for this statement are related to the main processes of contemporary world that are the triggers of our development:

- Industrialization
- Urbanization
- Globalization

As a result of the increase income and ameliorated living condition we are observing an unprecedented population grow. But the increase in population number and density are increasing the exposure to the disasters damaging factors. Nowadays the citizens (the urban population became 53.4% in 2015 (4) are highly dependent on critical infrastructure (roads and other traffic lines, lines of communications, electricity and water distribution, food production, storage and distribution, governance and administration), that is vulnerable to disasters.

Moreover, it is almost impossible to predict that some of the main reasons for this trend, could be eradicated or even decreased in scope.

Based on these observations the interest on organization and management of medical support in cases where the available resources are scarce and insufficient for adequate medical aid provision is more than justified. One of the methods to better adjust the healthcare system organization and resources for best possible state of readiness for management of the disaster casualties health is to thoroughly analyze the experience gained into disaster medical support throughout the years - to analyze challenges and shortfalls and to implement measures for decreasing the disaster damaging impact on population health and healthcare systems or to mitigate the expected health related consequences.

**The aim** of this study is to present some of the medical support lessons identified during disasters associated with natural hazards and man-made disasters consequence management and to discuss some requirements for changes into disaster medicine education

**Material and Methods** By the means of descriptive and comparative analyses the main shortfalls of disaster medical support throughout last two decades in Bulgaria and during some of the greatest disasters with significant impact on the affected population and countries main lessons have been explored and results presented for withdrawing the plausible activities for increasing medical assistance to the casualties capabilities.

**Results and Discussion** The thoroughly performed analyses led to the conclusion that the recorded knowledge and practice shortfalls are present throughout entire medical support process. Main of the shortfalls detected are the following:

- Ignorance about Incident Command System;
- Medical Intelligence could be described as terra incognita for great majority of healthcare providers;
- Difficulties in Triage standard operating procedures (SOP) implementation;
- Strive for definitive treatment;
- Medical evacuation performed more as patient transportation.

Great majority of medical specialist when are present within or nearby area of disaster damage are forgetting about everything in order to provide as soon as possible their knowledge and skills to the people in need. And no one could blame them, if there is no disastrous situation. But when disaster occurs the most important is to assure the safety and security in the area, therefore the first obstacle we are facing in our teaching is to convince the medics to obey orders of the incident commander regarding time and place of medical support provision.

The safety and security of the medical teams is of utmost importance, because in and around the area of damage there is shortness of medical capabilities and if one team is not operational its lost will cost lives. Moreover, the members of the affected team will increase the number of people in need, thus increasing the already existing disparity. (5, 6)

The medics have to know that without police officer, or other incident commander, permission they are not allowed to enter into the affected area.

Even for those of medical specialists who can recall something in his/her mind about medical intelligence it is only about hazard identification. Hazards identification is a common effort – but the medical intelligence is expected to provide its valuable input, especially regarding the health prevention measures related to the extent of the health risks. Eight out of ten medics are looking surprised when asked to define the medical intelligence steps and expected outcome. (7)

Next great challenge is how to organize the best possible support with the less than required and needed medical means and capabilities – every failure into organization is as deadly threat to the life of affected population as the disasters damaging factors. Therefore, every single medic has to be educated and trained how to perform triage and how to organize the medical support provision till arrival of the medical incident commander.

The greatest change required is in the very heart of the medical ethics – in most of the disasters there is not enough medics to attend all in need – someone has to be attended later than the others – a human in need has to be left behind – real hard choice for every medical specialist (not only for physicians).

Disaster Medical Support is a specific system established in order to provide the required life, limb and eye-sight saving to greater part of the affected population and what is most important into the limited time-frame set by the severity of the injuries and the austere environment caused by the impact of the disaster's damaging factors. This well established system is taught to medical specialists, but is almost instantly forgotten and we have observed a lot of instances of this ignorance that are threatening the casualties life and health.

Because of the man power and equipment shortages and the time limitation dictated by the injuries severity and hostile environment the medics have to:

- Limit the treatment to stabilization – a prerequisite for early evacuation;
- Evacuate the casualties to medical installations, where they could receive definitive treatment.

The treatment limitation is one of the most difficult lessons to be comprehended by the specialists, because is almost on the contrary to what they are taught during their university classes - to do everything possible for better patients' outcome.

The other common mistake is in the process of medical evacuation – under the pressure of the time or of the imminent disaster related threats, the medical teams do not prepare patients well for the evacuation, sometimes with extremely negative consequences.

Based on the disaster medicine principles and requirements and on the results of the performed analyses the following topics are proposed for implementation in the medical specialists education and postgraduate training:

1. The first and most important training is to understand the structure of the Incident Command System and the roles of its members. The best possible effect could be achieved by combined training with the other elements – police, fire brigades, rescue teams and etc.
2. Medical students have to be taught during their medical studies on:

- how to assess the situation, damaging factors, hazards, health risks;
- self-protection;
- medical station establishment – triage area, treatment and evacuation areas – where to lay and what to be performed;
- communications and reports;
- basic knowledge about most frequent natural and man-made disasters. (8)

A lot of countries have inserted disaster medicine in the curricula of the medical education, but their number is still far from desired level. (9)

In order to maintain and upgrade the knowledge and skills the following education and training have to performed after graduation:

- Medical Intelligence/Disaster Medical Information
- Disaster Medical Planning
- Triage
- ATLS
- Medical Evacuation
- Medical support to particular Disasters

As a conclusion of the performed study could be noted that the healthcare providers disaster medical support knowledge and skills have to be enhanced in both undergraduate and postgraduate levels in order to prepare the medics for adequate medical assistance provision in case of calamities - man-made ore associated to natural hazards.

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# INTERNATIONAL FEDERATION OF RED CROSS AND RED CRESCENT SOCIETIES IN DISASTER MANAGEMENT

***Dr. Sofia Stoimenova, M.D., Yana Mihaylova***

*The International RC/RC Movement is the world's largest humanitarian network. The Movement is neutral and impartial, and provides protection and assistance to people affected by disasters and conflicts. The Movement is made up of nearly 100 million members, volunteers and supporters in 190 National Societies. It has three main components:*

- *The International Committee of the Red Cross (ICRC)*
- *The International Federation of Red Cross and Red Crescent Societies (IFRC)*
- *190 member Red Cross and Red Crescent National Societies*

*As partners, the different members of the Movement support communities in becoming stronger and safer through a variety of development projects and humanitarian activities. The Movement also works in cooperation with governments, donors, aid organizations and other partners to assist vulnerable people around the world.*

*The ICRC, the Federation and the National Societies are independent bodies. Each has its own individual status and exercises no authority over the others.*

*The different Movement partners meet regularly to discuss common issues and share best practices. Every four years, the different members of the Movement hold talks with representatives of the States parties to the Geneva Conventions at the International Conference of the Red Cross and Red Crescent. The Conference is the Movement's highest deliberative body and offers an opportunity to examine cross-cutting priorities and challenges.*

## The International Committee of the Red Cross (ICRC)

The International Committee of the Red Cross (ICRC)[1] is an impartial, neutral and independent organization whose exclusively humanitarian mission is to protect the lives and dignity of victims of war and internal violence and to provide them with assistance. During situations of conflict, the ICRC is responsible for directing and coordinating the Movement's international relief activities. It also promotes the importance of international humanitarian law and draws attention to universal humanitarian principles. As the custodian of the Geneva Conventions, the ICRC has a permanent mandate under international law to visit prisons, organize relief operations, reunite separated families and undertake other humanitarian activities during armed conflicts. The ICRC also works to meet the needs of internally displaced persons, raise public awareness of the dangers of mines and explosive remnants of war and trace people who have gone missing during conflicts. The ICRC's headquarters are in Geneva, Switzerland, and the organization has more than 12,000 staff in 80 countries around the globe. About 30 per cent of the ICRC's operational activities are carried out in cooperation with National Societies.

## The International Federation of Red Cross and Red Crescent Societies

The International Federation of Red Cross and Red Crescent Societies (IFRC)[2] is a global humanitarian organization, which coordinates and directs international assistance following natural and man-made disasters in non-conflict situations. Its mission is to improve the lives of vulnerable people by mobilizing the power of humanity.

The IFRC works with National Societies (NS) in responding to catastrophes around the world. The organization acts before, during and after disasters and health emergencies to meet the needs and improve the lives of vulnerable people with impartiality as to nationality, race, gender, religious beliefs, class and political opinions. Its relief operations are combined with development work, including disaster preparedness programmes, health and care activities, and the promotion of humanitarian values. In particular, it supports programmes on risk reduction and fighting the spread of diseases, such as HIV, tuberculosis, avian influenza and malaria. The organization also works to combat discrimination and violence, and promote human rights and assistance for migrants.[3] The result: help reduce vulnerabilities, make communities more resilient and foster a culture of peace around the world.

The main guiding document is Strategy 2020[4] - this is guiding document to tackle the major humanitarian and development challenges of the present decade. The Strategic aims (SA) of the IFRC are:

- Save lives, protect livelihoods, and strengthen recovery from disasters and crises
- Enable healthy and safe living
- Promote social inclusion and a culture of non-violence and peace

## National Societies

There are 190 National Red Cross and Red Crescent Societies[5] around the world. This unique network forms the backbone of the International Red Cross and Red Crescent Movement.

Each National Society is made up of volunteers and staff, who provide a wide variety of services, ranging from disaster relief and assistance for the victims of war, to first aid training and restoring family links.

National Societies support the public authorities in their own countries as independent auxiliaries to the government in the humanitarian field. Their local knowledge and expertise, access to local communities, and infrastructure enable the Movement to get the right kind of help where it's needed, fast.

National Society volunteers are often the first on the scene when a disaster strikes and remain active within affected communities long after everyone else has come and gone.

This unparalleled network of community-based volunteers and staff also plays a vital role in ensuring that care, prevention and preparedness programmes are carried out on a day-to-day basis – from visiting chronically-ill HIV patients in Africa to organizing early warning drills in disaster-prone areas of the Asia Pacific. This local presence and community-based approach, coupled with the Movement's global outreach, resources and know-how, give the Red Cross and Red Crescent a distinct advantage when it comes to dealing with today's complex humanitarian challenges.

The promotion of humanitarian values is an intrinsic part of all Red Cross and Red Crescent activities. The National Societies conduct campaigns and speak on behalf of vulnerable people in their own countries. They also promote awareness of international humanitarian law and advocate internationally through the IFRC and with the International Committee of the Red Cross. Key facts[6] from The IFRC's Everyone counts, Progress 2015[7]:

- 110 million people reached by disaster response and early recovery, 160.7 million people reached by long-term services and development programmes in 2015.
- The Movement's National Societies represent 80 million members and over 16 million volunteers. About half are youth volunteers and approximately 50 per cent of the Movement's volunteers are women.
- National Society programmes and services address both immediate and long-term needs and include: disaster preparedness, emergency response, community-based health and care, First aid training and activities, restoring family contact for disaster victims, youth and volunteer activities, etc.

## The Emblems

The red cross, red crescent and red crystal emblems provide protection for military medical services and relief workers in armed conflicts. Moreover, the emblems are also used by National Societies of the Movement in each country for identification purposes[8]. These are symbols of assistance in times of conflict or disaster, and have worldwide recognition in national and international law under the 1949 Geneva Conventions[9].

The Geneva Conventions and their Additional Protocols are international treaties that contain the most important rules limiting the barbarity of war. They protect people who do not take part in the fighting (civilians, medics, aid workers) and those who can no longer fight (wounded, sick and shipwrecked troops, prisoners of war). The use and misuse of the red cross, red crescent and red crystal emblems is clearly defined in law[10]. Moreover, they also require each State party to the Geneva Conventions and their Additional Protocols to enact legislation defining the use and preventing the misuse of the emblems on the national level.

There are two main uses of the emblems: the "protective use" and the "indicative use". The rules for both uses are very precise.

Firstly, the emblems are a visible sign in armed conflict of the protection given to the medical services, equipment and buildings of the armed forces under international law. That protection extends to certain humanitarian organizations working alongside the military to relieve the suffering of the wounded, prisoners and civilians caught up in the conflict. This first use is usually referred to **as "protective use".** In armed conflicts, the protective emblem must be in red on a white background with no additions. It must be clearly displayed in a large format on protected buildings, such as hospitals, and vehicles. Emblems on armbands and vests for protected personnel must also be clear and stand alone. A deliberate attack on a person, equipment or a building carrying a protective emblem is a war crime under international law.

Secondly, National Red Cross and Red Crescent Societies around the world are allowed to use the emblems to identify themselves as part of a global network known as the International Red Cross and Red Crescent Movement. This use is called the **"indicative use".** The indicative use is thus primarily a peacetime use. National Societies may in peacetime make use of the name and emblem of the red cross for their activities other than assistance to the medical service of the armed forces. In wartime, National Societies may continue to use the indicative emblem, but only if it cannot be confused with the protective emblem.

To this end, the indicative emblem must be comparatively small in size and may not be placed on armlets or on the roofs of buildings[11]. The International Committee of the Red Cross (ICRC) works actively with all National Societies and the IFRC[12] works to protect the emblems against misuse and abuse, as it is essential that they stand unchallenged as symbols of neutral and independent assistance at all times, and as guarantees of protection in times of conflict or emergency. Governments have accepted an obligation to prevent misuse and abuse, and in many countries the misuse or abuse of the emblems can lead to prosecution.

## The IFRC activities related to Strategic Aim 1: Save lives, protect livelihoods, and strengthen recovery from disasters and crises.

The International Federation of Red Cross and Red Crescent Societies carry out relief operations to assist victims of disasters, and combine this with development work to strengthen the capacities of its member National Societies.

What we witness nowadays is that more people are becoming vulnerable to disasters or are forced to cope with acts of violence, financial crises and growing uncertainty, often without adequate support. The world is changing, more people are vulnerable, there are more frequent and more severe disasters and more actors involved in "humanitarian

space". Humanitarian aid is increasingly politicized – serving more than just a humanitarian imperative.

There are new challenges to humanitarian coordination and concerns over slipping standards and accountability. More capable states and National Societies are exercising leadership over humanitarian response, and presenting new opportunities to mobilize the collective resources of the IFRC in non-traditional ways. In order to be relevant and achieve greater impact with our humanitarian work, the IFRC is open to learn, adapt, use innovative approaches and partner effectively.

Disaster and crises management[13] can be defined as the organization and management of resources and responsibilities for dealing with all humanitarian aspects of emergencies, in particular preparedness, response and recovery in order to lessen the impact of disasters. The Red Cross and Red Crescent National Societies, supported by the IFRC, work with communities to reduce risk, mitigate the effects of, prepare to respond, respond to and recover from disasters.

The first people to respond to a disaster are those living in the local community. They are the first to start rescue and relief operations. The Red Cross and Red Crescent National Societies focus on community- based disaster preparedness, which assists communities to reduce their vulnerability to disasters and strengthen their capacities to resist them. When the capacity of a community or country to respond and recover from a disaster is overwhelmed, and upon request from the National Society, the International Federation uses its regional and international networks, assets and resources to bring assistance to the communities and National Society which is assisting them.

At an international level the International Federation advocates with Governments, international organizations and humanitarian donors for better practice and accountability in disaster management and greater respect of the dignity of the vulnerable people.

Natural disasters have been increasing in number, scale and complexity. Climate change modifies disaster risk and in most cases, will increase the risk of disaster loss. Managing risks, rather than managing disasters and building community resilience is important. Over the last 10 years, there has been progress in developing institutions, policies and legislation for disaster risk reduction. Capacities for risk assessment and identification, disaster preparedness, response and early warning capacities and in reducing specific risk have been strengthened. Investing in disaster risk reduction is a precondition for developing sustainably in a changing climate.

The experience tells that there is an urgent need to properly link humanitarian response to disaster preparedness and risk reduction, as this saves lives, is cost-effective and builds resilience. Of course this approach makes a lasting difference, because it has been a cornerstone of our work for decades.

Red Cross Red Crescent volunteers add value as they live in the communities they serve, and are present before, during and after a crisis. They are the first to respond when disaster strikes and have the greatest motivation in helping their community recovers. Volunteers know best how to comfort and support the affected people, because they are the affected people.

- The IFRC strives to ensure that a well-functioning, relevant global disaster management system is in place to address the needs of communities who are vulnerable to or affected by disasters and crises, by working as part of an effective global disaster management team to: Provide leadership for the development of global disaster and crises management policies and programming approaches, with a focus on disseminating the Principles and Rules for RCRC Humanitarian Assistance[14], to reflect the changing humanitarian environment and the growing capacities of National Societies, supporting the process of strengthening Movement coordination and cooperation; Promote IFRC - wide tools and capacities for disaster and crises in the areas of response preparedness and contingency planning, disaster needs assessment, relief to recovery planning, the scaled-up use of cash in emergencies and global surge capacity systems;
- Improve the timeliness and quality of Emergency Appeal (EA) and Disaster Response Emergency Fund (DREF) – supported operations through Emergency Plans of Action and support to resource mobilization efforts.

Core functions that the Federation delivers are related to: field - based technical support for response preparedness, relief and recovery programming globally; quality assurance, real time evaluations of major operations, mobilisation of global surge capacity / disaster response tool upon request, disaster management information systems, global coordination and representation on disaster and crises management with Movement and non-Movement partners.

The IFRC supports shelter & settlement programming to meet emergency, medium and long term shelter needs, gives advice on housing, settlement, reconstruction of buildings, management of collective centers, and other issues related with shelter. It ensures fulfilment of the International Federation role as convener of the Shelter Cluster for natural disasters. Logistics is a key professional element in successful disaster management. It is a support service to both disaster relief operations and ongoing programmes of the IFRC.

The IFRC supports National Societies to build resilient communities that are able to adapt and cope with recurrent disasters and other crises, to protect and build on the development gains that have already been made. [15]

The Principles and Rules for Red Cross and Red Crescent Humanitarian Assistance[16] govern National Societies and their International Federation in international humanitarian assistance (excluding armed conflict, internal strife and their direct results). These Principles and Rules are adopted by member National Societies within the statutory framework of the Movement and were presented to the International Conference of the Red Cross and Red Crescent in 2015. They shall be a part of the future Movement-wide coordination and cooperation framework.

Recognizing the importance of strengthening organizational, coordination and delivery capacities of National Societies, to respond to the increasing number and complexity of disasters and the growing number of vulnerable people, they call for greater collective learning, adaptation, innovation and leadership to ensure greater humanitarian impact. These Principles and Rules encompass preparedness for response, disaster relief and early recovery activities. They complement commitments to disaster risk reduction. They establish a coordinated and agreed approach to quality and accountability, and recognize partnerships with public authorities, humanitarian actors and other external partners.

## World Disaster Report 2015 (WDR) /Facts and Figures

Every year IFRC's launches World Disaster Report[17]. WDR 2015 focus is on local actors, the key to humanitarian effectiveness and examines the complex and challenging relationship between local and international actors responding to crises. The report presents the case for a shift to the localization of aid and equal partnerships. Although responsibility for responding to large-scale disasters cannot be borne entirely by the people, organizations and governments responding locally, a better balance must be struck.

Disasters in 2014

- 317 natural disasters reported worldwide in 2014, affecting 94 countries, according to the Centre for Research on the Epidemiology of Disasters (CRED). The number of natural disasters was the lowest of the decade, 17% below the average.[18]
- Almost 107 million people were estimated to have been affected by disasters in 2014, a relative increase on the previous year. This number is still well below the highest number of disasters in the last decade, which occurred in 2005, when a total of 810 disasters were reported. However there is little doubt that climate change will lead to an increase in the frequency and severity of hazards and the number of people exposed to them.
- In 2014, disasters caused 8,186 deaths worldwide. Nevertheless, the mortality level was almost 90% lower than the decade average. 2014 was also the year with the lowest mortality rate since 1986 (7,303). On the other hand, the death toll of the Ebola epidemic in West Africa (8,600) is higher than the total mortality rate of all natural disasters in 2014.

- 48% of all disasters occurred in Asia in 2014. Over 85% of those killed and 86% those affected globally were also in Asia. The higher attribution of deaths in Asia comes in a year, which also saw a lower mortality rate in the Americas where 8% were killed compared to the 25% average.
- China was the most disaster-affected country, with drought, storms and flooding affecting more than 58 million people. An earthquake in August 2014 killed 731, attributing the highest mortality rate in any country in 2014 to China.
- In 2014, 87% of disasters were climate-related. This continues a 20-year long trend of climate-related disasters outnumbering geophysical disasters in the ten most disaster-affected countries in the world.
- Floods and landslides accounted for 49% of all natural disasters in 2014, causing 63% of the total number of disaster related deaths and 34% of the total number of people affected by disasters, floods in India, Pakistan and the Balkans were among the most severe. Drought affected 39% of the total number of people affected by disasters.
- 5,884 people were killed by technological disasters. The event which resulted in the highest number of deaths (304) was the sinking of the Sewol ferry, in the Republic of Korea. Nine other technological disasters caused more than 100 deaths each, for a total of 1,537. Transport accidents accounted for 74% of deaths from technological disasters.
- In 2014, economic losses were estimated at $99.2 billion US dollars well below the annual average of 147 billion seen in the past ten years. The floods in Jammu and Kashmir along with Cyclone Hududh in India were the most costly events at USD 16 billion respectively. For the first time since 1980, the world experienced a consecutive decrease in economic losses over the last three years.

The balance of investment in humanitarian assistance

- Humanitarian aid and assistance has grown to become an industry valued at nearly 20 billion US dollar.
- UN OCHA's Financial Tracking System reports that 3% of total international humanitarian assistance in the decade 2005–2014 was channeled directly to affected states.
- In the same period 1.6% of total international humanitarian assistance was channeled to national and local non-government organisations (NGOs).
- 86% of international humanitarian assistance went to international NGOs during the period 2010-2014.[19]

- Around the world, only 16 local NGOs and 80 national NGOs were reported as direct recipients of international funds in 2014.

### *Rhetoric and practice*

The humanitarian community and donors have increasingly recognized the importance of local actors to humanitarian action.

The current humanitarian system is based on a model that seems increasingly at odds with the changing reality of the field.

The International Federation of Red Cross and Red Crescent Societies is urging the international community to bridge the gap between rhetoric and practice, by localizing aid and rebalancing investment to ensure the greatest impact.

### *Access and networks*

Experienced local staff or partners are able to build long-term relationships in communities, helping to maintain access. In conflict settings, staff with a presence prior to the arrival of the armed group, and staff who are accustomed to working remotely are better positioned to negotiate access on behalf of the organization. This is true also in disaster risk reduction and response as local actors negotiate relationships with community leaders, overcoming mistrust of organizations, and access to remote locations international actors may struggle to reach.

The Red Cross and Red Crescent Movement is local by nature, we have National Red Cross and Red Crescent Societies in 189 countries and local presence through more than 165,000 branches, in cities, small towns and in the most remote villages. Our staff and volunteers are embedded in the communities they serve and have a unique understanding of the context and the obstacles to access. It is these characteristics that enable our volunteers in Syria to get aid to people in conflict zones, vital information to fearful and wary Ebola-affected communities, and reach remote villages after the Nepal earthquake.

### *Diversification of actors*

Actors providing disaster risk reduction initiatives and crisis response are increasingly diverse and outside of traditional humanitarian systems. At a local level, in addition to governments, military, and non-government organizations, those responding locally can include charities, civil society groups, businesses, faith-based organizations, communities and diaspora networks. At the international level, global technology companies have joined the ranks, alongside other private sector innovators and service providers. This coincides with the rise of huge private foundations whose annual budgets may not only match, but surpass those of individual countries.

Local actors delivering protection and assistance to affected communities are often new to the provision of assistance and protection, and may not be aligned particularly with core

humanitarian principles. Flexible new frameworks must be mapped to ensure international agencies can adapt to coordinate with this broadening category of responders.

### *Innovation*

Technology is transforming the ability of people and communities to plan for emergencies and to organize their own responses. Although this is true of all technologies, the most significant technological shift has been the rise of digital communications. An additional 130 million people in low- and middle-income countries will become mobile service users over the next three years. More people in low- and middle-income countries now have access to mobile phones than basic sanitation or reliable electricity.

This rapid uptake of technology by local actors and vulnerable communities sees a shift in the reliance on humanitarian actors. The truest innovation in communications technology is coming from disaster- and crisis-affected communities using communications technology to meet daily needs, join global networks, transfer money and transform their daily lives. And in so doing, they are creating entirely new models of disaster response and bringing in major new actors, particularly the private sector and diaspora networks.

The challenge for international aid agencies is to learn how to support, add value and work alongside community-based models. If tools and platforms are rooted in local contexts and constraints, then they should not be expected to transfer elsewhere without adaptation. Aid agencies need to focus on understanding and building on community-led models rather than bringing in external technology, especially in a crisis.

## International legal framework for disaster response[20]

In 2007, the 30th International Conference of the RC adopted the *Guidelines for the domestic facilitation and regulation of international disaster relief and initial recovery assistance*[21], also known as the IDRL Guidelines (referring to “international disaster response law”). These were adopted after six years of research and consultations by the IFRC, which revealed a consistent set of regulatory problems in international relief operations, resulting from a lack of clear rules at the domestic level. The IDRL Guidelines provide recommendations as to how states can strengthen their own laws, rules and procedures to avoid common regulatory problems in disasters.

Why was it necessary to adopt such a document? When major disasters strike, international assistance can mean the difference between hardship and recovery for affected communities. But aid unfortunately does not always reach those in need as effectively as it should. Bureaucratic procedures related to entry visas, personnel registration, customs clearance, taxation, and transport permissions for example often slow down relief efforts. Similarly, the incapacity to monitor and coordinate the action of aid providers often leads to poor quality goods, duplication of efforts, or even lack of

respect for the beneficiaries. These problems are getting worse over time, in part because the number and variety of international responders are both increasing. Affected states in a number of recent large and medium disasters have found themselves ill-prepared to handle a flood of well-intentioned but not always uniformly effective international responders.

The absence of a specific domestic regulatory framework can make it very difficult for an affected state to oversee, regulate and facilitate the entry of life-saving relief. Ad-hoc approaches, hastily devised in the wake of a catastrophic disaster, have often led to a certain loss of state control and the arrival of inappropriate or poor quality relief. They also frequently result in unnecessary restrictions, delays and expenses hampering the right aid, just when it is most urgently needed. Nevertheless, few states have comprehensive legal frameworks in place. At the 32nd International Conference in December 2015, representatives from states and all components of the movement negotiated and adopted a resolution covering a number of topics related to strengthening legal frameworks for disaster response, risk reduction and first aid.

Since their adoption in 2007 to date, some 23 countries have developed new laws or procedures drawing on the recommendations of the Guidelines (including 4 in Africa, 6 in the Americas, 8 in Asia-Pacific, and 5 in Europe and Central Asia). Over a dozen more have bills or draft rules currently pending. In addition, the IFRC with other international partners such as OCHA and IPU jointly completed a Model Act on the Facilitation and Regulation of International Disaster Relief and Initial Recovery Assistance. The IFRC and OCHA have also worked to develop a Model Emergency Decree on the Facilitation and Regulation of International Disaster Relief and Initial Recovery Assistance. A number of global and regional organizations have made use of the IDRL Guidelines to develop or strengthen regional mechanisms for international disaster cooperation and numerous National Red Cross and Red Crescent Societies have been active in supporting their authorities to make use of the IDRL Guidelines.

In 2015, the IFRC released the results of a survey carried out with the assistance of the United Nations Office for the Coordination of Humanitarian Affairs, United Nations Development Programme, World Bank Group, World Customs Organization, World Food Programme and the World Trade Organization about disaster relief, regulation and protection.[22] The survey, aimed at humanitarian and disaster risk management practitioners in government, non-governmental agencies, the private sector and academia, was intended to measure current experience about the most challenging regulatory and protection issues in domestic and international disaster relief operations. Detailed responses were received from over 200 participants from around the world. With regard to international operations, the survey rated problems with coordination, customs issues with relief goods and equipment, and issues in the entry of personnel as frequently encountered problems have an important impact.

The Bulgarian Red Cross has actively participated in the process, taking part in a number of regional initiatives. In 2010 BRC has published the national report, studying the normative requirements for receipt, origination and transit of disaster relief through the territory of the Republic of Bulgaria[23]. It was a part of a broader project being undertaken by the IFRC and the National Red Cross Societies of Austria, Bulgaria, France, Germany, the Netherlands and the United Kingdom to study EU and Member States' regulations for cross-border disaster assistance within Europe, supported by the Civil Protection Financial Instrument of the European Community.

## Civil Military Co-operation

The deployment of military personnel and assets during disaster response operations is increasing, particularly during the emergency phase[24]. Due to the scale and complexity of disasters, especially in over-populated urban settings, the involvement of military bodies in such operations is inevitable and can be beneficial in many aspects. In many countries, the military is in a position to provide fast and effective relief as first responders. They can be quickly mobilised and have the capability to reach or provide access to affected populations in remote areas. The level of military response varies according to a country's preparedness and response system, the disaster and the impact. It ranges from providing indirect support, such as logistics assistance, to taking full responsibility of a Government's response. A number of organizations or country structures are prepared for an international response in the event of a "natural disaster", and have structured their capabilities to cover this aspect and this type of operation.

Military actors may also face issues in regard to the facilitation of assistance provided to a disaster affected state, especially in regards to customs or immigration procedures. In terms of addressing the role and initiation of military relief, the IDRL Guidelines state that military assets should only be deployed for disaster relief at the request or with the express consent of the affected state, and that comparable civilian alternatives should be considered first (IDRL Guideline 11)[25]. As with disaster assistance from international humanitarian actors, governments could avoid many of these common issues by investing in legal preparedness in advance of a disaster, through the adoption of the IDRL Guidelines into their national legal frameworks. Guidelines are an important tool for governments to increase coordination among humanitarian relief providers, as well as to improve the quality of relief provided.

Despite the benefits which the use of civil and military defense assets can bring to a disaster relief operation, in terms of logistics and technology, etc., there remains a need for more dialogue and exchange of information between national militaries, regional organisation and humanitarian actors in order to improve efficiency and coordination between key actors in disaster response operations.

Guidance exists at the international level in the *Guidelines on the Use of Military and Civil Defence Assets In Disaster Relief* (Oslo Guidelines), and various processes are underway to further clarify how military actors and humanitarian organizations can coordinate in disaster operations, while ensuring that humanitarian assistance is provided effectively, in an impartial, neutral, and humane manner. The United Nations and other Organizations have been assimilating the concept of integrated missions that include civilian and military actors with common goals and purposes. Various civil-military simulation and coordination exercises are taking place in different regions.

IFRC and the National Societies discuss the best ways to engage with armed forces in disaster contexts, based on RCRC guidance materials as well as international standards and guidelines. To ensure the effective coordination of disaster response, and to safeguard the neutrality and impartiality of humanitarian assistance, it is essential that the Red Cross Red Crescent and the broader humanitarian community remain engaged in discussions with all actors likely to participate in a disaster response, including military and defence organizations. As auxiliaries to their governments National Societies are in a unique position to advocate and spread clear common RCRC messages on civil-military relations in order to improve this coordination in disaster response.[26]

### *An example and lessons from Great East Japan Earthquake*

The Study Group on the Great East Japan Earthquake & International Humanitarian Assistance[27] recommends the followings to prepare for future mega-disasters in Japan:

1. To receive international assistance in an efficient manner in order to maximise the good-will of international community;

2. To establish national minimum standards in humanitarian assistance based on the international norms and standards in order to protect rights of affected population, and

3. To train, register and mobilise disaster relief professionals both in national and international level.

The conclusions and recommendations in the report could be very useful as lessons learned: It is expected that international community will offer assistance when a large scale natural disaster hits Japan, the Government of Japan should pre-establish its policy clarifying the criteria and procedures for receiving - or declining - offers of international assistance. The basic policy and procedures for accepting international assistance should be translated into foreign languages and shared with the international community during the pre-disaster phase. A comprehensive disaster management body within the Government should make centralised and proactive decisions on the acceptance of incoming international assistance. This body need to bear full responsibility in terms of quick and smooth acceptance of assistance, including transport of relief goods and personnel to disaster affected areas, temporary storage of relief items.

Standard Operating Procedures (SOPs) needs to be developed for the officials of the respective institutions and joint exercises testing such SOPs with the involvement of multiple stakeholders need to be conducted once a year. The SOPs need to be developed by taking into consideration existing international guidelines.

Legal arrangements and administrative orders on liability for damages and indemnification need to be put in place for handling any damages caused by international responders as well as any accidents or incidents that may occur to international responders. Based on the lessons learned of receiving international assistance in the past and in light of the existing international guidelines such as the International Disaster Relief Laws (IDRL), exceptional legal measures and administrative orders need to be put in place before a disaster strikes.

Legal frameworks with foreign countries, from where the likelihood of receiving international assistance is high, should be established in advance. Securing and developing human resources – A system needs to be developed that allow pre-registration and deployment of human resources those who have experiences related to international disaster relief from outside the Government structures and who have sufficient knowledge and experience to lead effective coordination in the acceptance of domestic and international assistance.

Ensuring accountability – Full responsibility to monitor the utilisation of international assistance and to explain the results and impacts of such assistance to the international community with the use of standard reporting formats.

Timely dissemination of accurate information -The Government of Japan should develop a system by which it can communicate well with the international community from the on-set of large scale disasters. The messaging should include damages caused, response activities and specific needs for international assistance, and the Government's communications efforts need to be more proactive, timely as well as be conducted in English.

Application of the existing international norms and – The existing international standards such as 'Human Rights Based Approach' and *The Sphere Project – the Humanitarian Charter and the Minimum Standards in Humanitarian Response*[28]', are known. Develop national minimum standards that are based on the existing international norms and standards as well as examples from overseas, and that do not contradict with Japan's local characteristics and socio-cultural background. Such minimum standards should include methodologies of needs assessments as well as types and qualities of assistance to be provided. Ensure that institutional aid providers fully recognise their obligations to abide by humanitarian principles including humanity, neutrality, impartiality and operational independence and fully recognising that assistance needs during disasters

differ depending on variables of the affected populations, such as gender, age, disability, nationality, mother tongues, family composition and livelihoods.

**Role of NGOs/NPOs, the civil society and actors other than designated public institutions.** Recognising the role of NGOs/NPOs and the civil society more institutionally, guidelines for local authorities should be developed, by which these diverse actors can promote the national minimum standards, and help integrate them into local disaster management plans. NGOs/NPOs and the civil society should recognise their leading roles in promoting responses to meet the diverse needs of the affected populations and in enhancing human rights based approaches. NGOs and the civil society should also strengthen their engagement in the policy processes in this particular domain. Coordination mechanisms need to be built in the pre-disaster phase, so that NGOs and NPOs can implement their assistance programmes in a coordinated and collaborative manner. For this purpose, frameworks of coordination need to be designed; a secretariat facilitating the coordination work needs to be supported; human resources of those who are involved in the coordination work needs to be developed, and roles of NGOs/NPOs need to be articulated in local disaster management plans. NGO/NPO staff should participate in the relevant meetings and trainings as well as build relationships with other actors during the pre-disaster phase, so that smooth and effective deployment of assistance can be ensured. In addition, common codes of conduct should be developed for NGOs/NPOs involved in assistance activities.

**Human Resource Development.** With the aim of human resource development of those who are equipped with necessary knowledge and skills for disaster response and who can fully demonstrate required competencies in the midst of crises – both in Japan and overseas – the following seven recommendations are made:

- Identification of priority areas where human resource development is particularly needed
- Identification of professional duties to be targeted for human resource development
- Implementation system of the human resource development programmes
- Basic curriculum and methodologies of trainings
- Functions required for human resource development
- Registration and mobilization of the pools of trained professionals
- Promotion of international cooperation building on domestic disaster response experiences

## The Bulgarian Red Cross (BRC)

The Bulgarian Red Cross[29] is a voluntary humanitarian organization which is a part of the International Red Cross and Red Crescent Movement and is guided by its Fundamental Principles: Humanity, Impartiality, Neutrality, Independence, Voluntary Service, Unity and Universality. Through its network of more than 19 000 volunteers all over the country, the BRC renders assistance to the vulnerable people in disasters and crisis situation. By means of training programs and activities for the benefit of the public, the National Society (NS) contributes to alleviate and prevent the suffering in all its forms, protects health and life and ensures respect for the human being.

As auxiliary to public authorities, the NS is integrated in the preparedness and response management system in Bulgaria. The BRC's activities related to DM are following the national legislation (Law on Disaster Protection in Bulgaria), the roles and responsibilities stated at the BRC's Law, Statutes, Strategy 2020 and DM Policy of the National Society.

The BRC is member of the Permanent, inter-ministerial commission at the Council of ministers and is a part of National Disaster Response Plan. In this regard, the BRC is actively involved in preparing and participating in the implementation of the National Disaster Response Plan:

- *Establishes voluntary units to help the affected population in case of disasters;*
- *Establishes and maintains a disaster reserve of relief items essential for the initial support of victims;*
- *Maintains Central and Regional/ Branch/ warehouses in the country;*
- *Maintains radio - communication network of HF and VHF frequencies;*
- *Carry out cooperates and coordinates with governmental and non-governmental bodies involved in rescue operations in case of disasters according it's capacity; Liaises and coordinates with IFRC and sister National Societies the mobilization, receipt and distribution of international assistance, if needed; Collects and distributes domestic and international aid for population in affected areas.*

All the activities in disaster management are carried out in close cooperation and collaboration with partners: state institutions, governmental and non-governmental organizations, (Ministry of Interior - General Directorate "Fire Safety and Population Protection", Ministry of Defense - Military Medical Academy; State Agency for Refugees, Ministry of Foreign Affairs; Ministry of Health, Ministry of Education and Science), NGOs, the media, etc.

BRC representatives actively participate in all national, a number of regional and international exercises of IFRC, neighboring NS, EU and NATO, as well as in a number of European programs, with a focus on disaster management.

The BRC initiated number of successful public campaigns to raise funds for assisting the victims of the devastating floods (2012 -2014) and earthquakes ( 2012) in Bulgaria, also

for European NSs (Macedonia, Serbia, Hungary, BiH, Greece, etc.) and provided contributions in response to IFRC's Emergency appeals worldwide (Pakistan, Japan, Haiyan, Nepal - € 58,700, etc. ).

After the catastrophic floods in Bulgaria (2014), the BRC collected 2.18 million BGN (1M€) and significant in-kind donations for more than 20 000 people. In 2015 BRC had supported more than 5 000 victims of disasters and over 7000 refugees.

During the last decade the number of disasters increased worldwide becoming a serious challenge at the global, regional and national level, causing suffering of millions and economic losses. This requires united the efforts of various partners to build individual, community and country's resilience.

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# LAND COVER MAPPING TO SUPPORT FLOOD PREDICTION MODELING - A PROOF-OF-CONCEPT OVER THE SAVA RIVER BASIN

***Michael V. Campbell***

*Flood and inundation predictive modeling typically requires surface roughness values associated with specific land cover types throughout the watershed. Current, detailed land cover maps can enhance model predictions by providing accurate surface roughness inputs. In this demonstration effort, an example land cover product was created over the Sava River Basin using eleven Landsat 8 multispectral satellite images. The remotely sensed images were acquired over a time range from 19 July through 29 August 2015, within five overlapping Paths. The multispectral data were acquired from an unrestricted U.S. Geological Survey image archive. The 11 scenes were post-processed, mosaicked and classified to create a thematic land cover map showing the distribution of six broad cover types: water, bare / urban, conifer forest, mixed forest, scrub / open forest, and agriculture / low vegetation. Resources to complete an accuracy assessment were not available. This rapid mapping effort demonstrates the potential for land cover mapping to provide quantitative data, as well as to build situational awareness, for flood disaster preparedness and response.*

*Keywords:* land use / land cover, Landsat 8, Sava River Basin, remote sensing

## Introduction

The Sava River Basin covers portions of six Balkan countries. The head waters of the Sava River begin in Slovenia. The river, 945 km in total length, flows through Croatia, forms the northern border of Bosnia Herzegovina, finally joining the Danube in Belgrade, Serbia. The watershed also includes drainages from Montenegro and Albania. The entire basin covers approximately 95,800 km$^{2.}$ (Figure 1). The US Army Corps of Engineer (USACE), Engineer Research and Development Center (ERDC) has engaged with the International Sava River Basin Commission (ISRBC) since 1995 to forecast flood conditions along specific sections of the Sava River. Hydrologists and engineers with the ERDC Coastal and Hydraulics Laboratory (CHL) are building a first-order flow prediction tool of the entire basin (Follum et al., 2016) using the Routing Application for Parallel computatIon of Discharge (RAPID) model (David et al., 2011). CHL has also developed a basic flood and inundation prediction tool applicable to large land areas called AutoRoute (Follum, 2013). These flow and flood prediction models currently use a global digital elevation model (DEM) with a 30 x 30 m grid cell. Both AutoRoute and RAPID could provide much more accurate flow and flood forecasts using a finer resolution DEM.

Commercial efforts are underway to build global DEM data sets with grid cells sizes of less than 15 x 15 m.

AutoRoute inputs surface roughness coefficients, specifically Manning's n, in the flood prediction algorithm. The coefficients are derived from land cover information, where surface roughness values are associated with each land cover class. When applying AutoRoute outside the U.S., global land cover is available as very coarse, 1 x 1 km grid cells. Similar to the enhanced effects of a higher resolution DEM, AutoRoute flood and inundation prediction capabilities may be significantly improved with the input of a much a finer resolution land cover product (e.g., 100 x 100 m grid cell).

## Objective

Landsat 8 is a space-borne earth imagining multispectral scanner that can provide regional, cross-border land use / land cover mapping capabilities perfectly suited to enhance the AutoRoute flood prediction algorithm. This brief investigation will provide an overview of the steps necessary to create a first-order land cover product developed from publically available Landsat 8 multispectral imagery. The potential application of multi-temporal, regional land cover mapping and land cover change detection for flood prediction and preparedness, as well as for immediate response and long-term landscape monitoring, was also be discussed.

Figure 1. The Sava River Basin in relation to the Balkan Peninsula. The Danube River is highlighted in blue.

## Methods

The Landsat earth imaging program has been continuously acquiring space-based images of the Earth's land surface since 1972 (U.S. Geological Survey, 2015). The following section summarizes the steps used in this proof-of-concept effort to create a thematic, or discrete, land use / land cover map covering the Sava River Basin.


## Landsat 8 Data Description

Launched on 11 February 2013, the Landsat 8 multispectral imager is on-board a sun-synchronous polar orbiting satellite at an altitude of 705 km. The satellite orbits the Earth

every 98.9 minutes and has a 16-day repeat cycle (i.e., the sensor captures the same location on the earth's surface every 16 days). The push-broom scanner records sunlight reflected from the surface of the earth over seven spectral channels, or bands. Table 1 lists the spectral regions covered by each band. The spatial resolution, or pixel dimension, for the reflectance bands is 30 x 30 m. The intensity of the incoming solar radiation is quantified as unit less digital numbers and quantized to 12 bits (min = 0, max = 4095, as unsigned integers). For many mapping applications, the seven spectral bands can be utilized with minimal post-processing of the digital number values. However, some image processing tasks require that the unit less numbers be mathematically transformed into percent solar reflectance values. The Landsat 8 Data Users Handbook gives reference material about the sensor, the platform and the science data products (U.S. Geological Survey, 2016a).

Table 1. Landsat 8 band numbers, names and wavelength regions.

| Band # | Description | Wavelength (nanometers) |
|---|---|---|
| 1 | Coastal Blue | 430 – 450 |
| 2 | Blue | 450 – 510 |
| 3 | Green | 530 – 590 |
| 4 | Red | 640 – 670 |
| 5 | Near Infrared (NIR) | 850 – 880 |
| 6 | Short-wave Infrared 1 (SWIR1) | 1570 – 1650 |
| 7 | Short-wave Infrared 2 (SWIR2) | 2110 – 2290 |

## Acquiring Landsat 8 Imagery

The polar orbiting Landsat 8 satellite captures images of the earth's surface in a continuous swath, or path, 190 km wide. The data are distributed as overlapping tiles and are identified with a longitudinally oriented path number and a latitudinal row number. The U.S. Geological Survey (USGS) distributes the complete archive of Landsat 8 imagery without restrictions. The archive includes many other remotely sensed data products, including digital aerial and satellite imagery, digital elevation models, as well as land cover maps. Some data sets are limited to the U.S., but many have global coverages. The global image archive expands daily as many of the sensors continue to collect data. The archive is accessed through the EarthExplorer web interface (EarthExplorer, 2016).

The search criteria used in EarthExplorer for this effort included:

- Specific Path / Row identifiers,
- Date range (15 July – 31 August 2015), and
- Maximum allowable percent cloud cover (across the entire image footprint).

The Path and Row numbers of the 11 images needed to cover the Sava River Basin are shown in Figure 2. The date of acquisition for each Landsat 8 image is also displayed. A twelfth image is needed to cover the western tip of the basin. However, suitable imagery within the required date range was not available. Therefore, this small area is not included in the final land cover product (Figure 2). The maximum percentage of allowable cloud was initially set at 10%. However, the threshold was raised to 20% to successfully identify the 11 images that were acquired within the date range.

To make the archived Landsat imagery more accessible and easier to work with, USGS provides a variety of high level data products created from the raw multispectral data. The Earth Resources Observation and Science (EROS) Center Science Processing Architecture (ESPA) On Demand Interface (U.S. Geological Survey, 2016b) pulls the requested scenes from the archive and creates user-specified image products. Some of the high level data products include: the original input images, surface reflectance, and spectral indices. The products are then bundled for bulk downloading.

## Image Processing

Figure 3 shows the seven reflected energy greyscale images that comprise a Landsat 8 multispectral image. Figure 3 also displays a true color image composite, as well as a false color image composite.

A typical workflow for creating a land use / land cover thematic map using multispectral satellite imagery includes the following generalized steps:

1. Acquire the multispectral imagery from an archive or tasking a new collection over a specific location.
2. Post-processing the imagery to remove know errors associated with the both the sensor and correct for atmospheric conditions.
3. Geometrically register the imagery to align the pixels to their precise coordinates on the earth's surface.
4. Mosaicking two or more images, all acquired on the same date, to create a single multispectral data set.
5. Subset, or clip, the mosaic to remove data outside of the area of interest.
6. Classify the image using a wide variety of algorithms to create a thematic land cover product where each pixel is assigned to a specific land cover class.
7. Complete a quantitative assessment of the thematic accuracy of the land cover map. This final requires the collection of ground reference information that defines the true land cover at hundreds of points throughout the area of interest.

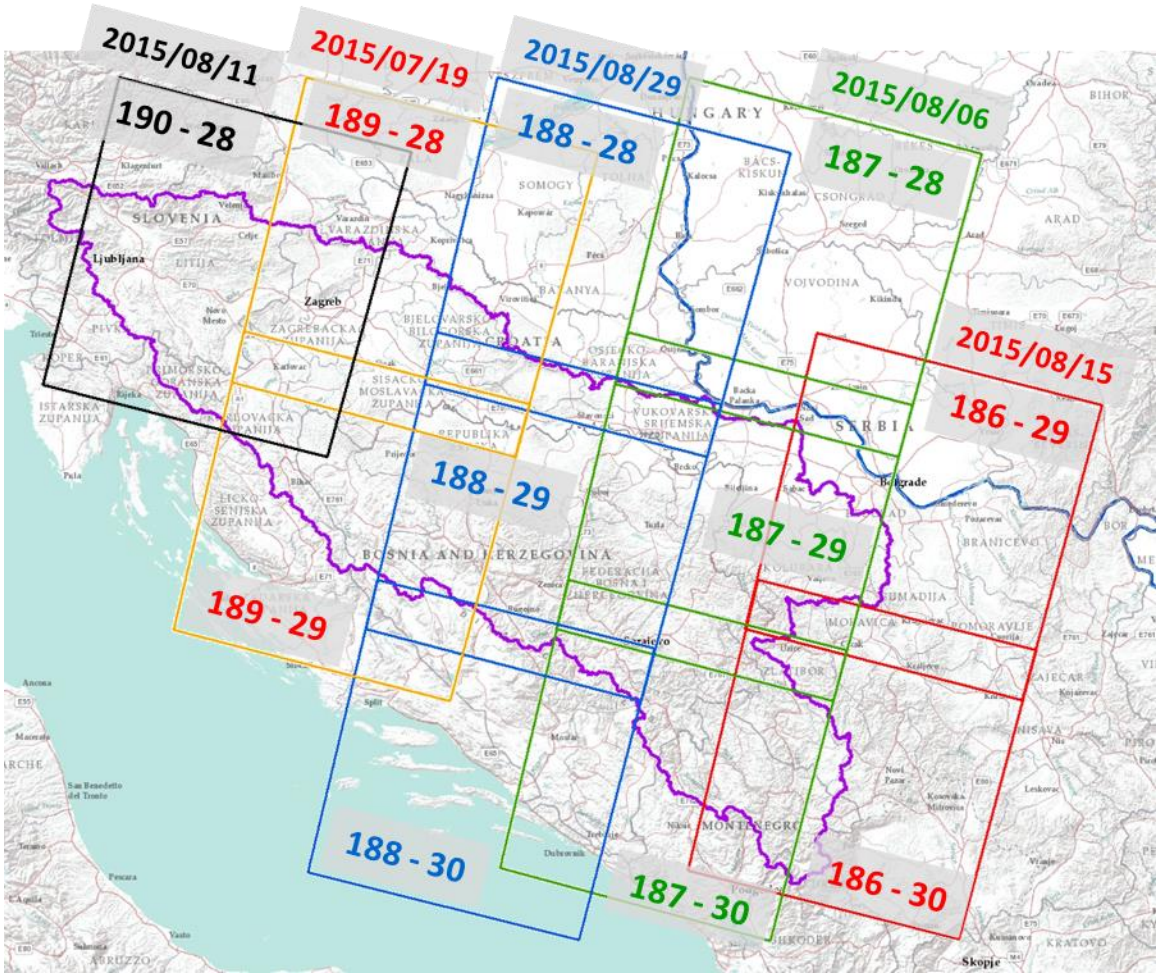


Figure 2. Image footprints of the 11 Landsat 8 scenes retrieved from the archive. The Path-Row identifiers are shown for each scene, as well as the date of acquisition for each Path. A small portion of the basin was not mapped due the lack of a suitable image.

Steps 1 through 3 were complete on the ESPA interface, prior to receiving the bulk download. Steps 4 through 6 were completed locally using ENVI image processing and ArcMap software.

## Mosaicking

The overlapping images within the same Path were mosaicked to create one combined multispectral data set. Images from adjacent Paths were acquired on different dates and cannot be mosaicked. Figure 4 displays the five adjacent, overlapping Path mosaics displayed as true color composites.

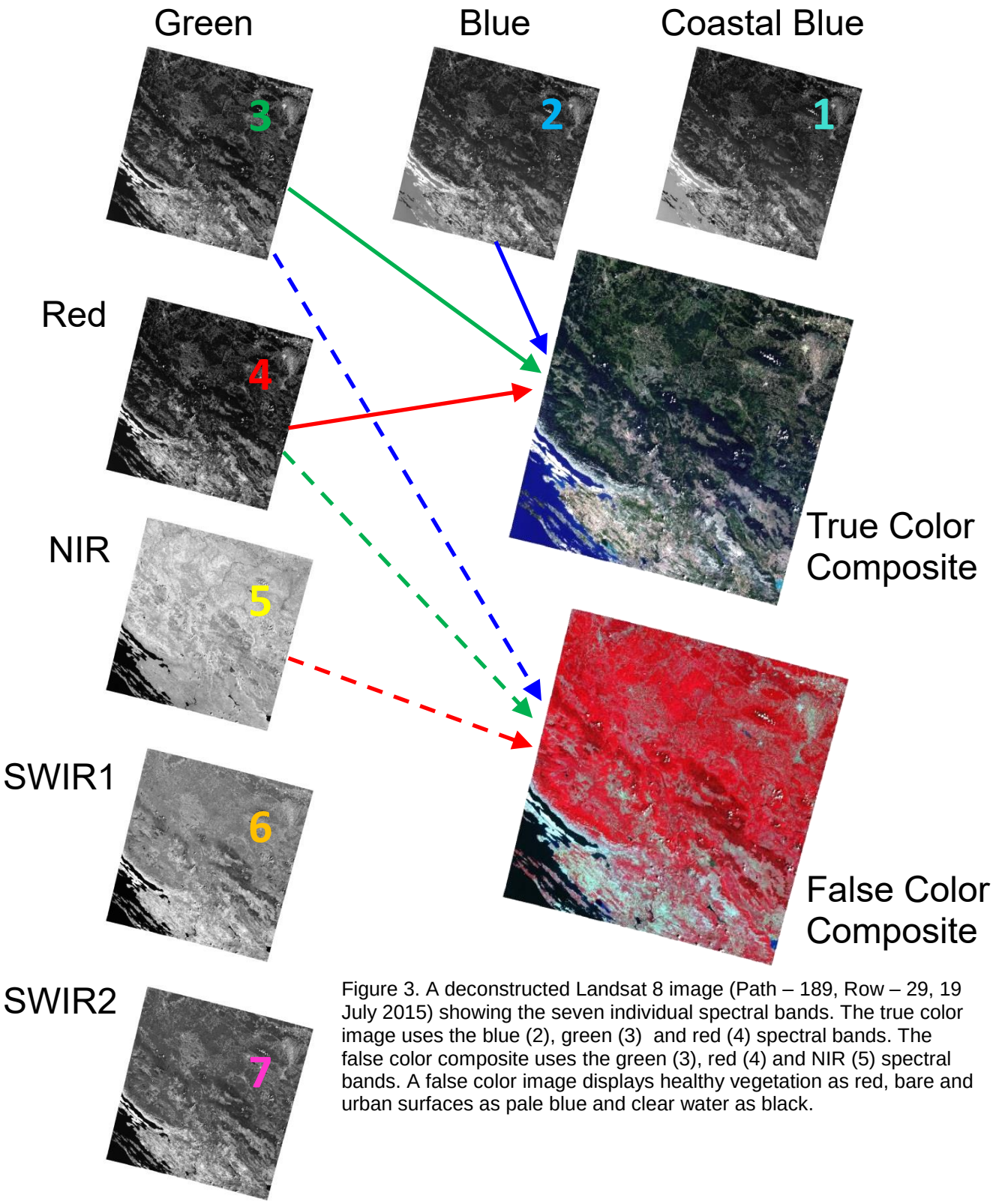


Figure 3. A deconstructed Landsat 8 image (Path – 189, Row – 29, 19 July 2015) showing the seven individual spectral bands. The true color image uses the blue (2), green (3) and red (4) spectral bands. The false color composite uses the green (3), red (4) and NIR (5) spectral bands. A false color image displays healthy vegetation as red, bare and urban surfaces as pale blue and clear water as black.

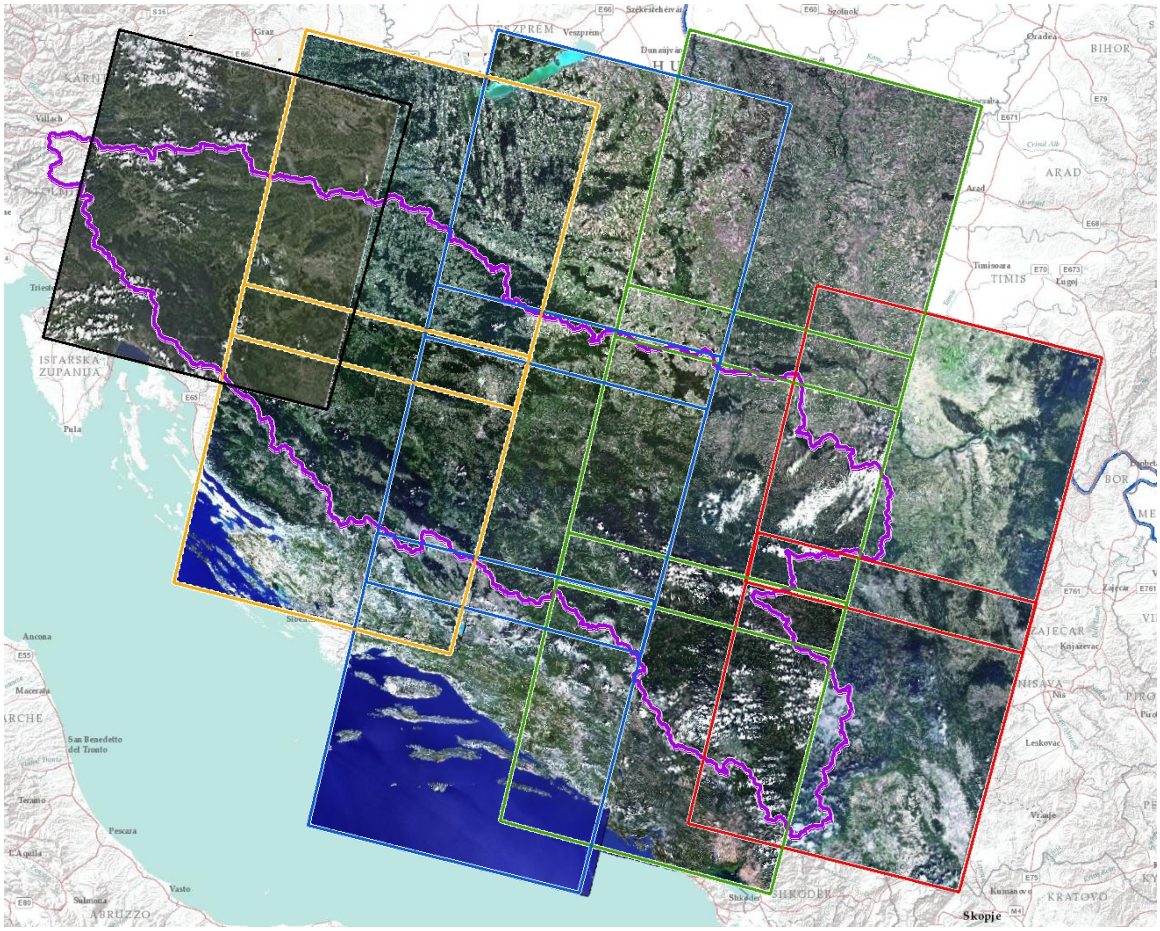


Figure 4. Layout of five Landsat 8 mosaics covering the Sava River Basin.

## Unsupervised Classification

The individual Path mosaics were then classified using an unsupervised classification algorithm. Unsupervised image classification uses a non-hierarchical clustering routine that assigns statistically similar pixels into a predefined number of land cover classes. A total of five land cover maps, one for each mosaic, were constructed.

For this exercise, the clustering routine created 12 classes. The number of classes defined by an image analyst is typically two to three times the total number land cover types that are required in the final product. Based on the surface roughness coefficients defined for the most common land use / land cover classes throughout the basin, six to seven final categories would be sufficient.

The 12 classes were visually identified and labeled by interpreting the surface features on the input multispectral Landsat imagery and high spatial resolution Google Earth imagery. Classes with similar surface features were combined to create final thematic raster products, one raster map for each Path mosaic, with the following seven cover types:

1. Water
2. Bare / Urban
3. Conifer Forest
4. Mixed Forest
5. Scrub / Open Forest
6. Agriculture / Low Vegetation
7. Clouds

The method used in this demonstration could not offer a more detailed land cover classification with additional feature classes due to the time constraints, computing power and size of the complete multispectral image data set (>25 gigabytes). For example, distinguishing bare soil pixels from built-up, or urban, pixels would require a more robust classification routine, such supervised classification. Supervised classification, another multivariate discriminant function used extensively for land cover mapping, requires an image analyst to identify examples of each surface feature class in the images and build training data. The sample sizes needed to accurately delineate each desired cover class with the supervised algorithm is based on internal class variability, but as a general rule the absolute minimum sample size is n = 30. However, sample sizes are generally much larger with typical training data sets requiring more than 100 polygons per class. Resources for this demonstration effort were not available to implement an enhanced supervised classification for the five Landsat 8 mosaics.

The end use of these basin-wide land cover maps is to provide estimates of surface roughness coefficients (i.e., Manning's n values) to support flood and inundation model predictions. Review of the published roughness coefficients, along with consultation with the AutoRAPID implementation team, suggested that these six cover classes, excluding the clouds, were sufficient to successfully run the flood model.

## Subset (or Clip) to Sava River Basin

The five thematic land cover raster maps were individually subsetted, or clipped, to remove all grid cells outside the boundary of the Sava River Basin. This significantly reduced the size the output maps. This clipping could have been applied to the multispectral Landsat images prior to running the unsupervised classification. However, it was determined that keeping the larger mosaics intact potentially enhanced land cover class separation and delineation by maintaining greater variability across the entire landscape.

## Mosaicking the Final Land Cover Maps

The five clipped raster products were mosaicked, two at a time, to create a single land cover map covering the Sava River Basin. Each pair were overlaid and combined to minimize the percentage of cloud cover that remained in the final product.

## Minimum Mapping Unit

The final step in preparing the basin-wide medium resolution land cover product is to apply a minimum mapping unit (MMU) filter. The MMU for all land cover maps, whether created through visual interpretation (e.g., using hardcopy aerial photography) or digital classification methods, defines the two-dimensional area of the smallest polygon maintained in the final product. For pixel-based land cover classifications using digital imagery applying an MMU also removes the thematic speckle, or single class pixels surrounded by clusters of different class pixels, and enhances thematic product utility.

The MMU applied to the Sava River land cover map was 10 pixels or approximately 9,000 square meters (0.9 ha).

The completed land cover map (Figure 5) was converted to a .tif format and delivered to the AutoRoute team as an enhanced input, providing the information needed to assign detailed surface roughness coefficient values, for improved flood and inundation prediction throughout the Sava River Basin. Table 2 lists the total area of each of the six land cover classes across the basin and their associated Manning's n coefficients.

## Accuracy Assessment

A quantitative estimate of the thematic accuracy, expressed as the percentage of each cover type that is classified correctly, is the typically the final step in building a land cover map. The methods required to complete the accuracy assessment include a statistically representative ground-based sample of hundreds of points, throughout the basin, that identify the true cover type. These field sample points are then compared to the class values that were assigned to the coincident pixel, or groups of pixels, on the final class map. Resources for a quantitative thematic error estimate were not available for this demonstration effort.

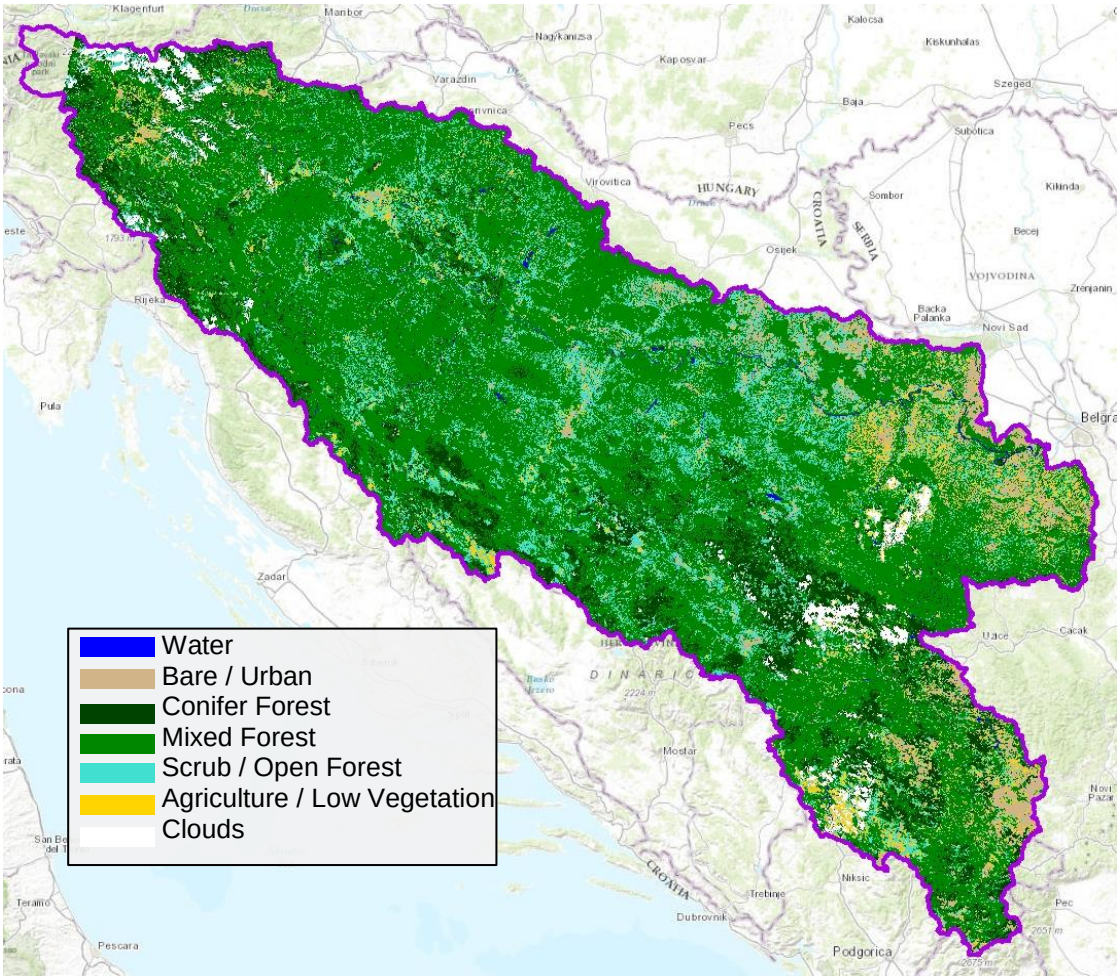


Figure 5. Final land cover product over the Sava River Basin.

Table 2. Total hectares in each land cover class. Representative surface roughness coefficients (Manning's n values) are also listed for each cover type.

| Class # | Description | Area (hectares) | Roughness Coefficients |
|---|---|---|---|
| 1 | Water | 32,908 | 0.025 |
| 2 | Bare / Urban | 529,093 | 0.04 |
| 3 | Conifer Forest | 1,270,693 | 0.10 |
| 4 | Mixed Forest | 5,420,449 | 0.10 |
| 5 | Scrub / Open Forest | 1,342,502 | 0.40 |
| 6 | Agriculture / Low Vegetation | 450,998 | 0.025 |
| 7 | Clouds | 201,923 | - |
| - | (unclassified area) | (~330,00) | - |

## Other Applications of Land Cover Mapping

Land use / land cover mapping was historically a time consuming task that required highly skill air photo interpreters. Regional mapping efforts covering areas the size of the Sava River Basin required years of effort. The first-order cover type map presented here was created in approximately 40 hours, using a laptop computer. With refined image processing methods, and better computing capabilities, surface feature maps with comparable detail and accuracy could be created in less than 20 hours. The constantly expanding Landsat 8 archive offers those ministries responsible for disaster prediction, preparedness and response with real situational awareness by providing a time-series of pre- and post-disaster "pictures" of land surface conditions. Historical satellite imagery can detect and quantify land use change over large, diverse landscapes. Landsat 8 data is distributed without restrictions and all output products can be disseminated freely among national and international crisis management agencies.

The Earth's surface is forever changing, both from natural forces and from man-made influences. Some weather-related disasters, such as floods, can be predicted. Preparing for a future crisis requires multi-dimensional planning at the strategic, operational and tactical levels. Land use / land cover information, generated from remotely sensed data, can significantly enhance situational awareness at a national, regional and local scales.

## Acknowledgments

The author would specifically like to thank Sean Griffin, of the Geospatial Research Laboratory, for his guidance and assistance with retrieving and post-processing the Landsat 8 image from the USGS archive, as well as his review of the completed land cover map.

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# FLOW SIMULATION IN THE SAVA RIVER BASIN USING AN OPEN-SOURCE MODEL

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*Rain and/or snow driven flooding affects every country in the world. In data-limited regions the effects of flooding can be devastating and occur with little warning. Large-scale hydrologic models can help assess the impacts of flooding, but are often expensive and take years to develop. This paper describes an open-source hydraulic model that is used to simulate flow estimates over large extents at a spatial resolution useful to water managers and emergency personnel. Using near-global datasets, the method routes gridded runoff data from land-surface models (LSMs) through a one-dimensional river routing model called Routing Application for Parallel computatIon of Discharge (RAPID). All required geospatial datasets used are freely available globally. Gridded runoff data from LSMs is the only dynamic forcing data required, for which this paper uses data from the European Centre for Medium Range Weather Forecast. The outputs are spatiotemporal flow estimates in any river reach. Using the RAPID model, the Sava River Basin in southeastern Europe is presented as a test case where river flows are hindcast simulated with no a-priori knowledge and no calibration, and are then compared to observed flow data. An example of forecast simulation is also provided as a demonstration of how the model could potentially be utilized.*

## Introduction

Flood warning systems have shown to be an effective means in reducing both human and material loss from flooding by providing information on the occurrence, severity, arrival, and duration of a potential flood (Carsell, Pingle and Ford, 2004; Younis and Thielen, 2008). Warning systems often rely on observed meteorological (i.e. rainfall) or hydrologic (i.e. streamflow) observations, but can also incorporate forecasting components combined with numerical watershed models (NOAA, 2012). The costs to develop, operate, and maintain data collection systems ranges greatly from manual and automatic observations (NOAA, 2012) to national radar systems (Zhang et al., 2011). Many regions of the world do not have the developed system of the hydrologic observation data and/or computational requirements (e.g. numerical models, high-performance computing, etc.). Therefore, providing an adequate and reliable flood forecasting system for many regions of the world is a challenge.

For the past several decades weather prediction and forecasting has been accomplished through the use of regional and global climate models. These climate models link atmospheric, oceanic, and Land Surface Models (LSMs) to calculate the mass and energy

exchanges between the different systems (e.g. evaporation is a flux of mass and energy between the land and the atmosphere). Gridded runoff is a product of LSMs that has recently become more common to use in river routing models (Getirana et al., 2014; Li et al., 2015; Wu et al., 2014; Wu et al., 2011; Yamazaki et al., 2011) to route the runoff generated from LSMs through gridded stream networks. The spatial resolution of the LSMs are often greater than 10 km and the river routing routines typically define river channel locations using a structured grid. To more precisely define the channel location, the Routing Application for Parallel computatIon of Discharge (RAPID) model (David et al., 2011) was developed to route flows through river locations defined by a vector (i.e. shapefile) stream network (David et al., 2013; Tavakoly et al., 2016a and 2016b).

Recently, Snow et al. (2016a) used the RAPID model to simulate streamflows in Columbia and the Dominican Republic. The stream network was defined using the HydroSHEDS dataset, and LSM runoff data from the European Centre for Medium-Range Weather Forecasts (ECMWF) was used. Using the HTESSEL (Pappenberger et al., 2010) land surface model, ECMWF provides both historical data (1979 through near-current) and up to 15 day, 52-member ensemble forecasting dataset. Using a similar approach as Snow et al. (2016a), the goal of this paper is to define a modeling framework for hindcast and forecast flow estimation at high-spatial and -temporal resolution for the Sava River Basin (SRB) in southeastern Europe. The vector stream network will be created using geographic information system (GIS) models and freely available 1 arc second elevation data. The uncalibrated model will be tested against historical observed streamflow data within the SRB. Emphasis is made in this paper to use only globally available data and open-source models to simulate the flow estimates.

## Methodology

In this paper more emphasis is given to the data sources used to generate the RAPID model for the SRB and to the initial comparison of the model results versus historical observation. The following sections describe the RAPID model, the RAPID Tools toolbox in ArcGIS 10.3, and the steps required to set up a RAPID model for the SRB using only elevation data.

### The River Routing Model, RAPID

In this section, the RAPID river routing model is briefly summarized. The reader is guided to previous implementations of the RAPID model (David et al., 2011 and 2013; Tavakoly et al., 2016a and 2016b), specifically those using ECMWF datasets (Snow et al., 2016a). RAPID routes runoff from LSMs through a river network defined using vector data. Flow is routed through each reach of the river network by solving a matrix-based Muskingum equation, which allows for lateral inflow from LSM runoff data. The following sections (Steps 1-3) describe the setup of the RAPID model for the SRB. These sections also

provide more detail in describing how the RAPID model translates runoff data from LSM data into river flow in thousands of river reaches.

Setup of RAPID models is accomplished through the use of RAPID Tools, an ArcGIS 10.3 toolbox that automates the generation of input files for the RAPID simulation. RAPID Tools is the result of a collaborative effort between the Environmental Systems Research Institute (ESRI), Brigham Young University (BYU), and the U.S. Army Corps of Engineers, Engineer Research and Development Center (ERDC) (Snow et al., 2016a; Tavakoly et al., 2016b). RAPID Tools are available under the Apache 2.0 License at https://github.com/Esri/python-toolbox-for-rapid.

### Step 1: Generating Stream Network

RAPID requires the stream network (in vector format) and the associated drainage area for each stream segment to be defined. Some countries have developed vector stream networks (for example, the NHDPlus datasets in the United States (Horizon Systems Corporation, 2006; McKay et al., 2012). Stream networks can also be defined using the HydroSHEDS datasets (as used in Snow, 2016a), or can be created using digital elevation model (DEM) data within GIS models.

Because this data is unavailable for the SRB, it is created from elevation datasets. The Shuttle Radar Topography Mission (SRTM) mission collected global 1 arc second (~30 m) resolution DEM data (Bamler, 1999) that is freely available from the United States Geological Survey (USGS). Due to high spatial resolution, global availability, and previous use in a RAPID simulation in the Philippines (Wahl et al., 2016), the SRTM elevation data is chosen for this paper and was collected for the entire Sava River Basin from the USGS website (USGS, Long Term Archive, https://lta.cr.usgs.gov/get_data. [Accessed 08 Feb 2016]).

Using the ArcHydro toolbox within ArcGIS 10.3 (ESRI, 2011), a flow direction (FDIR) and flow accumulation raster (FAC) are generated using the SRTM 1 arc-second dataset. The FDIR cell value indicates the direction of the steepest downslope neighboring cell, thus describing the direction water will flow from that cell. The FAC cell value defines how many upslope cells hydraulically contribute to that cell. FAC cells with high values often indicate the locations of rivers. Arbitrarily it was determined that any FAC cell with a value greater than 10,000 be considered a location of a river. The locations of each river segment (in raster format) were then converted to shapefile format within ArcGIS 10.3 (Figure 1-A). Using the *Add Surface Information* tool within ArcGIS 10.3, the slope of each stream segment is determined from the DEM data. Associated drainage catchments (raster and shapefile formats) are then generated for each stream segment using the FDIR raster to determine which cells drain to each stream segment (Figure 1-B).

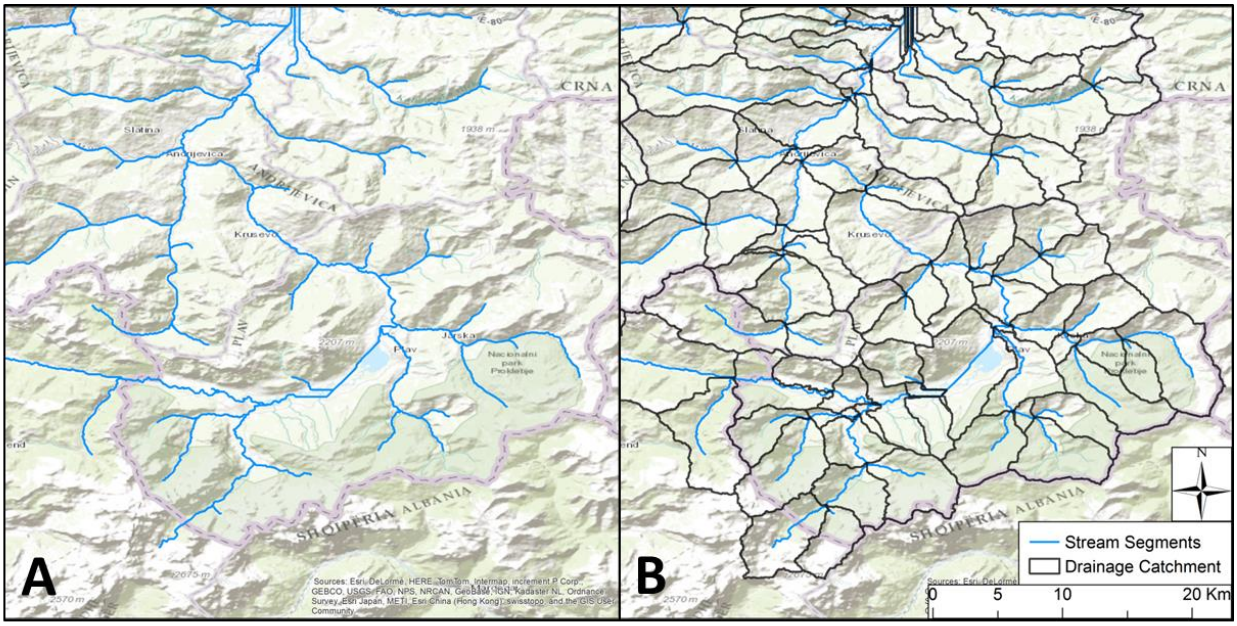



*Figure 1. Development of Hydrography Data from Elevation Dataset. Background imagery for Figures 1-3 obtained online through ArcGIS 10.3, sources: Esri, DeLorme, HERE, TomTom, Intemap, increment Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordinance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community*.

### Step 2: Generating RAPID Model Files

Using the hydrography data (stream length and slope) developed in Step 1, RAPID Tools generates the Muskingum *K* and *X* parameters for each stream segment. The *K* parameter represents the travel time (seconds) and *X* represents a dimensionless weighting coefficient for each river segment. Tavakoly et al. (2016b) showed that considering topography information such as river length and slope to estimate the *K* parameter improves the RAPID model performance. Following the same approach the *K* parameter was calculated based on the length and slope of each river segment for entire Sava Basin.

RAPID Tools also defines the river connections by determining how water is routed from upstream to downstream. The *HydroID* and *NextDownID* attributes in the river network shapefile allows for the tools to create the river network connectivity for RAPID.

### Step 3: Generating Inflow from Land Surface Model

The dynamic input file for the RAPID model is gridded spatiotemporal surface and subsurface runoff from LSMs. Multiple LSMs are operational for various regions and countries of the world. For example, in the United States the North American Land Data Assimilation System (NLDAS) (Mitchell et al., 2004) provides historical runoff data and the National Centers for Environmental Prediction Global Forecast System (GFS) (Saha, 2010) provides global forecast runoff data. ECMWF provides both historical and forecasted runoff data globally, with the historical data (ERA Interim) freely available from

1979 through near-current from the European Centre for Medium-Range Weather Forecasts website (http://apps.ecmwf.int/datasets) at a temporal resolution of 3 hours and a spatial resolution of approximately 39 km. Due to global coverage and previous use with RAPID outside the United States (Snow, 2016a and Wahl et al., 2016), historical runoff data from the ERA Interim LSM will be used within this paper.

In recent studies, ArcGIS tools were used to prepare inflow to each reach in the stream network by downscaling the gridded LSM runoff grids for the RAPID flood routing model (Snow et al., 2016a and Tavakoly et al., 2016b). The first step in this process is to generate a weight table. The weight table defines which LSM grid cells each catchment intersects, and the area of the catchment within each intersected LSM grid cell. This process is only performed once because the catchment boundaries and the structured grid of the LSMs are static. The volume of runoff is calculated for each catchment at each time step. Further details can be found in Snow et al. (2016a) and Tavakoly et al. (2016b).

The process of generating the inflow for RAPID and running the RAPID simulation is performed using RAPIDpy (Snow et al., 2016b). RAPIDpy is a python interface for RAPID that assists to prepare inputs, runs the RAPID program, and provides post-processing utilities. RAPIDpy is available under the BSD 3-Clause at https://github.com/erdc-cm/RAPIDpy and at https://pypi.python.org/pypi/RAPIDpy.

## Model Evaluation

Within the RAPIDpy python library, the Nash-Sutcliffe Efficiency (Nash and Sutcliffe, 1970) (NSE) and Kling–Gupta Efficiency (Gupta et al., 2009) (KGE) are used to evaluate model performance. NSE is calculated as

$$NSE = 1 - \left[ \frac{\sum_{i=1}^{n} \left( Q_i^{obs} - Q_i^{sim} \right)^2}{\sum_{i=1}^{n} \left( Q_i^{obs} - \overline{Q_i^{obs}} \right)^2} \right] \tag{3}$$

where: $Q_i^{obs}$ is the observed flow ($m^3\ s^{-1}$), $Q_i^{sim}$ is the simulated flow ($m^3\ s^{-1}$), $\overline{Q_i^{obs}}$ is the average observed flow ($m^3\ s^{-1}$) over the period of record, and *n* is the number of compared values. NSE ranges from $-\infty$ to 1, with a value of 1 indicating that the model prediction is perfectly matched with the observations. A NSE value lower than zero indicates that $\overline{Q_i^{obs}}$ better represents the observed flow than the simulation.

KGE decomposes NSE and finds an optimized solution from the three-dimensional criteria space considering correlation, variability, and bias together. The KGE is calculated as

$$KGE = 1 - \sqrt{(r-1)^2 + (\alpha-1)^2 + (\beta-1)^2} \tag{4}$$

where: $r$ is the linear correlation coefficient, $\alpha = \frac{\sigma_s}{\sigma_o}$ is the relative variability in the simulated and observed values, $\sigma_s$ and $\sigma_o$ are the standard deviation of simulated and observed values respectively, and $\beta$ is the ratio of the mean of simulated flow and observed flows. KGE ranges from $-\infty$ to 1, in which KGE equal to 1 indicates that the model prediction is perfectly matched with the observations.

## Implementation for Sava River Basin

The Sava River Basin in southeast Europe is approximately 95,793 km2 and includes drainages from Slovenia (11% of drainage area), Croatia (26%), Bosnia and Herzegovina (40%), Montenegro (7.5%), Serbia (15.4%), and Albania (0.1%). The 945 km long Sava River begins in the mountains of Western Slovenia and flows through three national capital cities, including Belgrade, Serbia, where the river joins the Danube River (Sommerwerk et al., 2009). Due to the high international significance of the river, the International Sava River Basin Commission (ISRBC) was established for purposes of establishing cooperation amongst the countries in navigation and water management. The SRB has been an area of interest for ERDC (formerly the Waterways Experiment Station, WES) since December 1995, when WES employees were asked to forecast flood conditions along the Sava River during a United Nations peacekeeping mission (Fatherree, 2006). WES employees were able to provide short-term flood forecasting at select locations along the Sava River by using flood stage data from the Croatian Flood Ministry that were sent by means of facsimile to WES by a British operative in Zagreb, Croatia. Approximately twenty years later, the entire SRB is used again as a test case for simulating flow using the RAPID model.

The ERA Interim and 52-member ensemble of LSM runoff data is used in RAPID to simulate flow in the SRB. For the ERA Interim data the simulation was implemented from January 1, 1980 through December 31, 2014, and for the 52-member ensemble dataset the RAPID model simulates two-week forecast streamflow results for all 8,006 river reaches in the study domain. Historical flow simulations are compared to observed flow data at several stream gages within the SRB using the post processing tools in RAPIDpy.

## RESULTS AND DISCUSSION

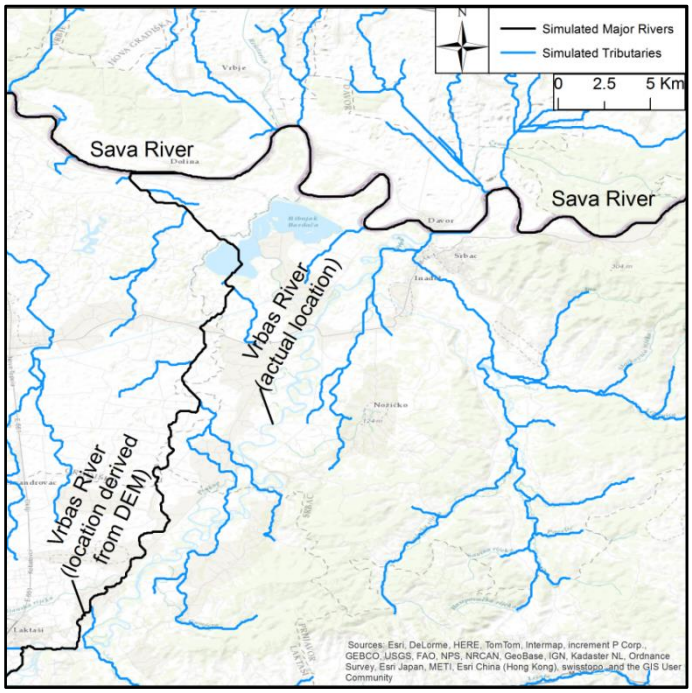
The hydrography data derived using elevation data and GIS tools is compared to observed stream locations. The simulated flow is tested by comparing to observed streamflow at 25 streamgage locations within the SRB. A single example of the two-week forecast flow is also shown as an example of how the model can be used for forecasting flow conditions.

## Hydrography Data

Comparison between stream locations defined by the elevation data and those shown in imagery tend to match well in mountainous areas where the high topographic relief allows for the streamlines and the basin catchment boundaries to be well defined (see Figure 1). In areas with less topographic relief and urban areas the placement of the stream locations tend not to match the locations found in imagery. Figure 2 shows an example of the misalignment of the stream network near Davor, Croatia, the confluence of the Vrbas and Sava Rivers. The southeast portion of the region shown in Figure 2 has medium to high topographic relief and the DEM-derived river locations match those shown in the background imagery. The rest of the region has minimal topographic relief (predominately farm land) and aside from the Sava River the DEM-derived river locations do not match those shown in the background imagery. The placement of the Sava River is accurate when compared to the background imagery. The DEM-derived location of the Vrbas River intersects the Sava River approximately 12 km to the northwest of the actual confluence of the two rivers. Smaller rivers and streams (shown in blue in Figure 2) also do not follow the actual locations, except for those in the southeast part of the region characterized by more topographic relief.

Figure 2. Streamline misalignments near Davor, Croatia – DEM-derived Sava and Vrbas River locations are shown in black lines, all other streams and rivers are shown in blue lines.

Accurate location of the river segment itself affects the slope associated with the river segment (which is defined by the elevation data) and thus how the runoff is routed downstream, while accurate location of the drainage catchments affect the inflow of runoff (from LSM) to the river segment. Although the river segments and associated drainage catchments may be improved upon, the effect on the hydrologic response is expected to only affect local runoff to the stream segment in areas of low relief and not the accumulated runoff from the headwater regions (typically the bigger portion of the stream hydrograph). Therefore, the initial stream segments and drainage



catchments derived from the DEM are used to simulate streamflow.

## Hindcast Simulated Flow

Figure 3 displays the derived stream network for the SRB as well as the 25 streamflow gage site locations where simulated flow and observed flow are compared. Daily observed flow data were obtained between January 2009 and June 2014, with some gages having periods of missing data. The gage site identification (ID) numbers in Figure 3 correspond to the gage location, river, and drainage area shown in Table 1. The NSE and KGE values (using daily simulated and observed flow data) are also shown in Table 1, with the KGE values mapped to the streamgage locations in Figure 3.

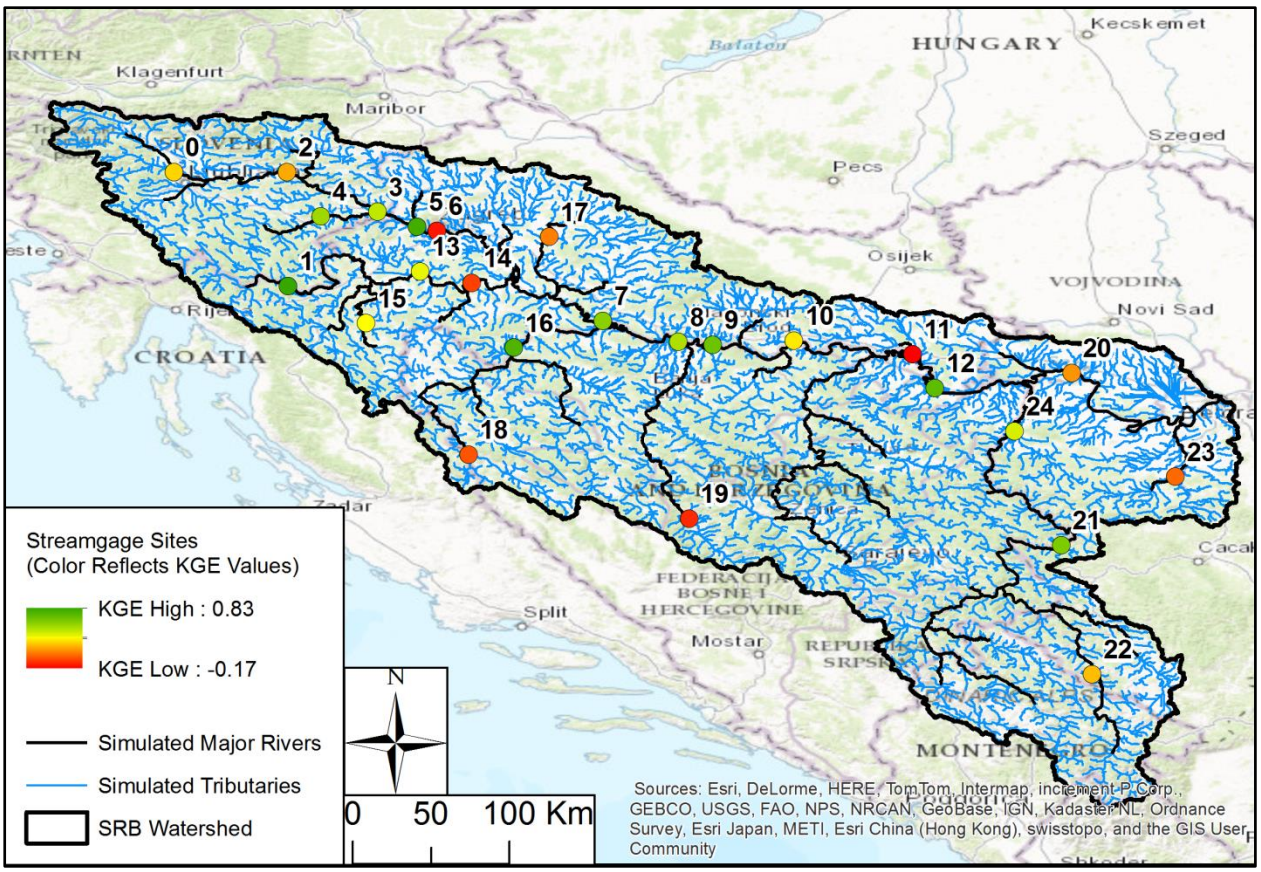



Figure 3. Sava River Basin. Gages are shown in circles with associated gage IDs. The color of the circles indicates the KGE value of that gage site when comparing simulated and historical streamflow data (only streamgage 19 has a KGE value below 0.0). Blue and black lines indicate the stream network that is used within RAPID.

Table 1. List of streamflow gages used for comparison with the SRB.

| ID | Name | Country | River | NSE | KGE | Drainage Area (km$^2$) |
|---|---|---|---|---|---|---|
| 0 | Medno | Slovenia | Sava | 0.30 | 0.37 | 2,156* |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | Radenci | Slovenia | Mur | 0.24 | 0.21 | 1,314* |
| 2 | Hrastnik | Slovenia | Sava | 0.26 | 0.49 | 5,200* |
| 3 | Čatež | Slovenia | Sava | 0.27 | 0.45 | 10,186 |
| 4 | Gorenja Gomila | Slovenia | Krka | 0.17 | 0.27 | 1,442* |
| 5 | Podsused-žičara | Croatia | Sava | 0.39 | 0.47 | 1,250* |
| 6 | Zagreb | Croatia | Sava | 0.39 | 0.50 | 12,450 |
| 7 | Jasenovac | Croatia | Sava | 0.70 | 0.82 | 38,618* |
| 8 | Mačkovac | Croatia | Sava | 0.71 | 0.81 | 40,838 |
| 9 | Davor | Croatia | Sava | 0.73 | 0.83 | 47,179 |
| 10 | Slavonski Brod | Croatia | Sava | 0.72 | 0.83 | 50,858 |
| 11 | Županja | Croatia | Sava | 0.75 | 0.82 | 62,891 |
| 12 | Gunja | Croatia | Sava | 0.80 | 0.79 | 64,137* |
| 13 | Jamnička Kiselica | Croatia | Kupa | 0.48 | 0.57 | 6,895 |
| 14 | Stari Farkašić | Croatia | Kupa | 0.53 | 0.65 | 8,992 |
| 15 | Veljun | Croatia | Korana | 0.46 | 0.59 | 979* |
| 16 | Struga Banska | Croatia | Una | 0.64 | 0.76 | 8,103* |
| 17 | Čazma | Croatia | Česma | 0.27 | 0.30 | 1,635* |
| 18 | Martin Brod | Bosnia and Herzegovina | Una | 0.30 | 0.35 | 1,150* |
| 19 | Daljan | Bosnia and Herzegovina | Vrbas | -1.08 | -0.17 | 908* |
| 20 | Sremska Mitrovica | Serbia | Sava | 0.61 | 0.71 | 87,996 |
| 21 | Bajina Basta | Serbia | Drina | 0.07 | 0.44 | 14,797 |
| 22 | Brodarevo | Serbia | Lim | 0.37 | 0.68 | 2,650* |
| 23 | Beli Brod | Serbia | Kolubara | 0.49 | 0.45 | 1,896 |
| 24 | Lešnica | Serbia | Drina | 0.49 | 0.60 | 928* |

* Indicates drainage area was calculated from FAC raster. Other drainage areas taken from World Bank (2015).

The model typically performed well at streamgages with large drainage areas and poorly at streamgages with small drainage areas. For instance, the average KGE for the 13 streamgages with the largest drainage areas is 0.69, as compared to an average KGE of 0.38 for the 12 streamgages with the smallest drainage area. The Vrbas River near Daljan, Bosnia and Herzegovina, (Gage ID #19) has the lowest NSE (-1.08) and KGE (-0.17) values, and also has the smallest drainage area (908 km2). Figure 4 shows the NSE and KGE at each streamgage compared to the drainage area of the streamgage. Drainage area for each streamgage was taken from the World Bank (Basin, 2015) or calculated based on the FAC value at the streamgage site. Sites with higher drainage areas (greater than 20,000 km2) are more consistent and tend to have higher accuracy (defined by KGE and NSE values closer to 1.0) than sites with smaller drainage areas.

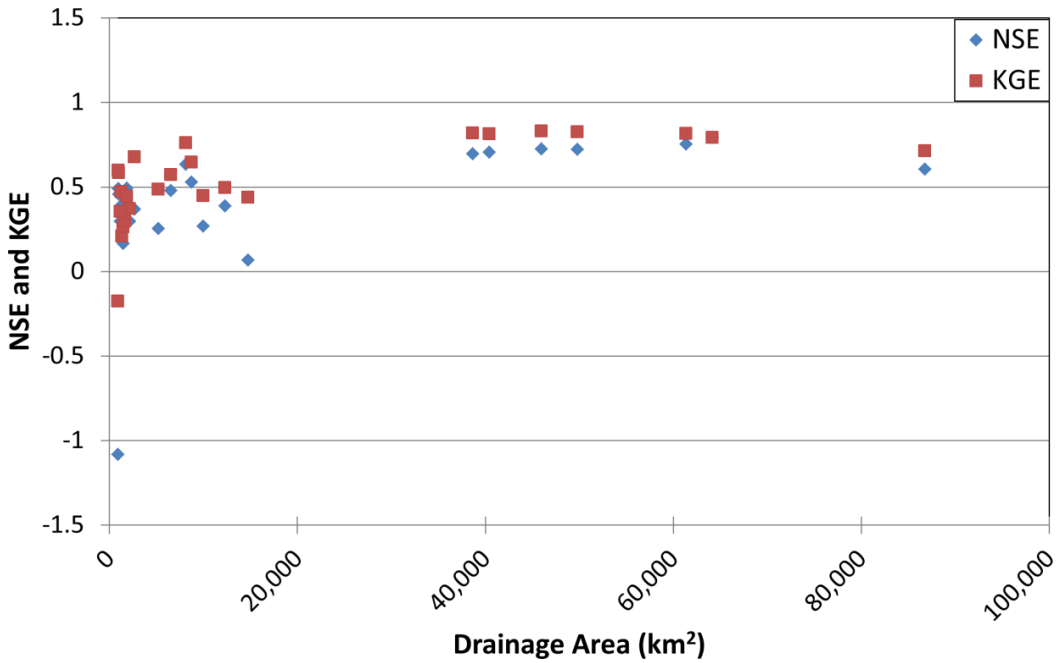



Figure 4. KGE and NSE values versus the drainage area at each streamgage.

Figure 5 displays the simulated and observed hydrographs at four of the gage sites ranging in drainage area from 1,150 to 87,996 km$^2$. The seasonal trends in the hydrographs match well in all four of the simulations. Sites with smaller drainage areas (Gage IDs #18 and #6) show many sudden and frequent increases and then decreases in both the simulated and observed hydrograph, indicating a flashier type of flooding. Although both the simulated and observed hydrographs exhibit several of these flash floods, the timing of them is not always coordinated, indicating an issue in the timing of how runoff from the LSM data is translated and transported through the river network. The timing and magnitudes of the simulated and observed flow in the gage sites with larger drainage areas (Gage IDs #9 and #20) are better, and indicate higher NSE and KGE values. These hydrographs show more gradual increase and decrease in flow, a common trait for a river that is the accumulated response of hundreds and thousands of stream reaches. The peak flows are also better captured at the streamgages with larger drainage areas (Gage IDs #9 and #20).

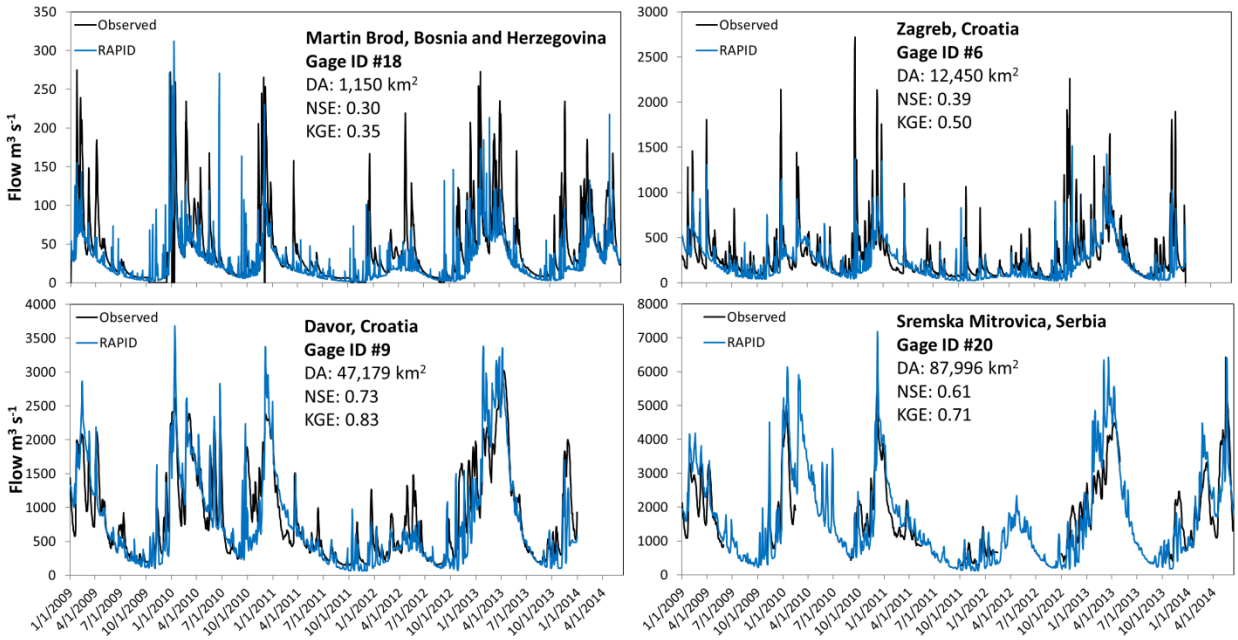



Figure 5. Hydrographs at four streamgage sites within the SRB. Gage ID values correspond to locations shown in Figure 3 and gage attributes shown in Table 1.

## Forecast Simulated Flow

Figure 6 displays a two-week forecast flow (May 20th through June 4th, 2016) for the Sava River near the confluence with the Danube River in Belgrade, Serbia. The forecast is viewable through the Streamflow Prediction Tool, an online application that shows the locations of simulated rivers through an interactive map, forecasted and historical hydrographs for each river reach, and warning flags when a forecasted flow exceeds certain criteria (e.g. the 20-year flow event). The forecast is updated every 12 hours and simulates flow in each river reach using the 52-member ensemble runoff forecast from ECMWF. The interested reader is guided to Snow (2016a) and Wahl (2006) for examples and more detail on the flow forecasts using the RAPID model and the Streamflow Prediction Tool.

This study shows a modeling framework that can be used for hindcast and forecast flow simulation. Although the model arguably performed well when compared to observed flow data, calibration of the RAPID model is required to improve the modeling performance. The model results (Figure 3-5 and Table 1) show that the accuracy of the simulated hydrographs varied, especially in river reaches with smaller (< 20,000 km$^2$) drainage areas. In addition to the calibration of the RAPID model for the SRB, some potential reasons for this varying of accuracy exist, including:

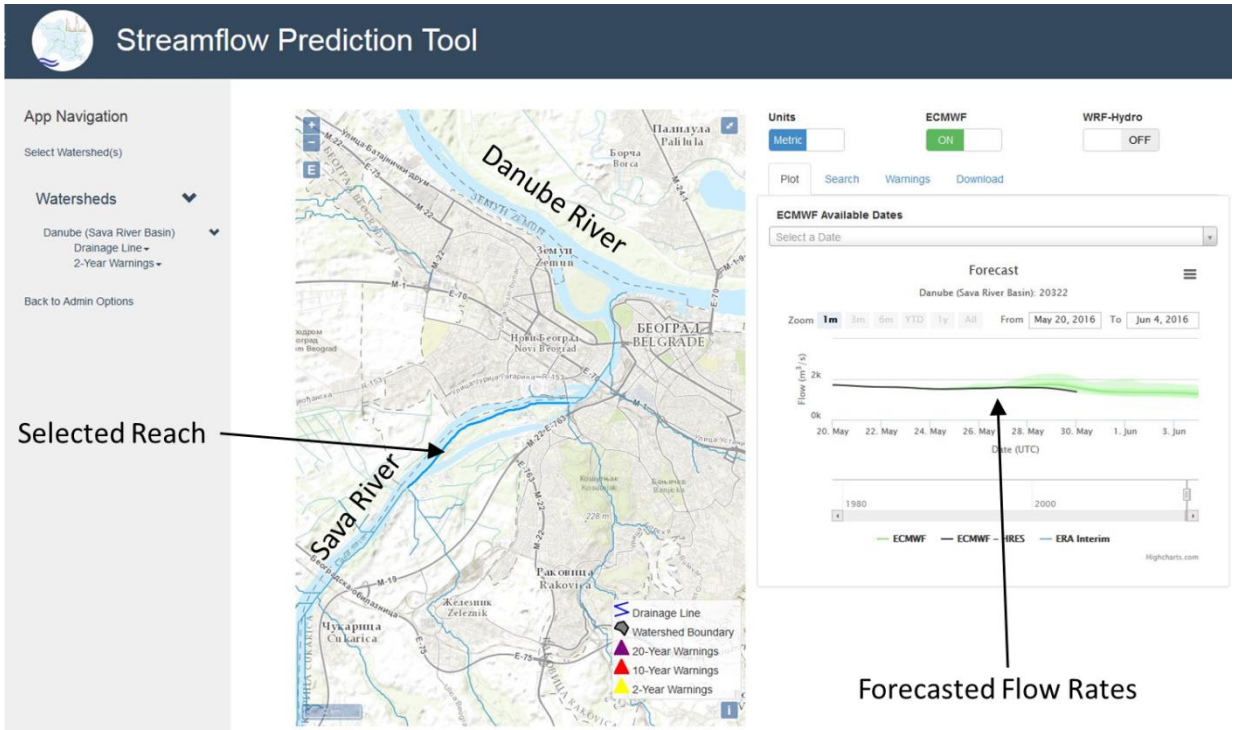



Figure 6. Flow forecast for the Sava River near Belgrade, Serbia, using the Streamflow Prediction Tool to visualize and assess the forecast.

1.) Local hydrologic variations (small storm and/or melt events) may not be adequately captured within the hydrograph, whereas these events may be aliased in the hydrograph farther downstream. The connection of coarse LSM grid cells to high-resolution stream segments and drainage basins may result in some small, local, hydrologic events not being adequately included in the hydrographs. For instance, approximately 1.5 LSM grid cells (~39 km resolution) would cover Figure 1B, and the entire area of Figure 3 would be covered by approximately 285 LSM grid cells. Hydrologic differences within these coarse LSM grid cells likely do not result in the ability to capture hydrologic phenomena at the small-basin scale. The misalignment of river locations (e.g. Vrbas River near Davor, Croatia in Figure 2) and drainage catchment boundaries may also adversely affect how runoff from the LSM is translated to the RAPID model.

2.) Runoff from the LSM grid cells are directly input into the stream network of the RAPID model, which neglects the travel time for runoff to flow overland or through the subsurface to the stream network. Due to aliasing this would also more adversely affect sites with smaller drainage areas.

3.) Dams, lakes, canals, and other manmade features present in the SRB were not included in the model, which may have a large effect on the accuracy of the hydrograph. An example of how dams effect local hydrographs can be seen in Follum et al., (in review) and regional hydrograph in Tavakoly et al., (2016b).

## Conclusions

This article described how the RAPID model was implemented for the Sava River Basin in southeast Europe using only globally available elevation datasets, and historical and forecast runoff data. An example was given for using the RAPID model with the Streamflow Prediction Tool to forecast flows within the SRB. Historical runoff data from the ECMWF was used within the uncalibrated model to simulate flow in 8,006 river reaches from January 1, 1980 through December 31, 2014. Although the model is uncalibrated for the SRB, simulation results are reasonably compared with daily observed flow rates at 25 streamgages. The primary conclusions of this article are as follows:

1.) The RAPID model provides a computationally efficient means to simulate hundreds to thousands of river reaches within a river basin. The structure of a RAPID model for large river basins (such as the SRB) can quickly be built using GIS tools that only require globally-available elevation and runoff data as inputs. While the GIS tools quickly define the river segments and associated drainage catchment boundaries, errors in river placement often occur in regions with minimal topographic relief. These errors are expected to predominately affect local runoff to the stream segments in areas of low relief, but more testing in a basin with higher density streamflow gages is required.

2.) The performance of the uncalibrated RAPID model was satisfactory (NSE and KGE values greater than 0.6) in several of the major rivers within the SRB. Dams and other man-made structures were not included within the model simulation, which if included will likely improve the accuracy of the flow simulations.

3.) The results in smaller river basins within the SRB had greater variation. The smaller river basins tend to be more affected by local hydrologic effects that can lead to quick response flooding (flash flooding). Although the model captured many flash floods, the timings of the events were not coordinated with the observations. This is likely the result of several factors, including: lack of hydraulic parameter calibration, not accounting for overland and subsurface runoff from the land to the channel, mapping of coarse runoff grid cells to high-resolution watershed boundaries, and not including the effects of dams and other manmade structures on the flow in the channel.

The RAPID model is viable means to utilize existing runoff data from global land surface models to simulate river flow routing at the regional to continental scale. Future work to improve the issues mentioned will likely strengthen the accuracy and usefulness of the RAPID model in regions with little to no hydrologic data. Future higher-resolution land surface models may improve the accuracy of river flow in streams with smaller drainage areas by better capturing the local hydrologic phenomena that lead to runoff generation.

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# DISASTER RELIEF AND HUMANITARIAN AID AT SEA.
# THE BULGARIAN EXPERIENCE

***Vyara Zhekova, PhD***

*In the contemporary reality the separate national countries are indeed facing many challenges. The safety issue is now especially important and topical, compared to the preceding decades: the safety of the state, of the institutions, of the individual citizens, the alliance safety, the safety of the whole world are all at stake in the modern global world. Safety has many dimensions today, one of which is the safety of the sea and seaside territories. This issue is especially topical also for Bulgaria, considering its Black sea coast and adjacent aquatory. The present article will be dealing namely with this aspect of safety.*

Considering that Republic Bulgaria belongs to the Black sea countries community, the issues of safety at sea, search and rescue of people and vessels, protection of the seaside infrastructure are not new issues for Bulgaria. However, nowadays, in view of the increased level of worldwide insecurity, the fugitive waves, flooding all Europe and protection of the borderline regions of illegal raids, the safety of our Black sea borders is a matter of special importance for the country. Beside the usual dangers, stalking our seaside territories, now we have to be ready to respond also to the contemporary challenges. Another question is whether our country is ready for that.

## Safety at Sea. National and International Priorities

Search and rescue (SAR) service are the performance of distress monitoring, communication, coordination and search and rescue functions, including provision of medical advice, initial medical assistance, or medical evacuation, through the use of public and private resources including cooperating aircraft, vessels and other craft and installations. Governments must fulfill their obligations and carry the responsibilities set forth in international regulations, procedures and practices contained in the documents of International Maritime Organization (IMO) and other relevant binding documents, participants who represented them, and also to take whatever measures may be

necessary to ensure their observance. Above all the National coordinator for SAR should be defined on a base of specific competency. Correction of this state will contribute for enhancing SAR efficiency and will release controlling activity from conflict of interests. The competent authorities of each country in which the law applies to Agreement On Cooperation Regarding Maritime Search And Rescue Services Among Black Sea (Coastal States (Ankara Agreement) 27 November 1998) are set out in Annex 1/Article 1 (Table 1).

Table 1

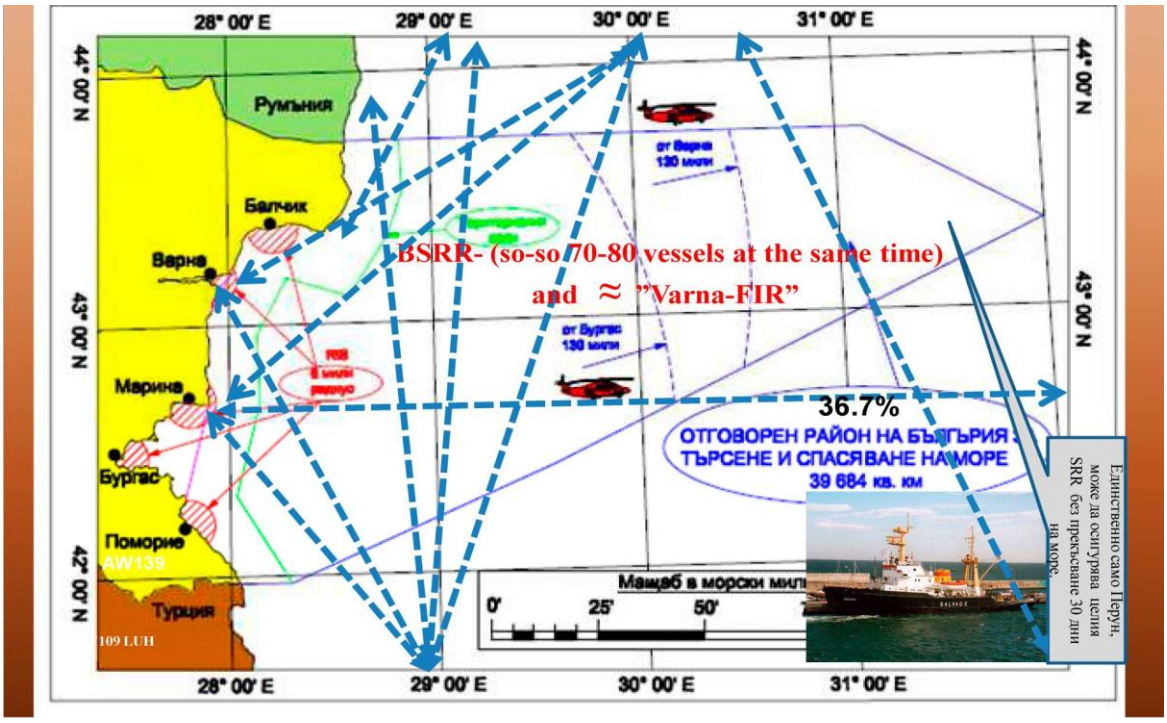
| | |
|---|---|
| Bulgaria: | Ministry of Transport |
| Georgia | Maritime administration of Ministry of Transport; (Change in 2007 - Ministry of Economics and Development ) |
| Romania | Ministry of transport |
| Russia | Maritime Administration to Ministry of transport of Russian federation; |
| Turkey | Under secretariat for Maritime Affairs to the Prime Minister; |
| Ukraine: | Ministry of transport (Change in 2011) |

## Agreement On Cooperation Regarding Maritime Search And Rescue Services Among Black Sea, Annex 1

According to a scientific research the possible probability for death of people in distress in a mass incident in the Black sea area is about 300 people every year. Upon appearing big passenger ships after 2005, enlarging the passenger terminals in the area of the Black sea, this probability will not be real and should be considered as minimum. The minimum upon which the necessary resources for our national SAR system should be estimated, is readiness for immediate search and rescue, as 1/3 of the people in distress should be accepted on board, and for the other 2/3 of them alternative emergency assistance should be provided by ships passing by the scene of event or in the responsible SAR area of the country (Figure 1). On the other hand more serious attention should be paid to The International Convention for the Safety of Life at Sea (SOLAS) requirements for SAR plans, between Maritime Rescue Coordination Centre (MRCC) and traveling companies whose ships enter or pass by Bulgarian Maritime Search and Rescue Region (BMSRR) (SOLAS 74, regulation V/7.3.).

Figure 1

**Resource characteristics of the SAR region**




1.1. Maritime politics, principles and directions

The state maritime politics should be the regulating connection with the public, as for the internal and external attitudes appearing upon carrying out the maritime activity. The state maritime politics should be the leading and main factor for realization of the national interests of Bulgaria in this area. The state maritime politics should contribute for building the country as a sea country, to create favorable conditions for achieving the aims and goals upon developing maritime activities. The state maritime politics should be the controlling unit for applying the principles of the maritime transport safety (MTS).

1.2. State politics for sea safety goals

The state politics for protection of human life at sea, the ecology of the sea and the protection of the critical sea-shore infrastructure including the cultural and material valuables upon disasters, are organizing connected and are very important priority, originated from the constitutional obligation of the country, to guarantee safety of people and fulfilling its international engagements. The most important goals of the state politics for protection of human life at sea, ecology and protection of critical infrastructure are:

- building an united rescue system for distress, incidents and crisis;
- classifying the responsibilities according to precautions;

•preventing developing risk factors upon threats;

•using the most efficient combination of regular and volunteers' organizations;

•guaranteeing visible governing of programs for restoring.

## 1.3. Maritime transport safety

The functions of Maritime Transport Safety are: Providing safety of shipping: people, ships and their load, sea route safety and protection of environment.These functions appear in the process of ships' movement from one port to the other and in the time of a sea accident. From the latter it is necessary to create and maintain maritime specialized forces and means to prevent disasters and finishing their sequences. This requirement define an important place and role of search and rescue activity in the system of Maritime Transport Safety. It is not efficient to create a system for protection upon disasters, if the function “search and rescue” doesn't exist.

### 1.3.1 The public priorities for Bulgaria are:

Balance of interests between:

- Personality;
- Society;
- Country.
-

### 1.3.2. The main features of maritime safety are:

- Safety at Sea - Search and Rescue;
- Protection of the Marine Environment of the intervention of human activity;
- Competent government oversight to effectively implement the objectives of these activities;
- Interaction between the subjects from maritime transport, infrastructure and organs of state power (local self-government), regional specialized citizens' formations and other ones, connected with international and national administrative and moral engagements to the activity availability of civilian control.

## 1.4. An Integrated Maritime Policy for the European Union

The seas are Europe's lifeblood. Europe's maritime spaces and its coasts are central to its well-being and prosperity - they are Europe's trade routes, climate regulator, sources of food, energy and resources, and a favored site for its citizens' residence and recreation.

Increasing competition for marine space and the cumulative impact of human activities on marine ecosystems render the current fragmented decision-making in maritime affairs inadequate, and demand a more collaborative and integrated approach.

Shipping is vital for Europe's international and domestic trade and remains the backbone of the maritime cluster. However, this industry will only continue to prosper if the Union keeps working to establish a high level of maritime safety and security, helping to safeguard human lives and the environment while promoting an international level playing field.

### 1.5. Responsibility for politics in area of disasters, maritime search and rescue

According Disaster Protection Act The Council of Ministers shall formulate the state policy in the area of disaster protection. The Council of Ministers shall:

- Ensure overall management of disaster protection.
- Adopt a National Disaster Protection Program and the annual plans for its implementation.
- Adopt a National Disaster Protection Plan and a National Plan for Performance of Rescue and Emergency Repair and Recovery Works.

Within the scopes of their competencies, Ministers and bodies under Article 19 (4) of the Administration Act, shall: (1). Analyse potential sources of risks and implement preventive activities, in order to eliminate or limit the impact of risk factors, which could cause occurrence of disaster. (2). Participate in the elaboration of disaster protection plans, of plans for performance of rescue and emergency repair and recovery works and of external emergency plans. (3). Maintain prepared forces and means and ensure the participation of the structures, reporting to them, as component parts of the integrated rescue system, in accordance with the plans for performance of rescue and emergency repair and recovery works. The indicated law treats the matter for responsibilities and politics for all national systems for safety (land, sea and air).

We are trying to regulate everything in our world with the help of normative acts, sticking to the dictum of placing law above everything, but when comes to search and rescue at sea activities, I believe human life should be treasured above all!

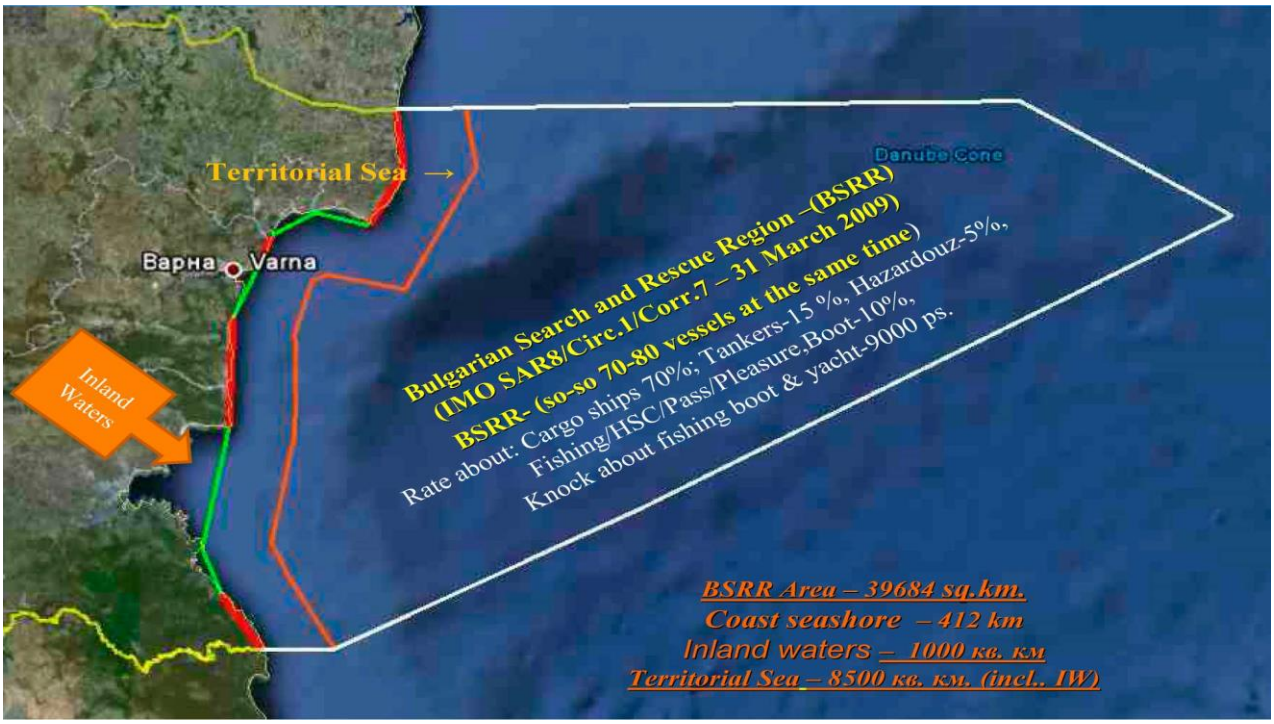
## National Maritime Saving System

The basic task of a seaside country is to ensure the safety of navigation. This brings to normal maritime business conditions and guarantees the human rights, regarding life and health at sea. The necessity of a reliable navigation system and the requirements thereto are regulated by multiple international and national legal acts. In this reference, beside the effective Bulgarian constitution and other national legislative acts, during the decades

Bulgaria has ratified various international agreements and acts on this issue. All these must not contradict each other.

Being a party per the International Search and Rescue Convention, 1979, Republic Bulgaria has a number of engagements, regarding the establishment, maintenance and administration of an adequate system for search and rescue of people in distress at sea. When related to a threat to human life, search and rescue is obligation of all countries, parties per the above convention. Besides, it is a duty of each person, having dedicated his life to the sea, one way or another. Therefore, this activity should be among the basic priorities of the governmental policy in the field of sea transport. The search and rescue system includes a number of offices, means and events, used to ensure timely and efficient response of the government is case of distress at sea. Naturally, such a system must be corresponding to the specific peculiarities of the country and specifically to its search and rescue region of responsibility (Figure 2). Factors such as size and configuration of the region, navigation intensity within and near to this region, the coastal strip peculiarities, the rescue capacity of the neighboring countries, etc. are determinant for the establishment of the search and rescue system of Republic Bulgaria.

Bulgarian Maritime Search and Rescue Region (BMSRR) Figure 2




On the territory of Republic Bulgaria the Executive Agency “Maritime Administration” (EAMA) is entrusted with the functions and responsibilities for ensuring the navigation

safety, as well as the search and rescue at sea activities. It is a legal entity, supported by the budget of the Ministry of Transport of Republic Bulgaria. The statute of EAMA is regulated in the Merchant Navigation Code, art. 360, par. 1. The activity, structure, organization and personnel of the Agency are fixed in the Structural regulation, approved by the Council of ministers. The basic functions of the Agency are:

- organization and coordination of the activities, relate to the safety of navigation at sea and inland waterways of Republic Bulgaria;
- ensuring real connection between the country and vessels, sailing under Bulgarian flag;
- exercising control on:

a) observance of navigation safety requirements by the Bulgarian and foreign ships;

b) observance of the working and living conditions of the seafarers;

c) rendering services on the traffic management and information services to navigation at sea, inland seaways, channels and ports of Republic Bulgaria and other regions, specified per the respective procedures;

d) observance of the quality requirements to the ships fuels.

- organization and coordination of the search and rescue of people, vessels an aircrafts in distress;
- exercises control and organizes protection of the water environment of the Danube river from pollution by ships;
- organizes and holds examinations for seafarer's competency;
- issues certificates of competency to seafarers;
- keeps registers of the ships, seafarers, ports and port operators in Republic Bulgaria, etc.

At the Maritime rescue coordination center (MRCC) there is a continuous 24-hrs watch by two experts - duty officer and deputy duty officer, held in shift. Since April 2015 the watch on weekends and holidays realized by two officers. The duty ship crew comprises a navigation officer and an engineers, per a monthly schedule. In 2015 MRCC submitted three cutters to voluntary organizations: in Kavarna, Sveti Vlas and Kiten in support of the activity in remote regions, far from Varna and Burgas. Annually scheduled drills are held (jointly with MRCC and the rescue cutters) every week, aimed to maintain the readiness for immediate actions and SAR operations.

MRCC and the crews of the cutters “Spasitel 1” and “Vyara” participated the search and rescue part of the navy drill “Breeze 2015”, held in July in the region of Varna Maritime Administration.

Table 2

**Distress signals, received at MRCC - Varna in 2015**

| March | signals | Of them Confirmed/unconfirmed/false | At BMSARRR YES / NO |
|---|---|---|---|
| January | 5 | 1 / 1 / 3 | 2 / 3 |
| February | 5 | 0 / 0 / 5 | 1 / 4 |
| March | 8 | 4 / 0 / 4 | 6 / 2 |
| April | 2 | 0 / 0 / 2 | 1 / 1 |
| May | 5 | 2 / 0 / 3 | 2 / 3 |
| June | 3 | 1 / 0 / 2 | 1 / 2 |
| July | 20 | 10 / 0 / 10 | 16 / 4 |
| August | 20 | 11 / 0 / 9 | 16 / 4 |
| September | 14 | 10 / 0 / 4 | 14 / 0 |
| October | 4 | 2 / 0 / 2 | 4 / 0 |
| November | 6 | 2 / 0 / 4 | 3 / 3 |
| December | 4 | 2 / 0 / 2 | 3 / 1 |
| **Total:** | **96** | **45 / 1 / 50** | **69/27** |

## Annual report SAR 2015, EAMA

In 2015 were received and processed a total of 96 distress signals, of which 45 confirmed, which is 47% of the total number. 22 SAR operations were organized, bringing to the rescue of 59 people. The number of received signals annually is of constant character, slightly lower, compared to 2014 (100 signals). Regarding the number of actual SAR operations, in 2015 22 operations were organized. Their annual number is also comparable (21 operations in 2014). As is evident from the table, the main number of distress signals is registered during the summer season (July - September) - 54, which is over 50% of all signals received (Table 2).

From the MRCC statistics it is evident that the main part of the incidents (60%) have happened near to the coast (respectively 60% of the distances are within 500 m, and 20% - between 500 m and 5 miles). The efforts an SAR unites were directed to these cases. The conclusions from the processing of the real distress signals show that for a timely reaction the rescue cutters must be deployed in the critical regions of the incident (Kaliakra, Golden sands, Byala-Obzor, cape Emine and south from Sozopol). In 2015 the rescue crafts for the northern region were deployed only in Varna and Kaliakra, and in the end of the summer cutters was deployed also in Byala. Duty vessels were also available in the southern region - Burgas, Primorsko and Sveti Vlas. It is necessary to deploy cutters also north from cape Kaliakra, as this region has specific weather and sea conditions. The

number of incidents in this region is of constant character, yet there are no crafts in the neighborhood to ensure a fast reaction.

MRCC participates the international project for navigation control and activities of international organizations and European structures in maritime SAR, as well as international forums like the one, held in October in Istanbul and the eleventh SAR conference of the Black sea countries.

In Bulgaria, beside Executive Agency “Maritime Administration” also active is the “Bulsar” non-profit association, established in 1996 for coordination, search and rescue of people in distress and shipwreck survivors in the Bulgarian SAR region of responsibility. The name of the association is an abbreviation from the name of the country (BULgaria) and the sphere of activity (SAR in Bulgarian = ТИС). The association was first registered on 20.04.1996 in Varna, re-registered per the Non-profit legal entities Act as “non-profit association to the public benefit”, and entered at the central register of the Ministry of Justice (Figure 3). The basic principles of the association are:

- Volunteering - the association is a voluntary, selfless organization, the members of which participate various forms of rescuing human life at sea at their own risk.
- Humanity - under all circumstances to assist the people in distress and shipwreck survivors to their successful rescuing. Such assistance must be ensured promptly, effectively and to provide high professional protection during the search, rescue and upon completion of the incident.
- Impartiality - to ensure help to any person in distress at sea, irrespective of his nationality, race, religion, status or the circumstances when such person is found.
- Prevention - using precise, professional oral propaganda of the SAR activities to enhance the feeling of responsibility of the people, not only as moral and enlightenment of the society, but also as public control.
- Cooperation - with all structures in Bulgaria and abroad, recognizing the SAR-79 Convention and Enclosures 1 and 2 thereto, the other conventions, related to protection of human life at sea and the Geneva Convention of the Red Cross organizations.
- Independence - the association is an independent, non-political non-profit organization to the public benefit. The association expenses are not bound to any political purposes, propaganda, or canvassing in favor of any political party.

Figure 3


Bulsar, being a civil movement, registered in the special register of associations to the public benefit at the Ministry of Justice, does continuously conduct events for propaganda of the maritime safety, does sharply criticize any manifestation of non-professionalism or irresponsibility during maritime rescue operation, as the association members are of the opinion that each human life is an unique gift from God and no one has the right to behave disparagingly or unprofessionally in case of distress at sea. During its twenty years of existence Bulsar has completed many actions at sea, managed to save a lot of governmental expenditure, participated meetings, seminars and conferences on the topic of maritime transport safety. Bulsar ensured 50,000 USD for purchasing, delivery and fitting of two satellite terminals in the Inmarsat system for the purposes of out navy. Per draft project - know-how of Bulsar, submitted free by Capt. Nikifor Guerchev, the association took part in the surfacing of the sunken “Mehmet Aslav” vessel, successfully overcoming this challenge, followed by a number of other achievements. In 2005 Varna Technical University submitted and equipped per Bulsar project a large premise to the “Volunteers' rescue coordination center” so well as telephones, internet access and other of considerable value. The Center is designed for training of all Bulsar members and applicant navigational staff, such as “SAR coordinators” and “SAR administrative personnel”.

At the end of 2015 the government of Republic Bulgaria has approved amendments in the Regulation on traffic movement, reporting and management of the traffic and information services to navigation in the Bulgarian sea waters, due to the introduction of European requirements on the creation of an Union system for control of the ships' traffic and information, as fixed in Directive 2014/100/EC. All this is meant to facilitate the information exchange and access to the integrated information system (SafeSeaNet) and of a platform for ensuring the uniformity and operative compatibility of the maritime systems and applications. The SafeSeaNet system was created to enhance the maritime safety, port and sea safety, protection of the environ and readiness to undertake actions in case of pollution, as well as providing possibility for exchange of additional information in order to facilitate the efficiency of maritime navigation and transport.

## Conclusion

In order to start a process for correction and/or amendment of the current SAR system and organization and elaboration if a strategy or conception for the future SAR activity in Republic Bulgarian, necessarily must be made: general assessment of the so-far activity, incl. the risk, analysis of the maritime accidents in the Bulgarian Black sea region of responsibility, assessment of the navigation and its tendencies in the following ten years, and last, but not least, analyses and perspectives of the development of the so-fat SAR participant: EAMA, the Navy, border police, etc.

The development of our national maritime search and rescue system must be focused on solving the main problem: what a system must Bulgaria create and maintain, so as to be able to adequately solve the current and future activities on coping with incidents at sea in the specific Bulgarian region of responsibility, who will be responsible for the organization, functioning and development of the maritime SAR system.

There are different organization models around the world: military, mixed and civil. Each of them has its advantages and shortcomings. It is important for Bulgaria not to invent a new model, rather unite with a one that is optimal in organization, functioning, efficiency and financing. Also an overall review must be made of the national legislation and international acts treating search and rescue at sea, aimed to solving the contradictions and reaching harmonization.

## Acknowledgments

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I do sincerely hope that article will be paid serious attention both by the Bulgarian government and the Union authorities, so that Republic Bulgaria could be adequately assisted it the efforts to make the necessary in order to reach a modern level in the maritime search and rescue both for the country and as an allied partner.

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# CRISIS MANAGEMENT AND DISASTER RESPONSE TOOLS IN IMPRESS PROJECT

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*In the framework of the FP7 a large European consortia has been funded to use the nowadays ICT tools in creation a sophisticated platform where medical, civil protection and public authorities teams can cooperate exchanging information and response in a faster way protecting people's life in cases of emergency situation. In our paper we will present overview of the tools and approaches used for crisis management along with the new taxonomies implemented in order to ease the process of medical decisions on the field in disaster situations. Hereafter is description in brief of the system components and their functionalities along with the planned validation and testing scenario in the cross-border area between Greece and Bulgaria.*

*Keywords*: IMPRESS system, WARSYS, LOGEVO, SORLOC, PATEVO, INCIMAG, INCIMOB, DSS module of IMPRESS system project DSS

## Introduction

In this paper we will present the IMPRESS system modules developed under the framework of the FP7 funded project called IMPRESS. Based on the defined business process models (BPMs) and use cases (UCs) appointed by the stakeholders and specialists in the field of disaster medicine, high-level architecture components of the IMPRESS system have been developed:

- Reference Semantic Model: defines an ontology related to the health emergency management domain;
- Data Harmonization Component:(DHC) achieves the harmonization and the homogenization of the data provided by the WARSYS component with the use of the Reference Semantic Model – this is necessary due to the diversity and different structure, format and nature data coming from a variety of external systems or the Web;
- WARSYS: provides the interfaces to import data from medical and logistics repositories (such as hospital information systems); further it will be used to store and view the extracted data and information generated inside the IMPRESS system;
- LOGEVO: provides models for the logistics of health care resources, particularly hospital surge: the ability to acutely increase available medical evaluation and care during events that exceed the limits of the normal hospital infrastructure;

- SORLOC: provides a tool to estimate one or more of the following: time, location and spatial extent (SOuRce LOCalization) of a biological release, based on data from the first few cases presenting at hospitals or other health-care facilities, of the resulting disease outbreak;
- PATEVO: Allows the simulation and prediction of the physiological/health state of casualties, including the effects of medical treatments INCIMAG: includes the tools and environment to manage emergency incidents (desktop solution);
- INCIMOB: refers to the mobile extension of the INCIMAG system, for on-field operations, patient tracking, receiving notifications, etc.;
- Training Component: used for online training purposes of potential users of the systems.

Several BPMs have been identified, which cover the response and preparedness of the crisis management lifecycle, as deemed necessary from the analysis of the domain requirements in the field. For each of the defined components one or several BPMs were defined. Especially, for the INCIMAG system, many BPMs were defined, since it is the major command & control system, operating in a distributed manner to manage communication and collaboration of the multiple actors of the system. At the bottom level of the architecture is the Data Storage, which consists of WARSYS and the DHC. While WARSYS collects the data (via interfaces to external systems utilizing standard data formats such as HL7-RIM or EDXL-HAVE), the DHC harmonizes it and other types of data originating from the Web (utilizing the Semantic Reference Model). On the top level is the Incident Management. It consists of the INCIMAG user interface (desktop application) and the INCIMOB (mobile application). Several incident management instances can be connected to each other to achieve a distributed crisis management. External medical devices (like pulse, blood pressure, or glucose meter) deliver their data to INCIMOB, which in turn passes this information to INCIMAG and consequently to WARSYS. Responders can access the decision support systems (LOGEVO; SICKEVO and SORLOC) through INCIMAG and INCIMOB to be facilitated and able to make more informed decisions according to the recommendations of the DSS engines.

## IMPRESS System components brief description

### WARSYS Component

WARSYS component is responsible for importing and storing structured data in the IMPRESS system. It provides data importing capability from medical and logistics repositories (such as hospital information systems), while it has also the ability to store data by listening to the IMPRESS Messaging Bus (ActiveMQ) module. WARSYS then provides the homogenized data stored, to the data harmonization component (DHC) module.

WARSYS incorporates technologies and knowledge extracted by various national Database projects in the past, but it's a totally new component designed and implemented for the IMPRESS Platform.

The innovation in WARSYS lies in the cooperation of various licensed and open source products integrated to a database system that support many different kind of data sources. In addition, this capability of WARSYS gives the opportunity to handle many different types of resources and data in the future.

The EDXL files family manipulation and importing is another innovation of IMPRESS and WARSYS as its subcomponent.

WARSYS architecture is presented in Figure 1 below.

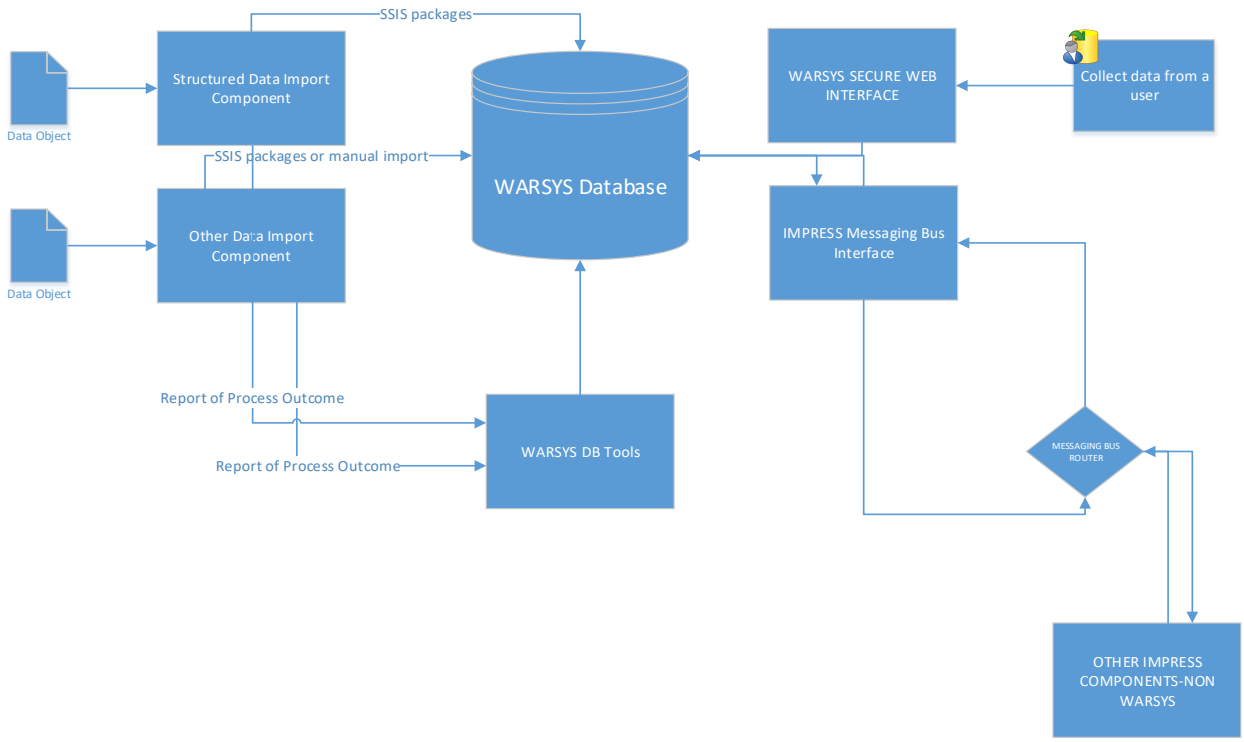



Figure 7. WARSYS Architecture

WARSYS architecture core component is the WARSYS Database where storage utilities are provided that make stored data available to the rest of WARSYS subcomponents as well as to other IMPRESS components. To support the operation of WARSYS Database the WARSYS DB Tools component is used. This component provides several administration tools which are used by authorised database administrative personnel (DBA) in order to manage import and export processes, provide maintenance, check WARSYS system health and connections to other IMPRESS components.

The rest of WARSYS architecture components are used to import (manually or automatically) and store data from different sources, as well as communicate with the other IMPRESS components through the message bus interface.

The Structured Data Import Component (SDIC) component is a set of visualised import stored procedures, called on demand by a user who has the relevant access privileges, in order to insert Hospital data into to the WARSYS Database. The SDIC component can be automatically called when data on the messaging bus become available.

The data import process is mainly handled by (SQL Server Integration Services) SSIS packages procedures. The first step is to validate the integrity of the files to be imported and append timestamp information, for security, validation and tracking purposes. Then the system identifies what this file is about and triggers the relevant import stored procedure. The stored procedure calls, the WARSYS SSIS mechanism and the file content is imported to the database on tables specified in the stored procedure. Apart from structured data, WARSYS can import data from other sources without using SSIS packages. This capability is mainly supported by python scripts. These scripts accept an XML as input, use the XSD schema file and insert data in MySQL tables. Using MSSM for MySQL, or other python scripts data from the MySQL databases are inserted to the MS SQL database.

Beyond the data import of EDXL files and other sources, WARSYS provides two more interfaces: one of the communication with the end user through the WARSYS Secure Web Interface and one for the interconnection with other IMPRESS components through the WARSYS IMPRESS Messaging Bus Interface.

Through the WARSYS Secure Web Interface component, and upon successful authentication, hospital personnel are able to connect to WARSYS and upload file or provide data manually regarding Hospital Availability data, through web forms.

The WARSYS IMPRESS Messaging Bus Interface is the WARSYS subcomponent handles, incoming and outgoing information to and from the IMPRESS Messaging Bus. WARSYS listens to the Message Bus, through a specific queue or topic, and may posts back through the same queue/topic, when needed.

### LOVEGO component

The main idea of the LOGEVO component is to forecasts the evolution of the provision of resources to the hospital and to the field (Hospital Surge and similar) determining the time-curve of the amount of resources that can be provided to the system by exploiting the incremental capacity of the health structures involved in the crisis. In a Mass Casualty Incident (MCI)[1] the health care resources which are necessary to treat the large number of patients exceed the resources available. The system's resources deployed in the field in normal situations are insufficient and are often quickly depleted. The management of an Emergency situation requires therefore putting into action plans capable to quickly and efficiently enhance the health care response. The ability of the health services to scale up their resource provision becomes a key point for decision support. The LOGEVO component is one of the Decision Support System (DSS) elements in the IMPRESS

system, set up to provide logistic support to the decision makers. The logic of LOGEVO was designed and samples were prototyped in Matlab[2] and the consensuses of medical doctors on the preliminary test results were obtained. LOGEVO component concerns hospital capacity, the hospital surge[3] capability and timing as well as the capacity and capability of the health service in general involved in a crisis event. By using this component, the imbalance between care needs, resources availability and the on-going modifications in the levels of both can become more optimized. The overall description of LOGEVO is depicted in *Figure 2*.

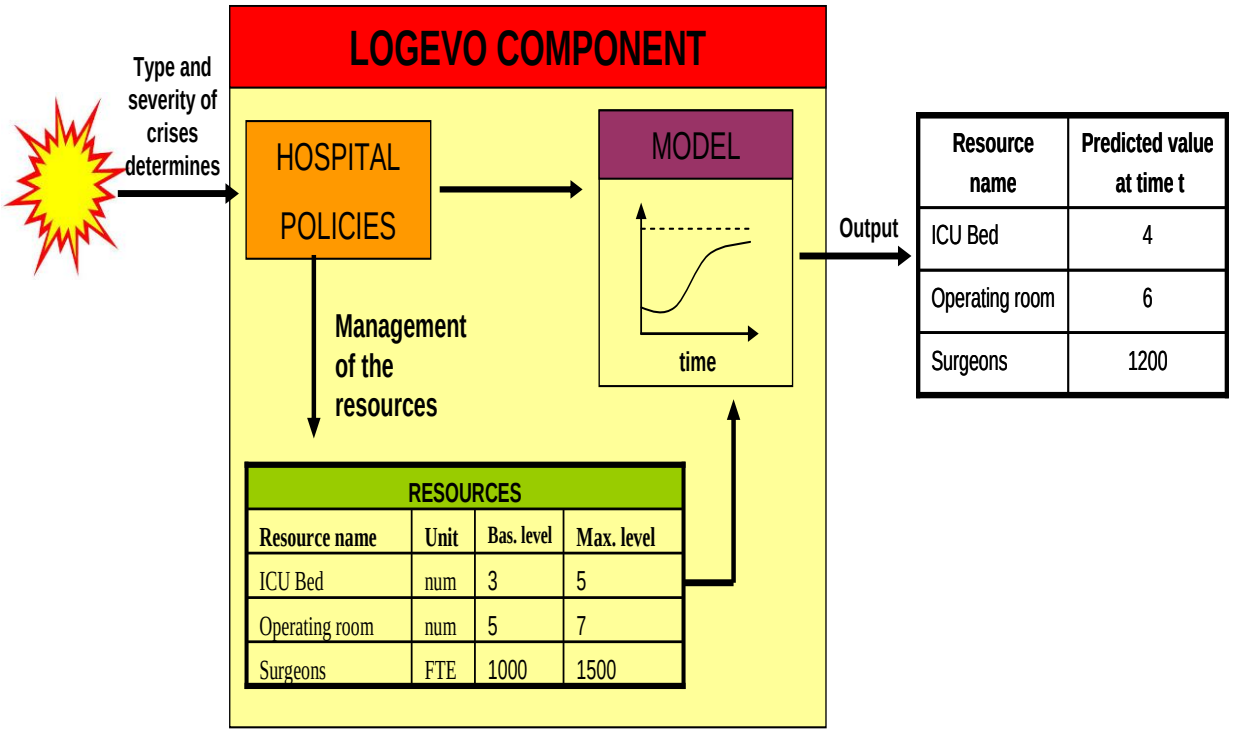



Figure 2. General architecture of the LOgEVO component

Since Health authorities will respond with different intensity to crises of different perceived severity, the forecast of the provision of any resource R is made here to depend on the type and degree of severity of the incident, as parameterized for this implementation, by the number of affected people: according to the characteristics and the number of casualties, the hospital will then adopt different policies to increase the level of critical resources in order to meet the specific needs. Given the resource R, its basal level, as well as the policies and capacity of the health structure, the amount of – provided resources at a specific time t will be predicted by means of the time-course model of the resource provision itself.

## SORLOC component

The rapid determination of a source of biological contamination in time and space is essential for a coordinated response to “Extra-Ordinary Public Health Challenge” (EOPHC). Determination of the source of contamination is harder for biological threats compared with incidents typified by physical trauma as they are expected to come to official attention several days after exposure and infection. SORLOC is responsible for determining the likely exposure source in time and space or simply time given field observations of a covert release of a biological contaminant. SORLOC component functionalities will be provided with observations and will return a probabilistic inference of the location of a release of a pathological biological agent. SORLOC is not an epidemiological surveillance system. A fundamental assumption of the models used is that the cases arise from a single confirmed outbreak of a known pathogen. SORLOC has been created to assist the decision maker in choosing where to focus resources (manpower and remediation measures) in the event of such an incident and arises from foreground work within Public Health England (PHE) on ‘back-calculation’ of epidemics or ‘reverse epidemiology’.

SORLOC therefore has a single scope: determine a SOuRce LOCation. This determination has two facets, one temporal and one spatio-temporal[4]. Each facet has two subcomponents:

- Locate a source in time or time and space
- Provide an estimate of epidemic progression

In keeping with the *one-task one-component* philosophy it was decided to split SORLOC into a set of discrete sub-components each of which would provide a single function to the greater SORLOC component. The natural subdivision was that of models and interface. This is because the models are (relatively) short running; very computational resource intensive processes while the interface is a long-running process that requires very few computational resources. Dividing the models into temporal and spatio temporal comes from a similar decision based on the fact that these models are likely to be grounded in different mathematical frameworks.

Treating the models as separate sub-components allows us to develop the interfacing technology with a known model before we investigate novel techniques for the spatial analysis. Part of the challenge in construction of the interfacing comes from ensuring a consistent run-time environment and placing and retrieving data from a shared high performance computing cluster in an automated way. The other part of the challenge is the specification of the data for input and output as before this project no standard for the transmission of epidemiological data. However the work on SORLOC component is still ongoing and the listed challenges can be met within the whole architecture of IMPRESS system.

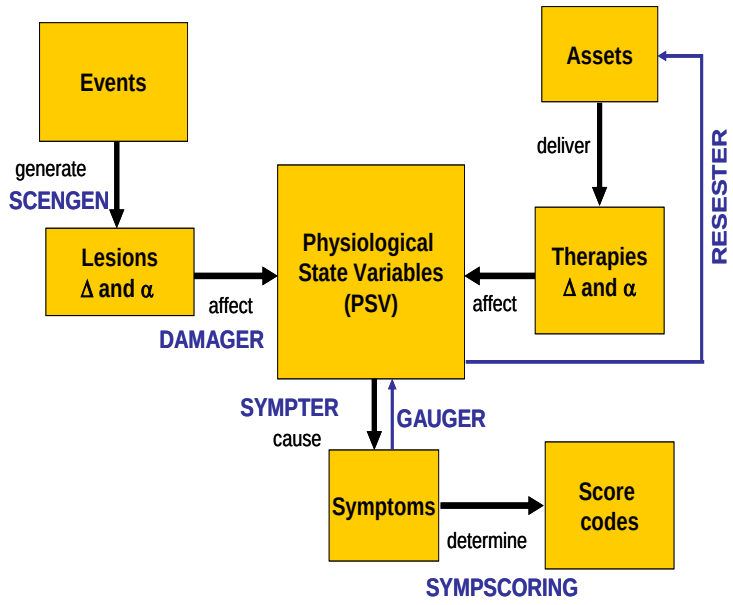
## PATEVO component

SICKEVO is a DSS component in the IMPRESS system which predicts the patient's physiological status evolution over time, predicting therefore the scenario evolution in terms of victim physiological status. SICKEVO has complementary functions, which support the functionality of SICKEVO component and those functions are: SCENGEN, SYMPTSCORING, STATSCORING, GAUGER, DAMAGER, SYMPTER, RESESTER, aiming to implement logically distinct tasks necessary to complete the architectural design for the description of Scenario evolution in cases of emergencies. SICKEVO is one of the DSS components designed to assess the evolution of patient health status with respect to evolving time, modelling both the effect of injuries and the effect of delivered treatments. To complete the picture of the Scenario evolution, a series of other functions are designed and implemented in order to test the functionality of the component in a real or simulated environment. The simulation environment will be also able to reproduce the two test-scenarios (the Palermo Scenario and the cross-border Scenario) against which the IMPRESS solution will be measured, as well as other different crisis scenarios. Each real or simulated crisis scenario produces a certain number of "affected" individuals (patients) among the existing "bystanders" (people exposed to risk), producing for each individual a set of anatomical lesions (with different levels of seriousness). Patients have to be triaged and appropriate care has to be delivered in the field, as first aid, or in definitive care structures, in order to restore their vital physiological conditions in an efficient way.

Each simulation instance starts with the generation of a CRISIS EVENT. SCENGEN is the component whose purpose is the generation of a new, original event from a pre-compiled library of prototype events. Examples of crisis events are: earthquakes, traffic accidents, poisonous gas diffusion, explosions, radionuclear leak, natural disasters, CBRNe terrorist attacks etc. Each event produces a certain number of "Affected" individuals among the existing "Bystanders" within some (variable) distance from the source of the event. The number of Affected is a function of the event severity (an input parameter of SCENGEN, quantifying, for instance, the dimension of the incident, the potential of the bombs, etc.). The type of generated event produces on the Affected a series of anatomical Lesions from a pre-compiled library of Lesions. Each anatomical lesion occurs with specified probability distributions depending on the type of events (a table associates each event to each lesion, specifying the probability of occurrence of that lesion in that type of event). In turn, the anatomical lesions determine the occurrence of physiological defects along some physiologic dimensions. The DSS SICKEVO component predicts the evolution over time of the above mentioned physiological dimensions, which are called the Physiological State Variables (PSVs). The evolution is determined by the initial variable status (the initial defect), the initial rate of worsening and by the therapeutic maneuvers (if any) delivered. In the present formulation, medical care (treatments) is delivered by structures, which are called medical Assets: while an isolated surgeon, however good, will not be able to deliver effective care without instruments, drugs and

assistance, an Operating Room (OR), endowed with all necessary human and instrumental accoutrements (surgeons, anaesthesiologists, nurses, defibrillators, blood, IV sets etc.), is actually able to deliver a given standard of care. So is, for instance, an Ambulance. In the current terminology, therefore, isolated medical personnel are not considered, while OR's and Ambulances are health assets which can be employed and can be subject to competitive allocation (to some victim or to some other victim), to gradual increase via Hospital Surge mechanisms, etc. Clearly, not all Assets deliver the same Treatments: while an OR can administer oxygen, fluids, blood and vascular repair, an Ambulance can only administer oxygen and fluids. Each Asset is therefore characterized by the set of Treatments it can deliver. It is to be noted that the state of a victim, at any given time, can be described by specifying both the victim's position in PSV space (x) and the victim's rate of movement (v) along each of the dimensions: using 10 physiologic dimensions, the victim's state is thus determined by an array of 20 real numbers (PSV). The relationship between the PSVs and the symptoms which can be identified in the field is represented in the bottom part of the figure 3. Each PSV determines, according to a probability function, the occurrence of a compatible symptom. The row connecting the PSVs to the Score codes box (STATSCORING function) allows the system to have, in the simulation phase, a global vision, the “true” one, of the affected victim’s status, determining the “true” scoring from the “Expected Time of Death”, which represents the time at which one of the PSVs reaches a value indicating death. Moreover, from the Symptoms (observed in the field), medical personnel or volunteers make their own triage and are able to then test their performance in the triage procedure by comparing their scores with that automatically performed by the system (implementing appropriate scoring algorithms) from the detected symptoms (the SYMPSCORING function).

Figure 3. General architecture of the PATEVO component and its collaborative functions



## Reference Semantic Model

The Reference Semantic Model is ontology defined as the IMPRESS Ontology, whose objectives are interoperability, data harmonization and linked data provision. The IMPRESS Ontology design and implementation process follows the METHONTOLOGY[5] steps and is implemented in OWL. The IMPRESS Ontology upper layer contains the following four main concepts:

- **EOPHC** (ExtraOrdinary Public Health Challenge): The concept refers to the emergency events and incidents that take place and require response.
- **Person**: The concept refers to the human individual.
- **Resource**: The concept refers to anything that is used to support or help in the response during a health emergency.
- **Activity**: The concept refers to any activity that takes place in order to reduce the impact of an emergency event.

The temporal aspects of the ontology have also been taken under consideration describing the evolution of the data through time. The data fact includes various sets of code lists described in SKOS as well as properties that are associated with user roles and geospatial data. The IMPRESS Ontology is further aligned with the TSO standard.

## Data Harmonization Component

The Data Harmonization Component implements the data harmonization procedure that is required in order to harmonize the multidisciplinary and heterogeneous datasets of the IMPRESS Platform and provide a semantically homogenized view of the data. Also, these data are provided as linked data to the rest of the IMPRESS Components. Thus, Data Harmonization is also responsible for the linking of the RDF data[6] with other third party linked data resources.

The Data Harmonization Component implements data harmonization using the IMPRESS Reference Semantic Model which covers the respective domains of knowledge of the domain of health emergency management.

The main tasks that are realized by the Data Harmonization Component are the following:

1. Provide a real-time RDF view of the IMPRESS data stored in the WARSYS database, based on a specific mapping file.
2. Provide access to RDF data views via a SPARQL endpoint.
3. Execute SPARQL queries to RDF data and process the results, if necessary.
4. Links the IMPRESS RDF data with specific linked data resources using a specific mapping file.
5. Handle and serve the requests for data from the Message Bus.

Based on the above, Data Harmonization Component includes four main subcomponents: the Mapping Generator which is responsible to generate the mappings between the

database data and the RDF view, the RDF Viewer which provides access and exposes the RDF views, the Query Handler subcomponent which handles the requests for data and the Data Linker.

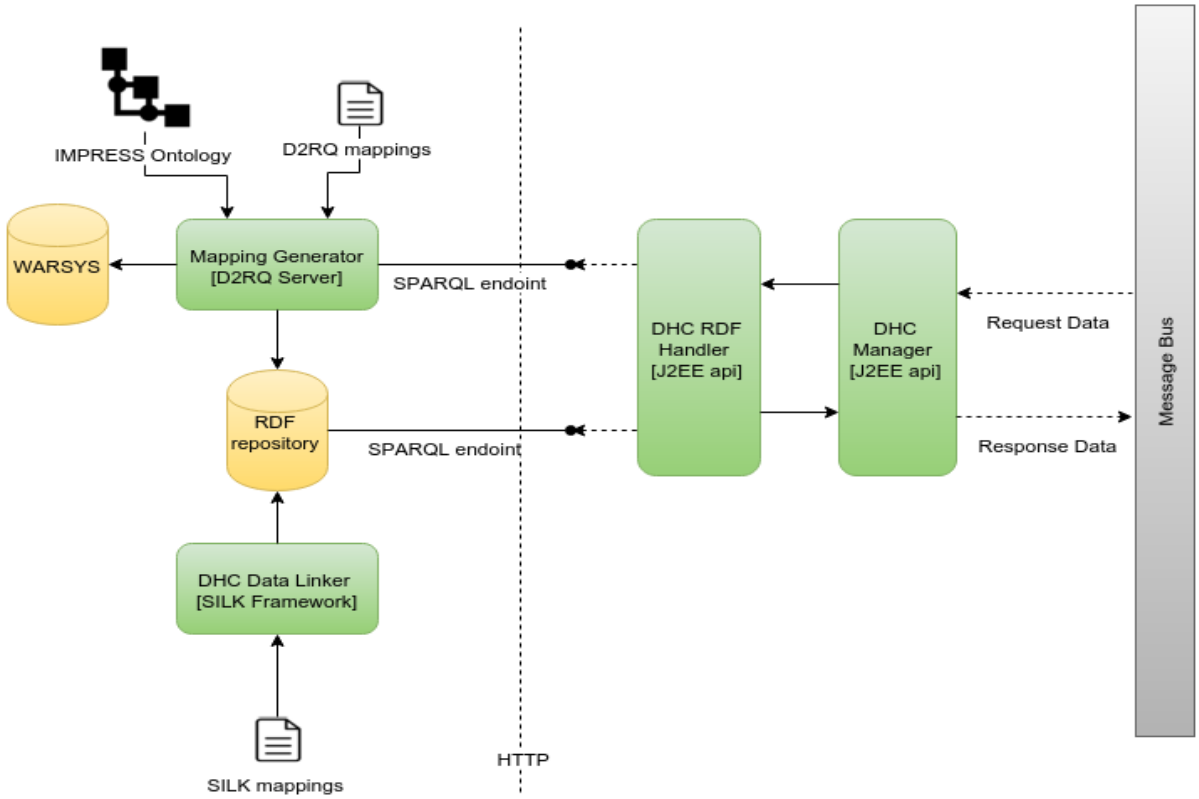



Figure 4. Architecture of the DHC component

As shown in the figure above, the DHC Manager receives requests for data from the Message Bus and based on the type of request calls the DHC RDF Handler which is responsible of querying the Mapping Generator for native RDF data or the RDF repository for linked data, through a SPARQL[7] endpoint. The Mapping Generator produces the dynamic harmonized view of the data that exist into the WARSYS database, while the DHC Data Linker generates RDF data linked with other Linked Data provided online. The results of the linking process are stored into an RDF repository in order to resolve issues of resources unavailability or low performance due to network latency issues. The Data Harmonization Component uses the D2RQ server[8], an RDB2RDF technology, as well as, the SILK framework[9].

## Recommendation Component

The Recommendation Component produces recommendations/suggestions on how to distribute the patients over hospitals. The component, based on the patient status (and status forecast, using the PATEVO component) and on available resources (ambulance vehicles and hospitals bed availabilities in different categories; also forecast of availabilities using the LOGEVO component), gives a recommendation about the order of

patients, the destination hospitals, and optimal routes to the hospitals. This component can be used in every day incident patients dispatching and case of mass casualty incidents (MCI).

The Recommendation Component consists of the Distribution Service and the Optimisation Services: The distribution computation is based on routing on a street network that will be loaded from a database (the street network parameters used for the routing can be adjusted manually, to reflect traffic information like max speed or road closures). Each patient has a transportation priority that determines the order of transport. In addition, patients have a set of needed Assest that determine the hospitals that come into consideration. The amount of available Assest of a hospital may increase over time, so additional patients can be brought to it subsequently.

The optimisation computation tries to find an optimal order for the patient transport. For this, it uses LOGEVO to determine the increasing Asset availabilities of the given hospitals. In addition, PATEVO/STATSCORING is used to get the health status of the patient, how its health status will evolve over time and how the treatment (Asserts) will influence the health status. Based on this an initial priority and needed Assets for each patient is determined which is used to compute the prehospital time of each patient via the distribution computation explained before. Based on the resulting prehospital time PATEVO is used to check the health status at arrival time. If a patient would be dead or if other constraints are not met, adjustments on the patient priorities are done and the computations are repeated.

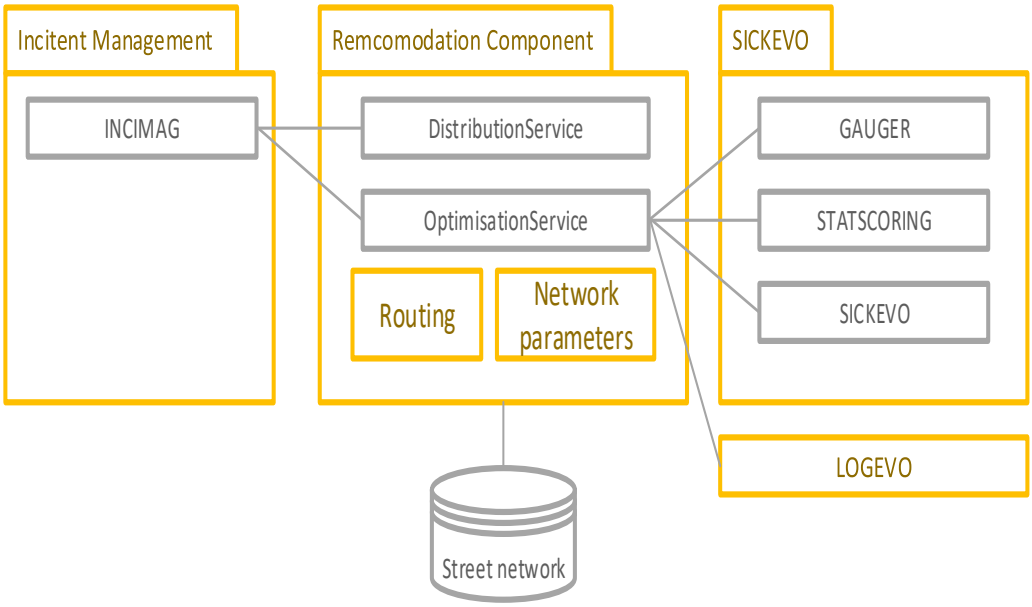



Figure 5. General architecture of the A Recommendation Component and relation to other components.

## INCIMAG component

During mass casualty incidents and disaster, Public Safety Agencies rely primarily on voice over radio communication along with pen and paper notes for situational awareness. The Integrated Incident Management System called INCIMAG that will intelligently interconnect stakeholders, decision makers, operators, first responders through standardized data interoperability for incident coordination and shared situational awareness. Although the system will be able to support different Public Safety Agencies our primary focus is for Emergency Medical Services by implementing payloads that include data specific to Emergency Medical Services such as incident representation, unit tasking, triage, treatment and transport tracking of emergency patients.

The core existing geospatial platform (CEF – Chameleon Enterprise Foundation) of Satways Ltd. provided the Enterprise Application Open Service Gateway Initiative (OSGi) framework on top of which additional modules in the form of OSGi bundles were developed. With the final goal of a Multi-Agency system for emergency call taking, incident and resource management and coordination, this initial round of implementation includes various client side plugins as well as server side components and services for call taking, address geocoding, resource management, and communication with field resources, hospital availability and patient tracking. An application server, database, back-end services and messaging middleware provide the necessary multi-tier infrastructure for the rich client application to visualize and manipulate data according to the various standard flows for incident and resource management determined by a Public Safety Standard Operating Procedures (SOPs). The interaction between agencies during normal operations and in mass casualty incidents takes place through an intelligent message router, designed and implemented for this purpose. Its aim is to route messages to the proper recipients who have declared their interest in particular messages, roles, or geographic areas. A subset of the Emergency Management Exchange Language (EDXL) family has been implemented: the Common Alerting Protocol (EDXL-CAP), the Hospital Availability Exchange (EDXL-Have), the Situational Reports (EDXL-SitRep) and the Tracking of Emergency Patients (EDXL-TEP) which can all be wrapped in the Distribution Element EDXL-DE); with the remaining standards presented during the design phase, Resource Messaging (EDXL-RM), to be implemented during the remaining implementation period of the project IMPRESS until March 2017. This subset provides the initial glue to begin to realize the interconnection of agencies. Finally a Mobile Application Programming Interface has been developed that will facilitate the interaction between INCIMAG instances and the related INCIMOB mobile application. Overall the first implementation round will provide the IMPRESS platform with a strong backbone for the INCIMAG tools to cater for the scale of mass casualty incidents as the primary software system of Emergency Call & Dispatching Center and Emergency Operations Center.

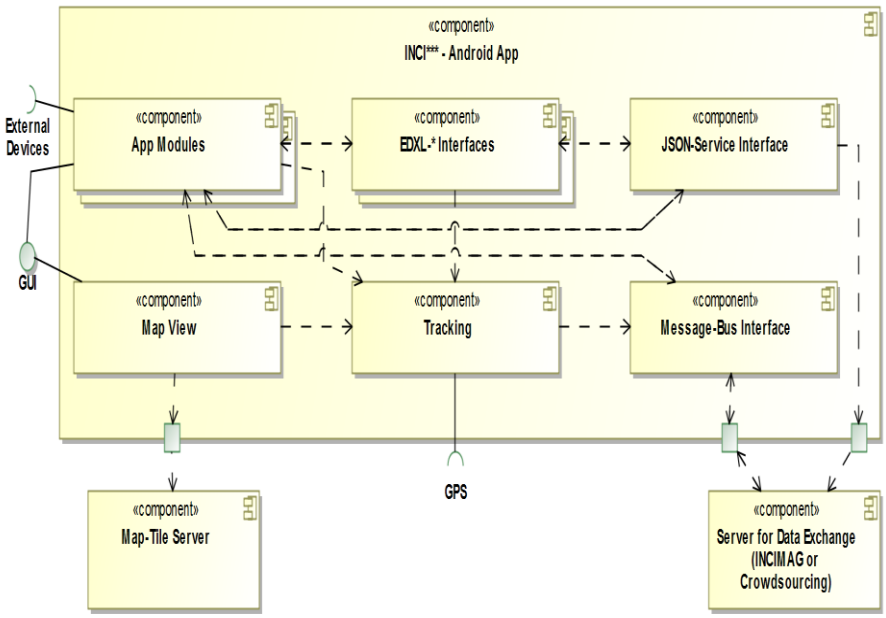
## INCIMOB component

The IMPRESS system comprises the mobile application INCIMOB that is connected to an INCIMAG instance. INCIMAG is a full-featured command & control system to be deployed in command posts or emergency centres. INCIMOB is defined as mobile interface for INCIMAG and is therefore only connected to this system. INCIMAG provides an SDK-API to INCIMOB, which defines data exchange formats and communication channels. One of the major functions of INCIMOB is the registration and tracking of emergency patients. Recorded data will be processed by INCIMAG and the IMPRESS integration layer used as input for the PATEVO/SICKEVO component. In addition, the app provides up to date information about the ongoing event, status updates and recommendations from the DSS tools.

Further development comprises also a public available version of INCIMOB, called INCIcrowd, which enables the public to support the IMPRESS system in terms of crowdsourcing. INCIcrowd will be a light version of INCIMOB, to enable the public to receive alerts, submitting observations and exchanging resource offers/needs. INCIcrowd will be connected to the IMPRESS system via a dedicated server and the IMPRESS message bus.

Both applications have a general common architecture, depicted in Figure 6. Each application contains of a set of modules. Furthermore, each module provides a set of features and uses a set of interfaces to communicate with the IMPRESS system. Each application will provide a set of features: some are similar in both apps, while others are unique for the specific app. Multiple related features can be bundled in one module. To switch between the modules, the applications use a design pattern that is called ‘navigation drawer’. This pattern is used in a wide range of mobile applications and is intuitive for persons that are using smartphones in their everyday life.

Figure 6. General Architecture of the IMPRESS Smart Applications



The modules, and with that the applications, use a set of communication channels to communicate with the rest of the world, in this case with the IMPRESS systems. To get data from the application to a server, a RESTful- or SOAP-Service is used to transfer data messages serialised in JSON or XML format. To get data from the server to the application without the need for the application to permanently asking for new data, another communication channel is necessary. This channel has to provide the possibility of pushing messages to the application. A message bus is used as solution for sending messages to the mobile application devices (smartphones). Furthermore, the applications need access to a map tile server, to display features on a map.

All these communication channels need an internet connection. Therefore, access to WLAN/Wi-Fi or 3G/4G mobile networks is mandatory.

## Impress platform test case cross-border scenario descrioption

The Blagoevgrad Province is a region in Southwestern Bulgaria. It is surrounded from four other Bulgarian provinces on north and east. On south has border with the Greek region of East Macedonia and Thrace and on west its border is the FYROM. The province has 14 municipalities with 12 towns. Its principal city is Blagoevgrad, while other significant towns include Bansko, Gotse Delchev, Melnik, Petrich, Razlog, Sandanski, and Simitli.

*Blagoevgrad region location*

*Kresnamunicipality location in Blagoevgrad region municipalities*

Kresna municipality, where is located most of Kresna Gorge is one of the most vulnerable areas in Bulgaria when it comes to earthquake potential. The potential for earthquakes in the area of Kresna municipality and Kresna gorge is evaluated as very high, because Blagoevgrad region is classified as one of the most vulnerable zones in Bulgaria (see fig. 7).

Figure 7: The most vulnerable area in Blagoevgrad region for earthquakes, where Kresna municipality and Kresna gorge are. The vulnerability for earthquakes is represented with dark brown color. Lighter colors mean lower risk cited from [10].

A total of seven seismic locations have been classified on the Bulgarian territory. All of them have the potential to cause earthquakes with a magnitude of 6.5 or greater, according to the latest statistics by National Istitute of Geology Geography and Geodesy – Bulgarian Academy of Sciences[10]. Four of the seismic spots in Bulgaria actually have the capacity of causing earthquakes with a magnitude of 7 and beyond. The Kresna municipality and Kresna Gorge are located in the Southwestern Bulgaria, where that potential has been estimated for earthquakes which may occur with magnitudes of 7-8. Last earthquake with such strength was recorded in 1904, which higher up the risk of reoccurance nowadays.

Municipality of Kresna is one of the smallest municipalities in southwest Bulgaria, with an area of 341 km2 and a population of 5,487 inhabitants. Covers part of the Struma River and most of Kresna Gorge. It has also parts from the western spurs of North Pirin and Northeastern slopes of the mountain Maleshevska. It borders on the municipalities of Simitli, Razlog, Bansko, Strumyani and FYROM.

The town of Kresna (3,428 inhabitants), is the administrative, economic and cultural center of the municipality. Situated at 42 km south of Blagoevgrad and at 23 km northwest of the town of Sandanski. Through it passes the international road E-79 and the railway line Sofia – Kulata – Athens. Nearby is located a marble mine, where part of the population is employed.

The Kresna Gorge is a steep valley in southwestern Bulgaria formed by the Struma/Strymónas River located on both countries Bulgaria and Greece. Its catchment area is 10,800 km². It takes its source from the Vitosha Mountain in Bulgaria, runs first westward, than southward, and enters the Greek territory at the Kula village. The river flows into the Strymonian Gulf in Aegean Sea, near Amphipolis in the Serres regional unit. The river's length is 415 km (of which 290 km in Bulgaria, making it the country's fifth longest).

Kresna Gorge is located on 52 km from the Bulgarian-Greek border (Kulata-Promahon) and it is the only connection for Trans European Corridor No. 4 called Struma Motorway. The nearest towns around Kresna gorge are:

- On north: Blagoevgrad (32km) and Simitli (15km)
- On south in Bulgaria: Kresna town (9km), Sandanski (37km) and Petrich (50km)

- Further on south in Greece after the the Greek-Bulgarian border (Kulata-Promahon) are located: Seres (96km), Thessaloniki (160km) and Kavala (186km)

The municipality of Kresna and Kresna Gorge areas are densely populated, from point of view of the territory they cover. This is because of the mild climate year-round and the marble mining activities. The area has recreational spa resorts and mountain hike roads which makes it touristic area for many Bulgarians and foreigners during most of the year.

Bulgarian country emergency response structure in case of huge emergency on the Bulgarian territory the involved authorities for the response are: local Incident Commander, Mayor of municipality or Governor of a region requesting help and support and the Ministry of Health in case of a mass casualty incident. The following structures are involved for the TTx: management, organization and resource provision of health care at disaster situations and catastrophes implemented by the Minister of Health, Chief State Health Inspector, Director of National Center for Health Provision, directors of the regional health inspections, medical and health institutions (hospitals, emergency health units, and hospices).

Management bodies that conduct activities in cases of mass emergencies that need inclusion of the medical system in case of disasters, accidents and catastrophes, have to be in close cooperation with the central and local government, the General Directorate "Fire Safety and Population Protection" (DG FSPP) under the Ministry of Interior, Ministry of Interior, Ministry of Defense and the Bulgarian Red Cross (BRC).

Bulgarian health system has centralized structure where the biggest response hospitals in cases of emergencies are in Sofia, Plovdiv, Varna and Bourgas. Every town has either hospis with emergency center with few ambulances or if it is bigger city there is one multidisciplinary hospital.

The events that cause a major crisis in the Bulgarian- Greek cross-border area is a mix between an earthquake in Kresna Gorge and flash flooding in Struma River. The earquake trigger a massive landslide with rock-falls phenomena in Kresna Gorge. Heavy reinfall north from Kresna municipality in the last two days has risen up the Struma river level very quickly. Road damages occurs, including at the beginning of the longest tunnel in Kresna Gorge (coordinates 41°47'25"N, 23°09'28"E). High waves in the river caused motorway collapse near the tunnel. A large numbers of vehicles on the lanes are also hit by rocks falls. A big truck transporting flammable fuel explodes at the entrance of the tunnel where many cars were stopped by the landslides. The potential alert which the IMPRESS system receives is from the regional Ministry of Health Blagoevgrad where a number of calls mentioning a large number of injured people in cars on the highway, as well as a confusing report on a massive explosion at the Kresna Gorge tunnel.

The dispatching center of the fire brigade and the emergency medical services are overwhelmed by calls for assistance by passengers all along the highway.

The first arriving ambulance is blocked by on their way to the tunnel by the road collapse. They are confronted with a large number of walking injured persons escaping the site of the explosion, some of them with severe burn injuries. There are also reports of a lot of persons entrapped in their car near the entrance of the tunnel. Additional ambulances arriving at the scene get stuck in the traffic.

An advanced medical post (casualty clearing station) is set up to try to triage the walking injured, initiate treatment at the scene, and organize transport from the scene to the nearby hospital. A team of paramedics is sent towards the site of the explosion to report on the number of casualties and the severity of injuries. Given the number of trauma patients, including patient with neurotrauma, crush injuries and severe burn injuries, and because of the difficulties of road transportation to the Bulgarian hospitals (given the collapse of the road and the traffic jam), contact is made with the Greek authorities.

A crisis center is set up both in Bulgaria as in Greece, to organize transfer of the most severe emergencies, especially with neurotrauma, crush and burn injuries, to the specialist hospital departments in Petrich, Sandanski and in Thessaloniki, Greece (neurosurgery, dialysis and intensive care burn units). Greek ambulances and mobile medical teams are sent towards the other side of the blocked tunnel to assist their colleagues from Sandanski/Petrich and provide triage and on site medical care for the entrapped injured people. NGO and Red Cross volunteers are mobilized to take care of the uninjured and slightly people escaping the scene of the incident, and a reception and information center is set up for psychosocial care of the persons affected and to inform the families of persons involved and the general public. Secondary transport by air ambulances is organized for patients in the nearby hospitals to be transferred to more specialized larger hospitals. .

***What can be tested for the purposes of IMPRESS:***

- critical decision points, analysis and categorization of the health needs, analysis of patient flow, communication, reporting and exchange of information, protocols and procedures for decision making in the dispatching center, the advanced medical post (e.g. START system of Simple Triage and Rapid Treatment), the crisis centers and especially in the different hospitals involved (e.g. the mass casualty incident protocol which they initiate as soon as they are notified, in order to organize a capacity surge, including calling in more staff, pulling extra and spare equipment out of storage, and clearing non-acute patients out of the hospital)
- the focus will be on the health services and not on interdisciplinary coordination between health services and the rescue/fire and police operations

This scenario is the working scenario where IMPRESS system after its development in the end of the second year of the project life time has to show to its stakeholders what additional functions can bring to stakeholders responding in the described scenario.

Further refinements and validations throught the proposed cross-border scenario may occur during the implementation phase of the tests and validations of the system.

## Conclusions

The project IMPRESS will end in April 2017, which is why its components are still under development and more functionalities and options will be added to the current described ones. The final year of the project duration is dedicated to the local scale scenario tests and the cross-border scenario where ERCC (Emergency Response Coordination Center) support will be also tested. The system initiative to optimize medical units in cases of mass emergency and distribution of all available logistic resources is one of the first attempts in combining all available systems into one common platform.

## Acknowledgements

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# COMMENTS ON CIVIL ENGINEERING COUPLING WITH IT FOR NATURAL HAZARDS AND RISK MITIGATION IN BULGARIA

***Mihaela Kouteva, Lyubka Pashova, Krassimir Boshnakov***

*Natural disasters occurrence is difficult, even in many cases, impossible to be forecasted, but their impact surely can be mitigated taking proper measures in the all disaster cycle – pre-disaster phase, response during disaster, post disaster phase and long-term risk management. Contemporary engineers have at disposal advanced scientific and applied tools for preliminary estimation of the disaster consequences and proper planning and performance of various activities to ensure gradual lowering of the natural disaster risk. This paper deals with the overall picture of natural disasters documented over the Bulgarian territory in the aspect of the running NATO SfP Project "Decision Making Support and Data Analysis Platform for CMDR and Climate Change", coordinated by the CMDR COE. Floods, droughts, wood fire, earthquakes and landslides have been recurrent natural phenomena in our country. Major reasons for potential damages due to such hazardous events are set out. Brief review of the involved institutions in the activities related to Natural Disaster Risk Mitigation (NDRM) and emergency situations and relevant legislation at national level is provided. International and local good practices coupling the civil engineering with the information technologies (IT) for NDRM are discussed.*

## Introduction

This paper is a working paper in the aspect of coupling the civil engineering with the information technologies (IT) for natural disaster risk mitigation, based on the international experience and including some personal comments, ideas and results. In Bulgaria there are some efforts towards disaster mitigation, but, in general, the potential of the IT in the disaster prevention, management and mitigation still remains largely untapped. Considering the IT high rate of development, IT become really essential tool in many fields of activities. Major IT roles in the disaster mitigation are related to: (1) data acquisition and relevant management of the data from disasters areas; (2) raw data processing; (3) contribution to developing models and prognostic estimates of the disaster situation dynamics and (4) supporting management and decision-making process during in the different stages of the overall disaster cycle.

## Disaster and risk – major concepts

### Necessity to define the disaster - major disaster definitions, relevant for disaster risk mitigation

Having a clear situation with the types of the disasters allows to build suitable strategy and action plan according to the particular national and international regulations and conventions. Considering the academic activities towards NDRM, building disasters resilience and disaster modelling are possible only based on comprehensive, internationally recognized, definitions of disasters that are necessary to be set into the corresponding knowledge databases. Clear comprehensive definition is of major importance with respect to the different decision support systems and modelling tools. The etymology points the Latin origin saying that "disaster" means bad luck, thus showing the important difference between the natural events and disasters and shifting the attention on the human perception of disaster. UNISDR (2009) defines a disaster as: "A serious disruption of the functioning of a community or a society involving widespread human, material, or environmental losses and impacts which exceeds the ability of the affected community to cope using only its own resources." The FEMA (1990) disaster definition says that the disaster is considered as "an occurrence that has resulted in property damage, deaths, and / or injuries to a community". Disasters are distinguished as natural, technological and human-initiated events that disrupt the normal functioning of the economy and society in a large scale. A detailed list is provided by FEMA (http://www.ready.gov/natural-disasters).

Defining the disasters helps us to (1) structure our knowledge and understanding about the qualitative classification of given disaster and (2) plan proper actions and (3) elaborate, choose and / or implement relevant tools to cope with the disaster. Thus our attention can be directed on important matters as: range of factors to characterize and scale the disaster, social systems matters, access to resource matters, overall impact matters (Emergency Management Institute, 2016).

### Risks associated with natural hazards

In general, risk is defined as "the combination of the probability of an event and its negative consequences" (UNISDR, 2009). It is accepted to determine the disaster risk by three main variables: (1) hazard (natural or anthropogenic); (2) vulnerability to a hazard; and (3) coping capacity linked to the reduction, mitigation and resilience to the vulnerability of a community associated with the hazard in question. It is important to distinguish between disaster and natural hazard, since the disaster might be provoked by the occurrence of one /or a set of/ natural phenomena. Hazards, in their origin, can be single, sequential or combined – the occurrence of one natural hazard might provoke another one or consequence of other hazards occurrence. Each hazard is characterised by its location, intensity, probability and likely frequency. An earthquake, for example, can trigger

landslides, avalanches, tsunamis, flooding, fires, etc. A recent example is the April 2011 Fukushima earthquake, when tsunamis, triggered by the earthquake caused an ecological catastrophe. Chemical manufacturing plants near settlements or exposed to significant seismic hazard can also be regarded as hazardous. Hazards can either be a creation of humans (anthropogenic) or the environment (natural) and in both cases the management of the hazard from engineering point of view remain the same.

Disasters are usually associated with functions disruptions, related to the environmental effects of the natural and/or induced /man-made or technogenic/ hazards, as listed in Table1. Relevant risks are generally related to the negative consequences of the natural hazards. Increasingly, researchers and stakeholders involved in disasters and their management are concerned with the interactions between man and nature, which can be complex and can aggravate disasters. The severity of the damages caused by natural or technological disasters is affected by population density in disaster-prone areas, community preparedness, local building codes, and the use of public safety announcements and education on how to respond correctly at the first signs of danger.

Table 1. Environmental effects of the major disasters due to natural hazards occurrence.

| Natural hazard | Environmental effects |
|---|---|
| Earthquake | human losses; structural damage; landslide, rock falls, avalanches; fire; industrial accidents; transport disruptions; computer systems disruptions; etc. |
| Floods<br>Thunder-storm | heavy rainfall; landslides; erosion; human losses; structural damage; destruction of plantation; transport disruptions; computer system disruptions; etc. |
| Lightning | fire ; |
| Drought | fire; soil deterioration; depletion of water resources; loss of plantations and animals; |
| Hot wave | fire; soil deterioration; depletion of water resources; loss of plantations and animals; snow melting (flooding); |
| Cold wave /wind /heavy snowfall | icing; snow melting (floods); avalanches; erosion; |
| Wild fires | destruction of ground cover; erosion; long-term smog; tainted soil |

Following the different definitions cited above, it is important to distinct between normal natural occurrences and natural hazards. Natural phenomena are extreme climatological (weather), hydrological (water), or geological (earth) processes that do not pose any threat to persons or property. When a strong earthquake occurs in an unpopulated area, it is a natural phenomenon. Once the consequences (a possible hazardous situation) of this natural phenomenon come into contact with human beings it becomes a natural hazard. When this natural hazard affects the people so that they are unable to cope, the situation becomes a disaster. The role of engineering and IT in hazard and risk assessment, analysis and mitigation is related to: (1) collection of reliable data in standardized formats via instrumentation monitoring, specialized internet sites and other tools; (2) organizing these data in relevant data bases, data storage; (3) data management and exchange, big data; (4) developing advanced tools for prognostic hazard, vulnerability and relevant

estimations – analytical modelling tools, neural networks, genetic algorithms, GIS tools; (5) data access and results dissemination – internet portals, information systems, etc.

### Resilience and Robustness – general view

The distinctions between resilience and robustness have been recently clarified (Teodorescu, 2013). A system is defined as robust to particular type (and scale of) event, when this system operates in the same way before and after the event. A resilient system is not able to withstand the event without major disruptions of its operation, but it is capable to adapt and quickly adopt a new manner of operation, suitable to the newly created conditions by the event and its consequences. The permanent dysfunctions of given system after a hazard occurrence indicates that this system is non-resilient, or it is hazard-vulnerable. The vulnerability can be rather different, since it might be associated with different types of hazard – earthquakes, floods, land sliding, etc. The role of engineering and IT in improving robustness and resilience include: (1) improving preparedness; (2) improving efficiency of emergency response and disaster management and (3) improving recovery and adaptation to post-disaster situation.

## Hazards and risks of concern in Bulgaria

### Natural hazards

Disasters cause a considerable amount of damage around the world every year. The number of natural disasters over the past few years has increased and the impact in terms of human, structural and economic losses has increased considerably. Following the definitions of Natural Disaster by the UN Office for the Coordination of Humanitarian Affairs, natural disasters can be divided into three specific groups: hydrometeorological disasters, geophysical disasters and biological disasters. The economic impact of these disaster usually consists of direct (e.g. damage to infrastructure, crops, housing) and indirect (e.g. loss of revenues, unemployment, market destabilisation) consequences on the local economy and social life. Natural disasters do not affect evenly the territory of Bulgaria and some of them have a trans-boundary impact. Two main groups of natural hazards of concern are distinguished, as listed in Table 2. They are related to (1) geological processes and phenomena and (2) hydrological and meteorological processes and phenomena. The statistical estimation of the contribution of the natural hazards of major concern for the Bulgarian territory is shown in figures 1a and 1b.

Table 2. Major natural threats in Bulgaria (revised from Pashova et al., 2010).

| NATURAL HAZARDS OF MAJOR CONCERN | |
|---|---|
| GEOLOGICAL PROCESSES AND PHENOMENA | HYDROLOGICAL AND METEOROLOGICAL PROCESSES AND PHENOMENA |
| ⇨ Earthquakes [L,R]<br>⇨ Slope failures (landslides, landslips, creep, falls, flows, subsidence) [L]<br>⇨ Mud-rock flows [L]<br>⇨ Erosion and abrasion [L, R]<br>⇨ Storm surge [L, R]<br>⇨ Tsunami [L] | ⇨ Floods [R, L]<br>⇨ Snow flows and glaciations [R, L]<br>⇨ Drought [R, L]<br>⇨ Temperature extreme [R, L]<br>⇨ Thunderstorm [L]<br>⇨ Tornado phenomena [L]<br>⇨ Dust storms [R, L]<br>⇨ Hailstorms [L]<br>⇨ Wet snow [L]<br>⇨ Fog (coastal, evaporation, radiation, valley, upslope) [R, L]<br>⇨ Silver thaw [L]<br>⇨ Wild land fire [R, L]<br>⇨ Strong wind [R, L] |
| L – local area affected; R – regional area affected | |

Natural hazards are hardly predictable, they are unpreventable and for the most part, uncontrollable, while the associated natural disasters are partially predictable as they cluster in geographic areas. Earthquakes, floods, fires or storm surges, avalanches and heat waves are characterized by acute onsets. In Bulgaria the droughts are the natural hazards with slow or gradual onset.

Similarly to other countries, the significant set of manifestation of natural disasters in Bulgaria indicates the need of prognostic natural hazard, vulnerability and risk estimations, large set of models, preventive measures, mitigations plans and plan for response actions, recovery plans related to the diverse hazards and emergencies that the society may have to confront. The particular contemporary means and plans, by default, have to be predominantly IT based, but the realization of the conceptual models and their implementation at operation level might be rather long-term process.

Figure 1. Natural hazards of concern for the Bulgarian territory for the period 1900-2016. Data Source: CRED EM-DAT (Feb. 2015): The OFDA/CRED - International Disaster Database www.emdat.be Université catholique de Louvain Brussels –Belgium.

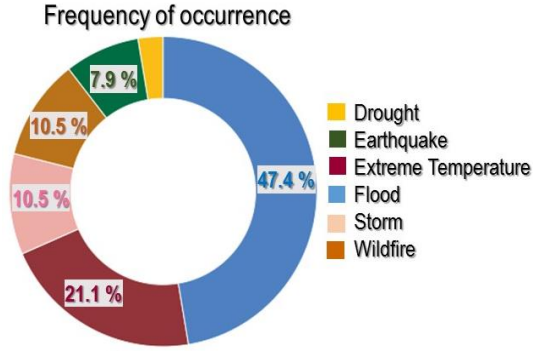



**Figure 1a.** Frequency of occurrence of natural disasters.

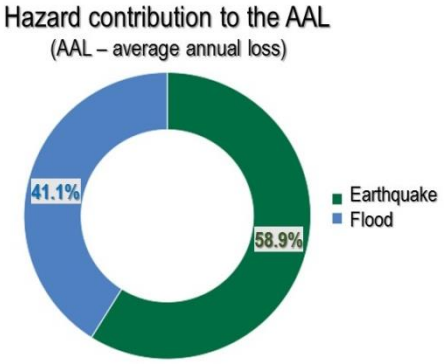



Figure 1b. **Hazard contribution to AAL.**

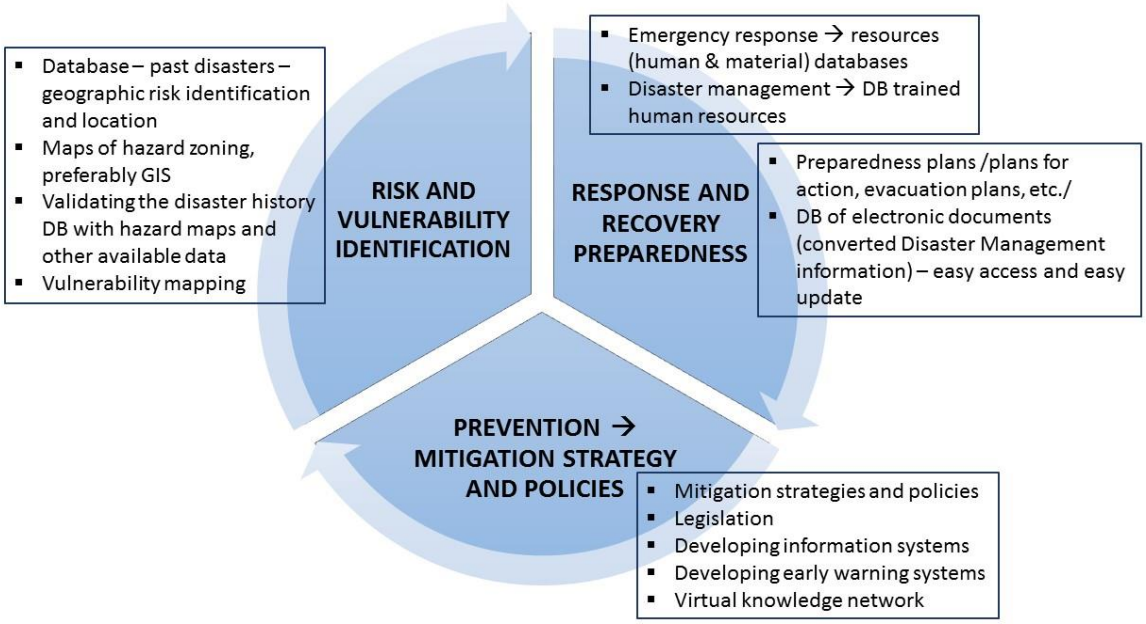
## Disaster risk management

The multiple efforts, the importance and uniqueness of hazard and risk reduction for the future have become more and more evident in the recent years. Traditionally, the disaster management as defined by the UNDP (1992:21) is “the body of policy and administrative decisions and operational activities which pertain to the various stages of a disaster at all levels” (USAID, 2011). Major problem is that the disaster management cycle remains still disaster-oriented and disaster-focused. NDRM by its nature is practically a continuous and integrated multisectoral, multidisciplinary process of planning, and implementation of measures, aimed at: (a) preventing or reducing the risk of disasters; (b) mitigating the severity or consequences of disasters; (c) emergency preparedness; (d) a rapid and effective response to disasters; and (e) post-disaster recovery and rehabilitation. Major challenge for the disaster risk management is to use multi-pronged approach to find effective means by which a comprehensive multi-sectoral participation of various professional disciplines and public interests can contribute to the reduction of natural and technological disaster risk in Bulgaria. Thus disaster reduction policies and measures need to be developed and implemented with a twofold aim: to enable society to be resilient to hazards while ensuring that development efforts do not increase vulnerability to these hazards. Appropriate IT solutions development and implementation would facilitate the transition from disaster-focused policy towards resilience–oriented multi hazard and multi risk policy.

It worth to mention that all the activities that we undertake for development and those linked to disaster risk reduction aim at improving our current development state. The logic, set in the disaster risk reduction framework, suggests that once we are successful in sustainable development efforts, we will significantly reduce the risks of disasters. The sustainable development context consists of socio-cultural, political, economic, and ecosystems or environmental domains - each of these domains can either contribute to overcoming or exacerbating disaster risk. Two of the most important contributions of engineering are related to the setting of codes and design and safety standards, and the actual design and construction of infrastructure used to prevent damage and losses caused by hazards.[1]

The role of the disaster information system in various phases of the disaster management differs depending on the related phase of the disaster management cycle. An interesting useful brief discussion on this topic is provided by Mohanty (2005). These roles are briefly illustrated in Figure 2.

Figure 2. Role of the disaster information system in the various phases of disaster management.




The roles of the main actors in the Disaster Risk Reduction in Bulgaria are regulated by a number of normative documents: Law on Disaster Protection, Law on the Ministry of Interior, National Plan for Disaster Protection and National Action Plan, National Program for Protection in Disasters, Regulation on terms and conditions for the functioning of the National System for early warning and alert, Strategy to reduce the risk of disaster, etc. The systems for EW & CM have just started to be developed and the Ministry of Interior is the responsible organization. Despite the general documents' title, the existing legal system in Bulgaria, related do natural disasters is guided by the traditional principle of the single event (hazard type). Natural hazards are discussed without relevant interconnections and consequences. In 2014 national Strategy for Disaster Risk Reduction 2014-2020 was adopted based on Hyogo Framework for Action, followed by a Road Map, in which key activities are described along with deadlines and structures responsible for their implementation. National Program and National plan for Disaster Protection were also adopted in the same year. Major actions, relevant to engineering activities, set out for each phase of the disaster cycle according to the National Strategy are listed in Table 3. The main role of the IT modelling applications is to contribute to the estimate if and how society is robust or at least able to face and cope with the disaster in a resilient manner. Data collection systems, expert systems, information systems, early warning and automatic shut-down systems are aimed to insure robustness or at least to increase resilience.

Disaster risk mitigation requires collection of data on the nature and the scale of the disaster – local, large area, regional wide spread affecting several large areas or several cities – e.g. the case of earthquake and flood. These data are the base of various hazard

and risk maps, published in different legislation documents – e.g., Flood Management Plans of the Basin Directorates, BDS EN1998-1:2012. These are some examples of the IT contribution in the evolution of the engineering design codes and safety instructions, orders and other documentation in Bulgaria over the years. This evolution has also incorporated lessons learned from past disasters or failures, as well as from research performed in the laboratory. Further step is the collection of data on the (1) population, (2) housing, (3) transport, (4) industry, (5) lifelines, (6) communication systems and (6) IT systems. Such data can be useful only if they are organized in suitable database, made available to stakeholders and decision makers. Some initial efforts to work out a conceptual date base model for seismic risk estimation and vulnerability mapping have been recently performed (Kouteva et al., 2015; Marinova et al., 2015; Pashova et al., 2015; 2016). These data have to be organized in different manners and might be used either in almost real time for decision making during the disaster and immediately after it as well as for long term sustainable disaster risk mitigation.

**Table 3.** Major actions, relevant to engineering activities, set out for each phase of the disaster cycle according to the Strategy for disaster preparedness (2014).

| | Earthquakes | Floods | Storms | Landslides |
|---|---|---|---|---|
| **Prevention / weakening** | ▪ Earthquake resistant design and construction;<br>▪ Rehabilitation / strengthening / of vulnerable structures;<br>▪ Seismic isolation and Seismic control system. | ▪ Construction of dams, dikes and embankments;<br>▪ Afforestation;<br>▪ Construction of pools / reservoir for flood control. | ▪ Breakwater construction;<br>▪ Afforestation – creation of woodland/forests; | ▪ Construction of dams and dikes for soil erosion limitation;<br>▪ Construction of revetments. |
| **Preparedness / readiness** | ▪ Implementation of seismic monitoring systems;<br>▪ Implementation of early warning systems /automatic shut down/. | ▪ Implementation of systems for meteorological monitoring. | ▪ Shelters, protection;<br>▪ Implementation and use of environment and meteorological monitoring systems. | ▪ Implementation of systems for meteorological monitoring. |
| | ▪ Preparation of maps of hazards;<br>▪ Risk assessment by quality and quantity;<br>▪ Information systems and data bases for risk assessment;<br>▪ Provision of water, food and materials reserves;<br>▪ Trainings for emergency situations;<br>▪ Establishment of early warning systems;<br>▪ Preparation of emergency sets. | | | |

| | |
|---|---|
| **Reaction** | ▪ Rescue operations<br>▪ First aid<br>▪ Fire fighting<br>▪ Monitoring for secondary disasters<br>▪ Emergent strengthening of affected construction<br>▪ Construction of temporary housing<br>▪ Establishing of temporary tent-villages |
| **Rehabilitation / Reconstruction** | ▪ Stable reconstruction<br>▪ Planning of land usage<br>▪ Auxiliary means for subsistence<br>▪ Planning for industrial rehabilitation |

Improving robustness and resilience requires coupling of civil engineering expert knowledge with the IT advanced tools. Large set of activities is necessary to be regularly and consequently performed to improve the preparedness, including (i) work on hazard and disaster modelling, (ii) improving the preliminary prognostic assessment of different hazards, (iii) determining and analysis of vulnerabilities, (iv) planning for disaster situations, (v) creation and keeping of databases and knowledge bases required for dealing with disasters and their effects.

## Engineering Contribution to Hazard Reduction

Natural and technological hazards often impact buildings and other structures – infrastructure elements. Buildings, bridges and road ways, underground pipelines, ports and marine terminals, electrical power systems are affected in different way by the potential natural hazards. All these structures have particular response to the excitations and loadings, triggered by the natural hazards and different damages or function disruption might be expected. All the damages of the various structures can be classified by a system of theoretical indices that are computed using the response parameters of the structures – these values might be obtained by experimental testing or numerical modelling.

The analytical evaluation of structural damage in general is based on developed structural damage functions (damage indices) resulting in single value under specified input – loading value or loading history. Comparatively rich set of damage indices has evolved over time to assess earthquake induced damages and collapse situations. The different damage indices consist of mathematical parts taking into account the contribution of different structural response patterns as brittle or ductile. This predetermines the major classes of damage indices as strength based, deformation based and based on hysteretic energy. The structural part to which the particular index is related – element, group of elements or whole structure determines it as local or global. Calibration of damage index values against experimentally obtained results show comparatively good certainty in structural response prediction through numerical evaluation. Some general information

about the damage index characteristics and the matrix of nonlinear structural analysis of structures is given in Figure 3 and 4.

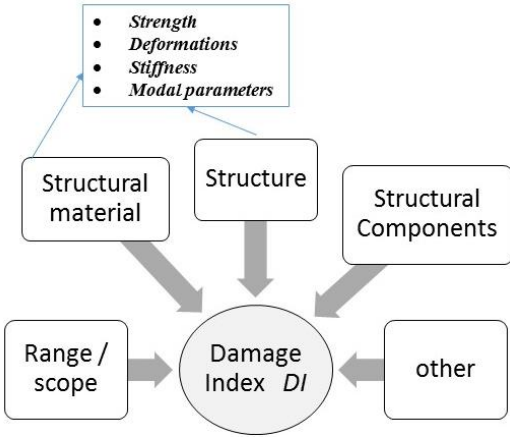



Figure 3. General Damage Index characteristics (Boshnakov & Kouteva, 2015)

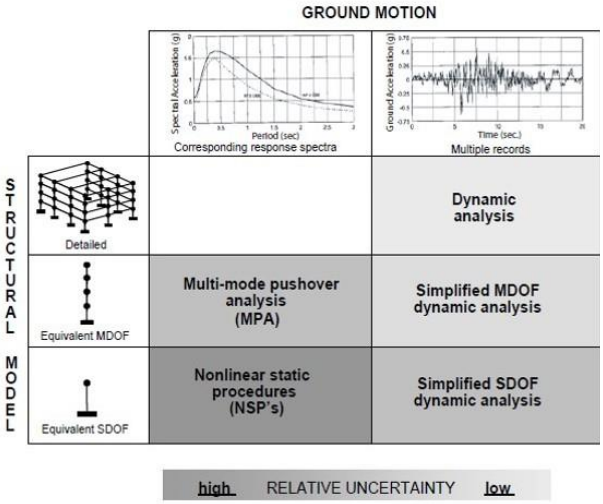



Figure 4. Matrix of nonlinear analytical results uncertainty at different seismic action models (FEMA 440, 2005)

Extending the analytical approach to constructing fragility and vulnerability functions (Porter 2016) relating structural response expressed as expected probability of exceedance of predefined damage state of a single building, group of buildings or whole typesets of building stock to different earthquake action intensities or expected uncertain damage to a measure of seismic excitation, respectively provided engineers and disaster managers a powerful tool for preliminary disaster assessment. Depending on different methods of deriving these mathematical structural performance models accumulation of sets of observational and experimental data is required if not directly then for calibration purposes, beside the presence of reliable database of strong ground motion records for hazard assessment and risk analysis. Both the rapid growth of collected data and the development in IT lead predefined the current trend of providing unification in access and further integration of the existing distributed data bases.

The database of tests performed at the European Laboratory for Structural Assessment (ELSA)[2] contains results of test campaigns that are available for authorised users to download. Useful large set of data about cyclic, lateral-load tests of reinforced concrete columns with different cross sections, material properties and reinforcing details are available through the Structural performance database at Pacific earthquake engineering research centre.[3] Dealing with seismic hazard and risk, it is very important to have reliable strong motion data to perform relevant structural analysis and/or experimental testing. Strong motion data are collected by different national registration networks. Most of these data become available to the public via various international research projects and internet portals.

Such contemporary tool is NERA – the Network of European Research Infrastructures for Earthquake Risk Assessment and Mitigation[4] targeted at measurable improvement and long-term impact in the assessment and reduction of earthquake vulnerability of construction stock and population in Europe. The logical framework for seismic hazard and risk and a scheme describing the data and databases necessary to understand and analyse the hazard, the exposure, the vulnerability and relevant risks is available via the NERA portal[5], Figure 4.

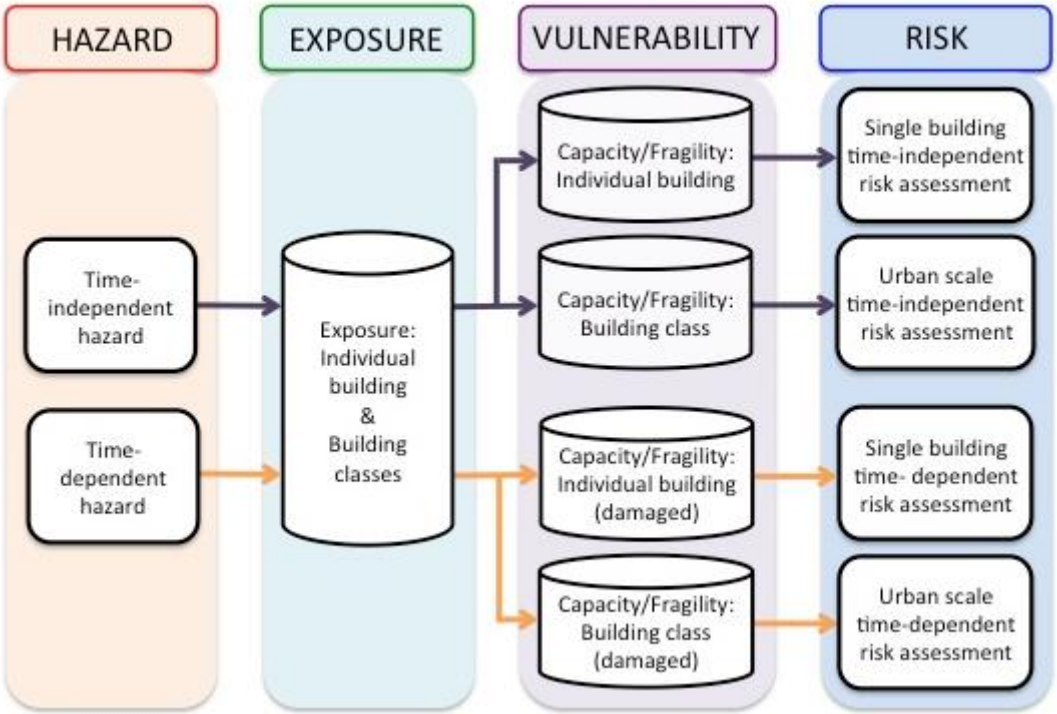



Figure 4. NERA portal: The logical framework for seismic hazard and risk, http://www.efehr.org:8080/jetspeed/portal/

Other important strong motion European database is reachable through the internet site for European strong motion data[6]. This platform provides an interactive, fully relational database and databank with more than 3000 uniformly processed and formatted European strong-motion records and associated earthquake-, station and waveform-parameters. The few European integrated experimental and theoretical research studies in seismology, applied geophysics, engineering seismology, earthquake engineering, soil dynamics and structural engineering have been performed in the framework of the EUROSEIS-RISK project[7], which included specific topics as seismic hazard assessment, monitoring of seismicity, design of 2D and 3D soil models for site response evaluation, 2D/3D theoretical computations, site effects, SSI effects in the presence of buildings or bridges yielding, validation of retrofitting techniques, etc. Another web platform that

provides access to data, models, tools and expertise relevant for assessment of seismic hazard and risk in Europe is the EFEHR, which is designed as a sustainable community resource for European Earthquake Hazard and Risk. EFEHR is hosted at ETH Zurich and operated by the Swiss Seismological Service (Schweizerischer Erdbebendienst SED), in close collaboration with EUCENTRE Pavia. It was sponsored by the EU FP7 project NERA from 2010 to 2014[8]. Different data base provide unified access and further integration of the existing distributed data – e.g. the NESS platform for research, collaboration and education[9]. The SERIES Project[10] is a nice contribution towards overcoming the extreme fragmentation of research infrastructures (RI) between countries and limited access to them by the S/T community of earthquake engineering, from which suffers the European seismic engineering research, especially that of Europe's most seismic regions. As state at the SERIES web site, the SERIES "*Networking sets up a public distributed database of past, present and future test results, installs distributed testing capabilities at all PsD labs, fostering development of up-and-coming ones at Europe's most seismic regions, drafts and applies protocols for qualification of RIs and engages the entire European community of earthquake engineering via the best possible instances: the European Association of Earthquake Engineering, EU's seismic code makers and their national groups, the European construction industry, as well as all relevant S/T associations or networks*". Data about systemic seismic vulnerability and risk analysis of buildings, lifelines and infrastructures becomes available via the European Collaborative Research Project[11].

## Use of GIS towards disaster risk mitigation

The geographic information systems (GIS) allow us to perform smart data visualization, analysis, and interpretation, which helps to understand relationships, patterns, and trends. There is currently growing interest in and awareness of the economic and strategic value of GIS. The contemporary power of the GIS mapping assures (1) better decision making (e.g. land use planning, real estate site selection, route/corridor selection, evacuation planning, etc.); (2) improved communication among different teams, departments, disciplines, professional fields, organizations, and the public; (3) better record track keeping (full transaction support and reporting tools). GIS has become essential to understanding what is happening and what will happen in geographic space - once the hazard, vulnerability or/and risk are understood, action can be prescribed. GIS benefits different organizations in numerous industry fields.

Advanced GIS and Web-based technologies are indispensable and highly effective tools in all phases of the disaster management cycle - prevention, mitigation, preparedness, operations, relief, recovery and lessons-learned. Proper natural risk assessment and management is performed by using the contemporary IT for gathering raw observational data from different sensors on land, in air or in space, which are used for real-time data analysis and decision support system with or without human intervention during disastrous events (Figure 5). Substantial focus on data and measurement which provide information

about examining variables related to disaster risk reduction, preparedness and resilience is posed in the Sendai Framework for DRR and the Sustainable Development Goal.

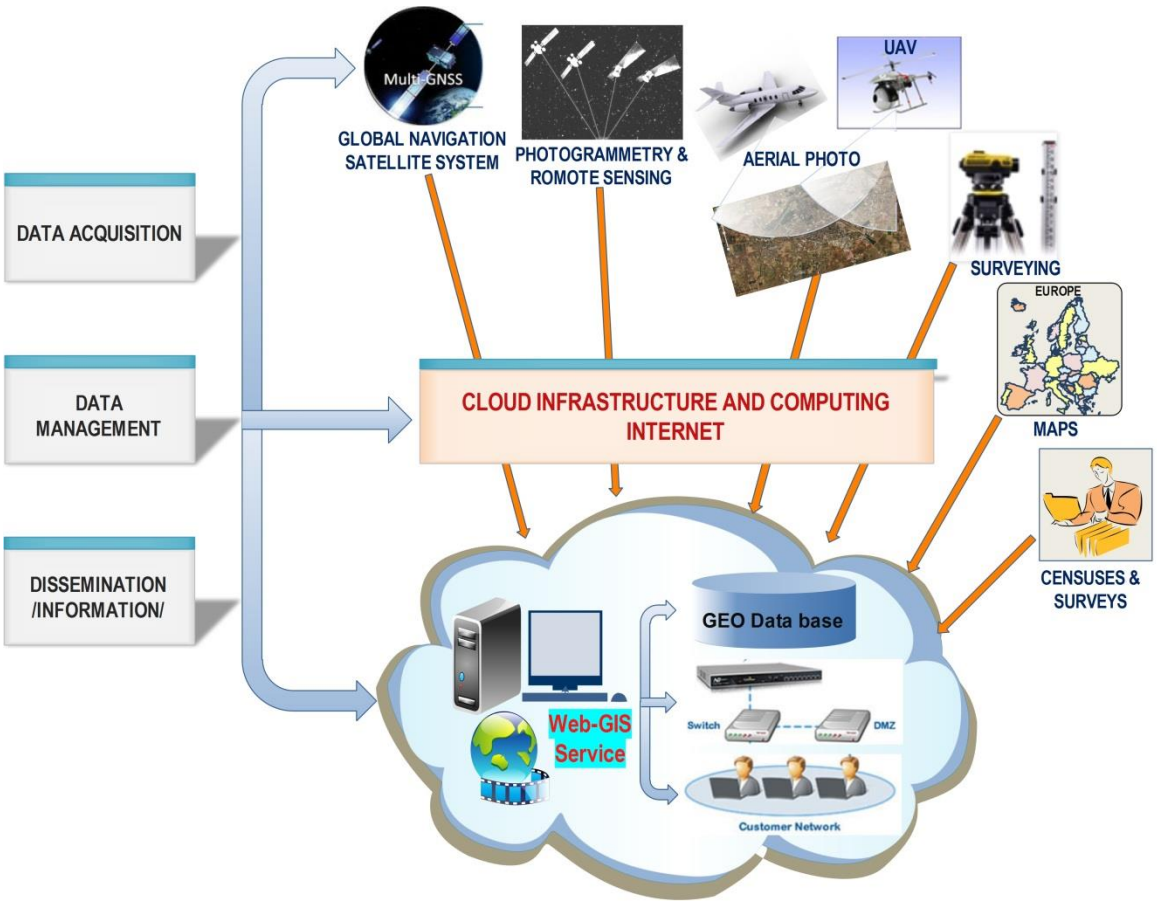



Figure 5. Web-GIS cloud platform – principal scheme of data collection and processing.

The Bulgarian National Regional Development Strategy (NRDS) for the period 2012-2022 (MRRB, 2012) is an important step towards defining the strategic framework of the government policy for attaining balanced and sustainable development of the country's regions in the context of the all-European policy. Very interesting GIS based analysis related to the socio-economic and territorial development of our country - population, degree of urbanization, urban development, educational system, health care system, and cultural heritage, transportation network (ground, water, and air) is supplied. The MRRB GIS portal[12] provides a useful set of GIS interactive specialized thematic maps – administrative territorial units, topographic maps, transport network, water resources, population density, normative data (seismic loading, wind, snow, temperature) and other important maps, risk maps, landslides map, etc. There are few public data sources that might be used for GIS mapping for DRR purposes in Bulgaria. Most of the reachable data are not in digital format, which makes GIS analysis very difficult, since very often raster data are not with good resolution. Even having some data with good resolution, data processing and preparation is time consuming process. Nevertheless, some efforts for comparative analysis and brief look to a qualitative vulnerability estimates at large scale

has been recently performed (Kouteva et al., 2015; Marinova et al., 2015; Pashova et al., 2015; 2016).

The rapid development in modern GIS, web, and spatial information technologies facilitates providing and communicating the risk information to a wider range of communities, assisting collaborative decision-making process of different stakeholders and parties concerned. Main capabilities of Geographical Information Systems (GIS) (data storage, management, analysis and presentation) are extended with the crowdsourcing mechanisms and web mapping. They are becoming increasingly more common in society for disaster management. The dissemination of information through GIS, Web-based platforms and cloud services is realized through coordinated early warning systems, monitoring, forecasting, risk assessment, response hazards and mitigates disaster impacts. New web technologies allow creating dynamic and intelligent websites mapping platforms (e.g., Google Maps, Bing Maps, OpenStreetMap, etc.), which have revolutionized cartography and have brought it to the masses. The exchange of spatial information through web-GIS platforms shared by several entities and the access to risk related information almost in real-time at various spatial and temporal scales assist decision makers through interactive tools to analyze available information, to interpret it, and to take informed decisions in emergencies situations such natural or man-made disastrous events.

The processes for risk management of the natural and man-made disasters are inter- and multidisciplinary, which can be essentially improved by timely, accurate and effective providing of Earth observations from diverse sources, including satellite, airborne, in-situ platforms, and citizen observatories (Pashova, 2015). Recent advances in information and communication technologies contribute to DRR, empowering the decision-makers and citizens to play a proactive role in managing disaster risks and providing more effective disaster response. Moreover, integrated use from in-situ to space-based data to monitor disasters, and the imagery and data they provide are invaluable to disaster recovery, as they offer overviews and information that people on the ground cannot obtain. For example, the International Charter: Space and Major Disasters[13] created in 1999 provides satellite imagery, free of charge, to disaster response organizations in the event of a large-scale natural or man-made disaster. Since its creation the Charter has contributed to over 400 disasters in countries all over the world. The Charter has been activated for Bulgarian territory on 9 June 2005 due to floods in different areas of north Bulgaria, killing several people and seriously damaging the infrastructure, and on 5 October 2006 due to oil spill polluted the Danube River over some 140 km in Bulgarian territory downstream.

Risk assessment, mitigation and management are closely tied with the spatial data compatibility, Annex III, Theme 12 – Natural risk zones (INSPIRE Data Specification on Buildings, 2013). Directive 2007/2 of the European Commission for establishing an INfrastructure for SPatial Information (INSPIRE)[14] aims to build a main framework of

developing Spatial Data Infrastructure (SDI) and to underpin rapid global access, sharing and exchange of geospatial information that support the informed decision-making and more effective action of all spheres of public life, including risk management. The process of INSPIRE Directive implementation depends on the coordinated actions at the national, regional and global levels, as well as within individual organizations, in both the public and private sectors. In Bulgaria, it becomes more necessary to improve quality and quantity of spatial data, sharing of information and to realize the need of serious collaborative multidisciplinary efforts to assess the available databases and their harmonization in accordance with national and European legislation. It is necessary to increase collaboration between the institutions and interested parties at all managing levels in developing initiatives to increase public resilience to natural and man-made disasters. Such efforts for building sustainable relationships between stakeholders, researchers, general public, and the individuals are directed to cope with the challenges of natural phenomena.

## CONCLUSIVE REMARKS

Major role of the information and communication technology in disaster management is to accelerate the process of disaster preparedness, response and mitigation providing access to vital information on disaster preparedness to the public. IT invaluable contribution concerns developing and use of GIS based decision support systems for planning; the design of different types of early warning systems, including automatic shut-down systems of critical processes, and emergency communication for timely response measures. Building knowledge warehouse to facilitate planning and policy making is other very important role of the collaboration of the IT and other engineering.

The contemporary IT application for monitoring and data acquisition, make available new data with manifestation of various natural hazards and ongoing research projects. Thus engineering codes and standards are under dynamic development over time as new research findings and lessons from past disasters become available and /or the society's acceptable levels of risk change. The recognized central role of the IT in disaster response and mitigation still needs to be elaborated providing diverse advanced tools for modelling, data collection, processing and mining. Comprehensive collaboration between research and national authorities remains a long-term target, considering the necessity of further development of models, specific databases, decision support systems, expert systems. Work on resource allocation and management systems, planning and task allocation tools is another important issue. In summary, the diversity of IT means and the effectiveness of the IT implementation towards disaster risk mitigation and improving resilience the society must be significantly increased.

Another IT advancement is represented by the Cloud services that could help authorities and people not only to improve the resilience to disaster, but also to be prepared for

mitigation disaster effects. Currently Grid and Cloud become more and more preferred platforms for modelling and simulation of complex processes that work with large quantities of data. Cloud gradually becomes IT leader for disaster prevention, disaster mitigation and improvement of resilience do disaster due to its high availability services, the involved virtualization of computing resources and the parallel computing potential.

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[12] http://gis.mrrb.government.bg/
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# EARLY WARNING SYSTEM FOR THE HYDRO-METEOROLOGICAL HAZARDS ALONG THE BULGARIAN COAST OF THE BLACK SEA

***Anna Kortcheva, Vasko Galabov***

*The National Institue of Meteorology and Hydrology, Bulgarian Academy of Sciences ( NIMH–BAS)* *conducts scientific and applied research related to the development and implementation of numerical models to the specific conditions of the Black Sea for prediction of wind waves, storm surges and the spread of oil spills resulting from natural disasters or industrial accidents. Daily operations include two wave numerical models: WAVEWATCH III (NOAA), SWAN (TU-DELFT), and storm-surge model of Meteo-France, results of which are used for numerical analysis and short-term forecast of wind waves and storm surges in the Black Sea. The forcing data for the wave and storm surge models are the wind at 10m and sea level atmospheric pressure fields from the limited area weather prediction numerical model ALADIN. The atmospheric forcing is calculated twice a day at 06.00 and 18.00 UTC, then 72 hour forecasts of storm surge level and wave parameters are produced. The models cover the Black Sea with a numerical grid from 41.5°N to 46.5°N and from 28.0°E to 41.5°E and have the space step of 0.125° in latitude and longitude for WAVEWATCH III , and 0.033° for SWAN model for the entire Black Sea. The wave models WAVEWATCH III and SWAN have been validated by a comparison with altimeter wave data from ENVISAT, JASON1/2 and ALTIKA satellites. The numerical models are the main components of the Early Warning System for the hydro-meteorological hazards (storms, high waves, storm surges ) along the Bulgarian coast of the Black Sea. Examples of wave and storm surge forecast for storm in February 2012 in the western part of the Black Sea are presented.*

*Keywords:* Black Sea, waves, storm surge, coastal hazards, storms, early warning

## Introduction

Some of the important dangers for the coastal areas are the high waves and storm surges (short term increase of the sea level in shallow waters close to the coastline potentially causing floods) due to sea storms but also technogenic disasters such as coastal pollution (with oil derivatives or other pollution). These hazards may cause economic loss but also loss of human lives. The Black Sea is relatively small almost enclosed sea and the frequency of events with high waves and surges is relatively low and the hazards are much smaller than the hazards for the oceanic coasts, but dangerous events are still possible and cause mainly damages on the infrastructure and only in rare occasions lost

of human life. The Bulgarian Black Sea coast is a part of the Western Black Sea coast. The wave climate of this part of the Black Sea is characterized by higher annual average significant wave heights and more frequent storms that may become comparable to the oceanic storms (Arkhipkin et al, 2014). Also the storm surges may become very significant (Mungov and Daniel, 2000, Galabov et al, 2015) and the combination of waves and surge may lead to coastal flooding and dangerous conditions for the maritime operations.

One of the most notable storms affecting the Bulgarian coasts is the storm of February 1979 (with the highest recorded surge in the Black Sea- more than 1.5m sea level rise) and waves with significant wave height more than 5.5m nearshore (Galabov et al, 2015). Another recent storm with significant consequences (including at least one victim) is the storm of February 2012. The storm intensity (magnitudes of waves and winds) was successfully predicted by NIMH-BAS, however the reaction of the warnings by some of the users of our information was not adequate enough and our conclusion was that there is a problem with the communication with the end users (especially between the institutions, responsible for the disaster prevention and the general public). In order to minimize the consequences of such natural marine coastal hazards a key requirement is to have a proper prediction of the expected winds, waves and sea level rise 24 to 72 hours before the beginning of the period with dangerous hydrometeorological situation and therefore to implement an early warning system that consists of input meteorological information (atmospheric forcing), a chain of numerical marine models and properly post processed output tailored to the needs of the experts that are responsible for the preparation and dissemination of warnings and also to the needs of the end users with their specific requirements. The final part of such early warning system is a web based presentation of the warnings easily interpretable by the people without existing specialized meteorological knowledge, preferably using single semiotic signs (such as symbols and colour codes), instead of multiple numerical values. Such early warning system must be reliable and supported 24 hours a day in terms of reliability of the informational infrastructure and permanent availability of experts (operational forecasters) ready to interpret the numerical models output and change the level of warnings. Quite naturally the institutions that already have the continuous availability of forecasters and permanent support of the informational infrastructure are the national weather services. In Bulgaria the only institution that for more than 20 years (Kortcheva et al, 2000) provides such early warning is the National Institute of Meteorology and Hydrology (NIMH- BAS).

## The structure of the early warning system (input information, numerical models and postprocessing)

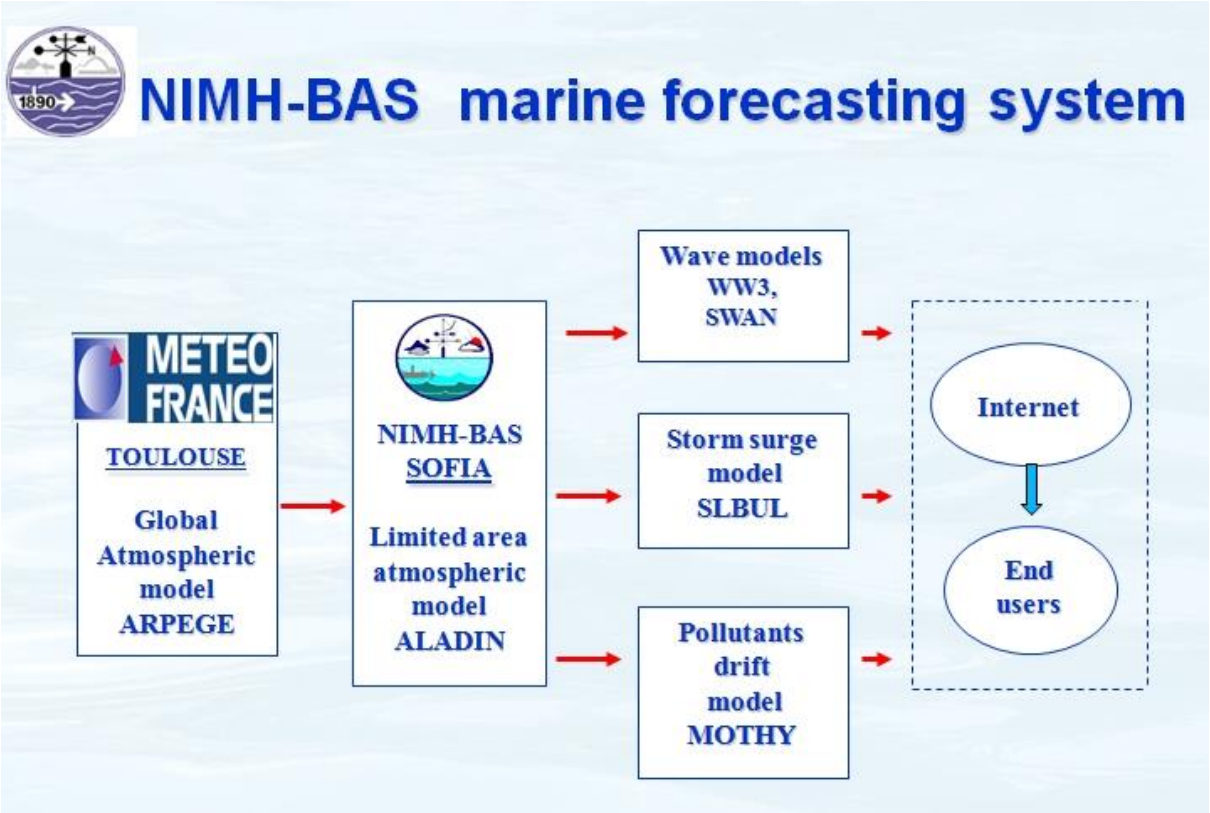


Figure 1. Scheme of the components of the marine modeling system of NIMH- BAS

The scheme of the early warning system is shown on figure 1. The marine models are:

-The wave models Wavewatch III (Tolman, 1991) and SWAN (Booij et al, 1999).

-The storm surge model SLBUL, which is a modification of the storm surge model of Meteo France (Mungov and Daniel, 2000, Daniel et al, 2001).

- The model MOTHY (Daniel,2006,Kortchev et al, 1999) that simulates the drift of pollutants on the sea surface, but may be used for other specific tasks, which will be discussed later.

The input meteorological information for the numerical models is coming from the limited area model ALADIN (Bubnova et al,1995) that is operational for Bulgaria and the Black Sea at NIMH-BAS. ALADIN model receives initial and boundary data from the global atmospheric model of Meteo France- ARPEGE. Figure.2 shows the computational domain of ALADIN.

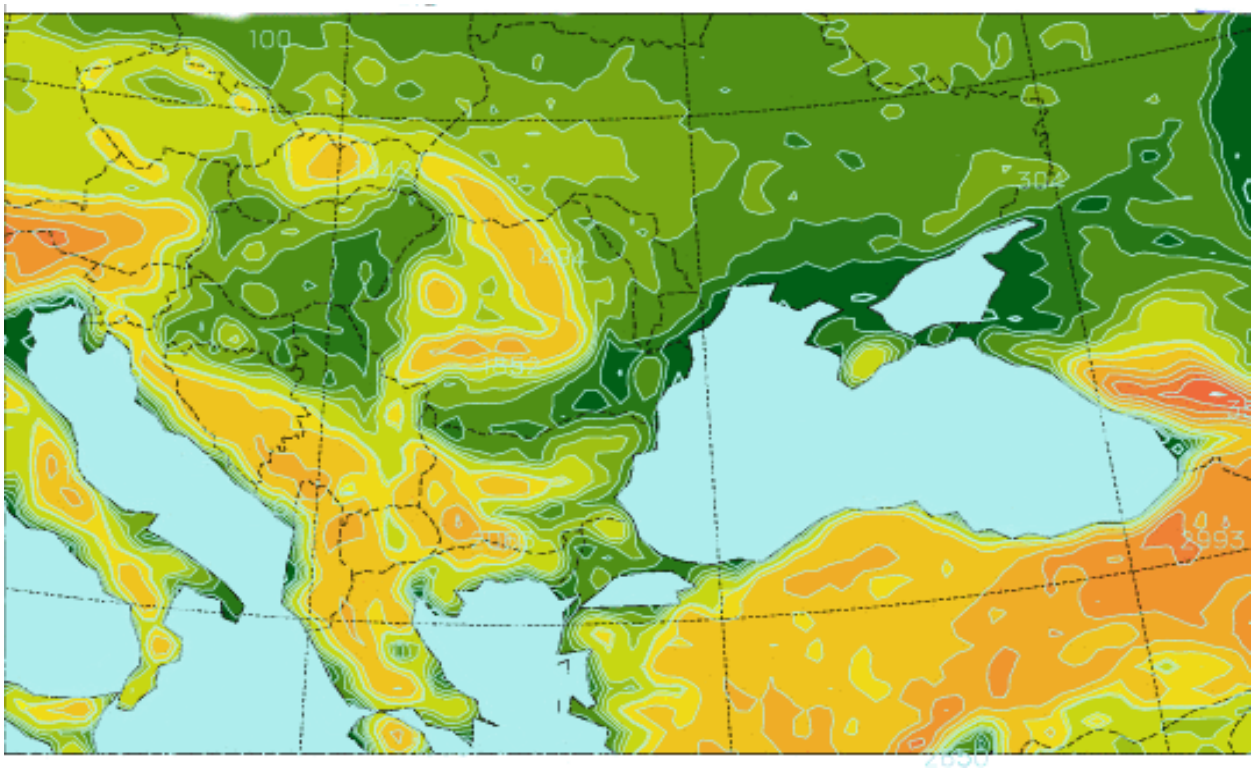

Figure 2. The computational domain and the orography of ALADIN limited area atmospheric model.

The wave models run in operational mode twice daily, the storm surge model runs also twice daily and the pollutants drift model is activated in case of emergency. The output from the numerical model is post processed with the use of specialized visualization and mapping software such as Generic Mapping Tools (GMT) and Grads. Finally the models output is transferred to a specialized web page, from where it is accessible by the end users as graphics (maps of the wave parameters), tables with data, time series plots of the sea level rise and text data. The forecasters of NIMH use the output from numerical models to prepare the marine forecasts for the Western Black Sea and to determine the level of warning in the so called METEOALARM system. The model data in specific form is also accessible to the Bulgarian Maritime Administration, Directorate „Search and Rescue", Maritime Rescue Coordination Centre in Varna.

In the next sections we will discuss the components of the system in more details.

## The Wave models

Black Sea is an almost enclosed sea, but the significant wave heights during storm may reach values typical for the oceans (up to 10m or even more in the open sea-see for instance the study of the maximum wave heights for a long period- Surkova et al, 2014). The high waves during storms are a significant risk factor not only for the coasts, but also for maritime activities and offshore constructions. Weather conditions with stormy waves are much more typical for the cold season and their frequency during the winter may be

high - more than 5 storms per season. This makes the reliable forecast of the wave parameters for the Western Black Sea coast the most important part of the early warning system (of course the storm surge forecast is also crucial but while the storm surges appear only in situations with high waves, the opposite is not necessarily true).

In the past before the computer era the only method to predict the wave heights was the usage of nomograms that link the wave heights with wind speeds and the so called fetch (length of the sea sector over which a given wind has blown). Later with the introduction in the meteorological services of computing infrastructure, the numerical modeling replaced totally the usage of nomograms. In NIMH- BAS the first numerical modeling of waves was initiated during the eighties of the 20$^{th}$ century (Kortcheva, 1990. Later during the nineties of the 20$^{th}$ century in the frame of bilateral cooperation of NIMH- BAS and the French weather service METEO FRANCE a second generation wave model VAG (that uses parameterized nonlinear interactions between the waves, the first generation is without nonlinear interactions) was implemented for the Black Sea (Kortcheva et al, 2000). The statistics of comparison of this model output during stormy conditions with satellite measurements from ERS-2 satellite shows some underestimation of the wave heights of about 0.2m and standard deviation about 0.6m with correlation between the modeled and measured wave heights 0.873. These values are within the normal range for such second generation models. The spatial resolution of VAG was 0.25 degree. Later in the beginning of the 21$^{st}$ century VAG was replaced in NIMH with a third generation numerical wave model Wavewatch III (Tolman, 1991). The third generation wave models simulate explicitly the physics of the sea state and its temporal evolution without limitations on the spectral shape. The comparison of the performance of VAG and Wavewatch III using again satellite measurements shows the advantages of the third generation wave model- lower bias and lower standard deviation (Kortcheva et al, 2010). Presently we continue the use of Wavewatch III for the entire Black Sea in operational mode. The input meteorological data is from the ALADIN model. The spatial resolution of the model presently is 0.125 degree (about 14 km). The model produce forecast for the next 72 hours twice daily.

Example of the wave forecast of the model Wavewatch III is shown on figure 3 together with the satellite tracks that are used for comparison (verification).

The next step in the development of the wave prediction part of the marine models system was the implementation of a wave model for the nearshore waters with much higher spatial resolution, that takes into account the processes close to the coast (in the so called shallow and intermediate waters- up to the depth of ½ of the wavelength, which for severe storms with very high waves may be in the order of about 50m). The most popular model worldwide for such coastal applications is SWAN (Simulating Waves Near Shore), developed by the Technical University of Delft, Netherlands (Booij et al, 1999). SWAN was implemented for the Black Sea with a spatial resolution of 2’ (about 3.5km) with

possible increase of the resolution in a nested domain in the coastal area up to 30'' (less than 1km horizontal resolution). SWAN became operational and a part of our set of operational models in 2011 (Galabov et al, 2012).

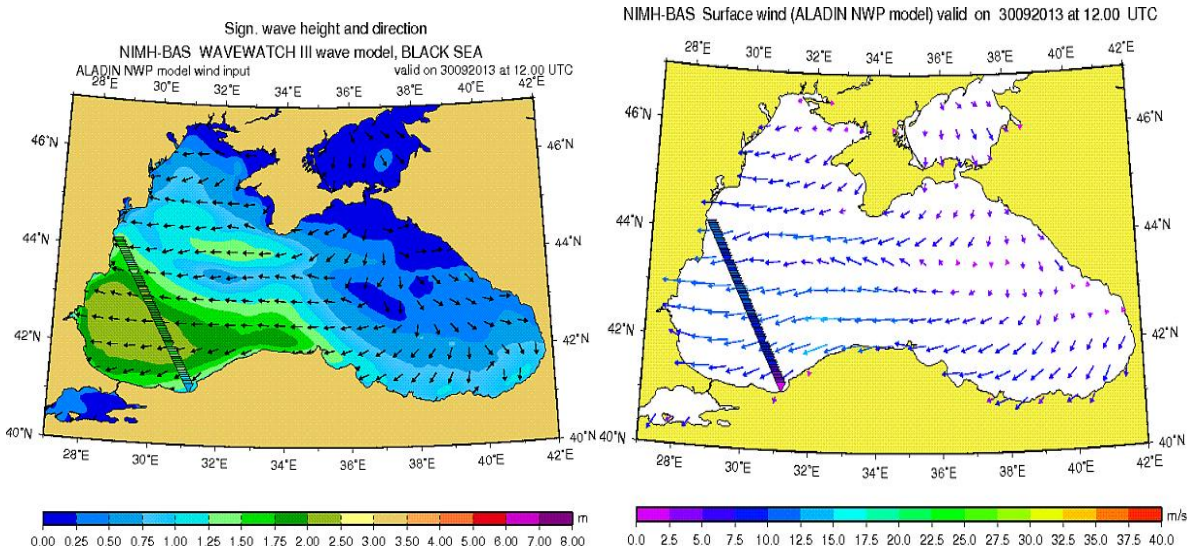


Figure 3. Left- Wavewatch III forecast of the significant wave height and mean wave direction (the line is the track of Jason-2 satellite above the Black Sea on 30.09.2013 at 11h26mi and the colors of the track correspond to the color range for the model output) Right- Winds at 10m height (from ALADIN model) and the track of Jason-2 on 30.09.2013 at 11h26min.

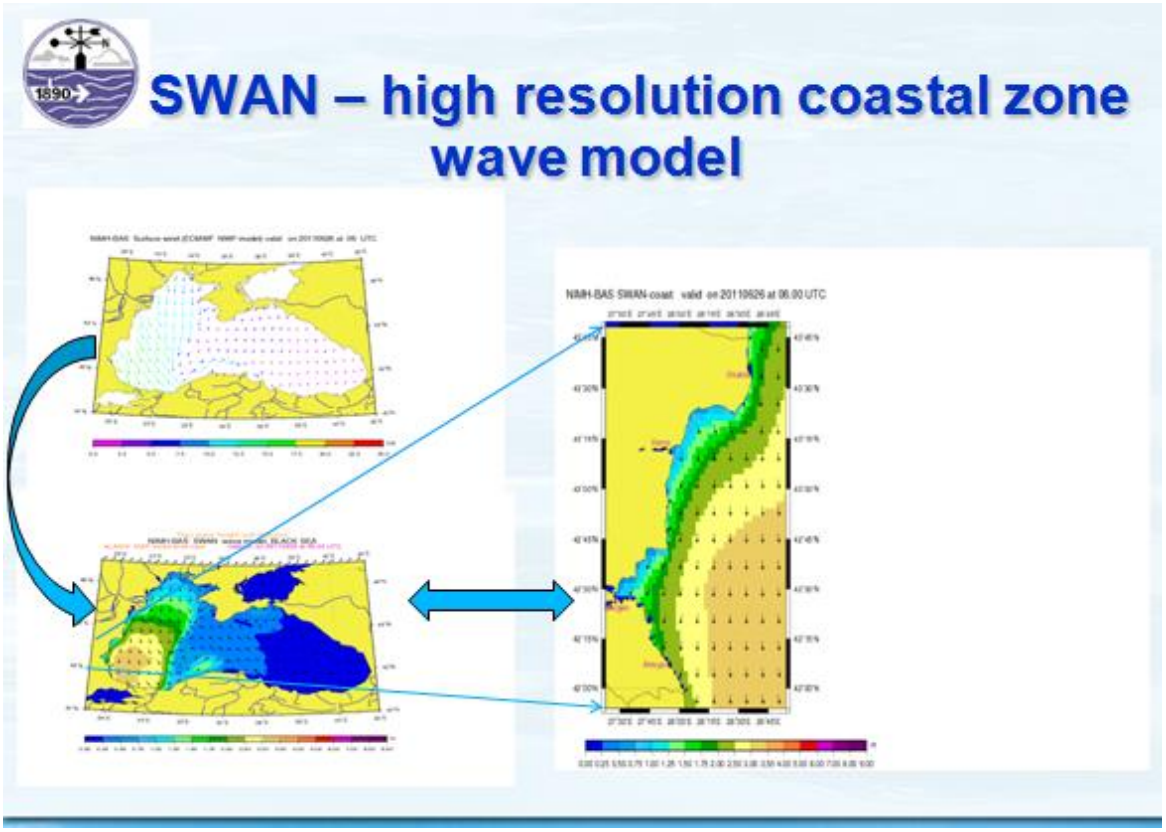

Figure 4. Example output of SWAN: the wind data forcing the wave model, the output for the entire Black Sea and zoom into the area of the Bulgarian coastal waters.

Figure 4 gives a schematic idea about the functioning of SWAN and examples of the graphical output for the entire sea and the coastal waters. Detailed information about the specific setup of SWAN for operational use is given in Galabov et al (2012) and Galabov et al (2015).

According to our study (Galabov et al, 2012) of a stormy period during January and February 2012 the performance of SWAN for stormy conditions was comparable with the results of similar operational systems in the European seas: the forecast for the significant wave height 3 days before the event is with bias -0.36m (underestimation by the model), two days before the event it is -0.27m and one day before the event it is 0.17 and the root mean square error of the forecast is 0.68m, 0.65m and 0.45m respectively. This means that the underestimation is in order of 5% 3 days before the event and drops below 3% underestimation 24 hours before the storm peak. The root mean square error drops from 12% to less than 8% of the mean of the satellite measurements during the storm peak. We also compared the model forecasts for a the most severe storm with instrumental measurements of the wave heights with acoustic Doppler current profiler (ADCP) at depth of 20m close to the coast at Pasha Dere beach south of Varna. The data from the ADCP were provided by the Institute of Oceanology- Bulgarian Academy of Scientists (Valchev et al, 2014). The highest measured significant wave height during the severe storm was 4.77m around 00h GMT at 08.02.2012. The forecasted highest significant wave heights for the same location and depth are shown on table 1.As it may be seen the forecasts prepared 72 to 36 hours before the event underestimate the maximum significant wave height at that location by 60-70cm, that is about 15% underestimation. Less than 24 hours before the peak the model was already able to predict without significant underestimation the magnitude of the event. Based on that conclusion in the recent years we worked on the proper fine tuning of the model parameters and the present setup of the wave model is able to simulate the same storm with underestimation below 7% 3 days before the event and with negligible overestimation of about 0.1m on the day of the event. As a conclusion reliable operational wave system was implemented and calibrated that is capable to predict the magnitude of the storms 72h before their peak.

| Forecast time, Hours before the peak | 05.02.2012 06h GMT (-66h) | 05.02.2012 18h GMT (-54h) | 06.02.2012 06h GMT (-42h) | 06.02.2012 18h GMT (-30h) | 07.02.2012 06h GMT (-18h) | 07.02.2012 18h GMT (-6h) |
|---|---|---|---|---|---|---|
| Predicted significant wave height for 08.02.2012 00h GMT, m | 4.1 | 4.1 | 4.2 | 4.1 | 4.3 | 4.6 |

Table 1. Predicted values of the significant wave height at for Pasha Dere for the location of the ADCP. The table shows the predictions of the operational model during the 3 days before the maximum of the storm.

## The Storm Surge model

The operational storm surge modeling for the Bulgarian coast was initiated during the eighties of the 20th century (Mungov, 1988) using different statistical and numerical approaches. At the end of the 20th century for the needs of the operational storm surge modeling NIMH- BAS adopted the French storm surge model and adapted it to the Black Sea conditions (Mungov and Daniel, 2000). It was found that the model generally underestimates the storm surge which was explained with the low spatial and temporal resolution of the atmospheric forcing. Another approach to the storm surge prediction by usage of neural networks technique was tested by Pashova and Popova (2011). The model use as an input meteorological data from the ALADIN MODEL- forecasted fields of the wind at 10m above the surface and the mean sea level pressure. The output is in a form of time series of sea level increase due to storm surge or in a form of a shape file compatible with geoinformation systems. The bathymetry is with $1/30^0$ resolution and the grid is a regular longitude-latitude grid.

We integrate the model not down to the actual bottom of the sea but to the mixed layer for the month taking into account the very stable stratification of the Black Sea and treating the surge as a long wave propagating only in the upper dynamical layer of the sea. The mixed layer depth of the Black Sea is very shallow when compared with the other European seas (in order of 40-60m during the winter, compared with the order of 300m for the Mediterranean sea). The data for the monthly mixed layer depth of the Black Sea was taken by the study of Kara et al (2005). Recently a coupling of the surge model with the wave model was introduced (Galabov, 2016). In our recent studies (Galabov et al, 2015, Galabov, 2016) it was found that taking into account the present accuracy of the meteorological model forecasts, the storm surge model without coupling tends to overestimate the storm surge by roughly 15%, while the use of a coupling lowers the overestimation within the range of 10-15%. Because the dangerous storm surges in the Black Sea are a relatively rare event, the storm surge model output is transmitted to the forecasters of NIMH-BAS regional center in Varna only in case of a predicted surge above 50cm. Example output of the storm surge model in the form of a map of the maximum surge levels along the Bulgarian coast of the Black Sea is shown on figure 5. This is a forecast for the case of the storm of 2012.

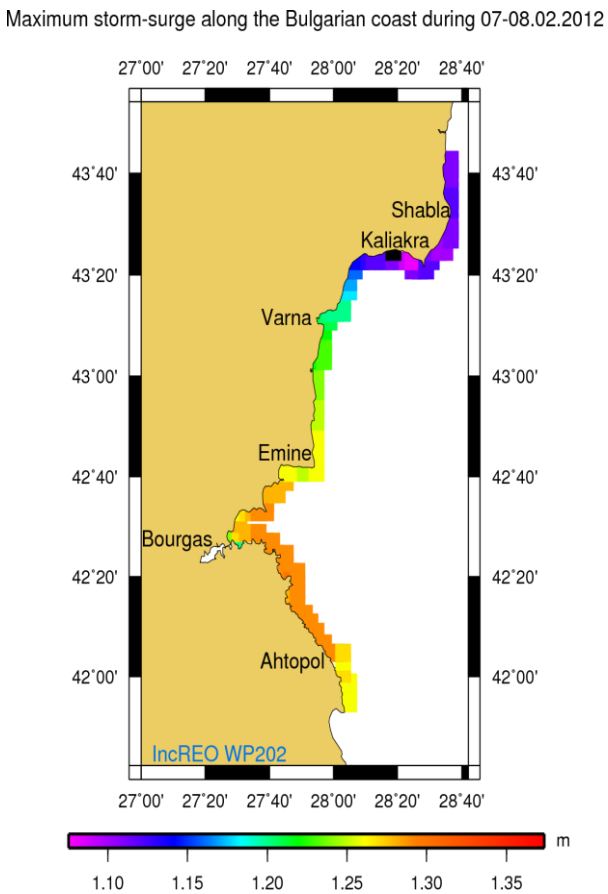


Figure 5. Example output of the storm surge model with the highest surge for a selected case- the severe storm of February 2012.

## The MOTHY model- simulation of drift of pollutants and other objects on the sea surface

The model MOTHY was developed by METEO FRANCE (Daniel, 1996) that was adopted at NIMH for the Black sea (Kortchev et al, 1999). This model represents a specific part of the system that is not related to natural coastal hazards. The model-can be used to predict or reconstruct post factum or to evaluate the possible risk of technogenic disasters- oil spills due to ship accidents, other spills due to various types of floating pollutants (the system is limited to the floating pollutants only). It may also predict the drift of different objects at the sea surface such as containers, which may be potential hazard for the ships, or drift of people on the sea surface or drift of animal carcasses (more specifically cetaceans). The model may work in forward mode- to predict the spread of pollutant or forward trajectory of an object or in backward mode (time reversed trajectory) in order to identify the possible location of the source of pollution or the location of the death of stranded cetacean. Fortunately the model was never used to predict the movement of an oil spill due to the lack of such big accident during the recent years, but it was used for various other purposes. The model is Lagrangian hydrodynamic model. MOTHY

simulates the pollutant as an ensemble of independent droplets. The components of the model are two- a component that calculates the wind driven sea surface currents and a component that models the spread of the pollutant. The first component is a two dimensional depth integrated hydrodynamic model that is in principle the same as the depth integrated storm surge model (they share the same dynamic core subroutine). The input meteorological information is the same information that is needed for the storm surge model. It needs also information about the termohaline circulation (the circulation in the basin because of the differences in salinity and temperature). This information may be either the seasonal mean or monthly mean values of the currents or information about the currents at the mixed layer depth (the depth of the well mixed turbulent upper layer of the sea) coming from an operational ocean model. We use both approaches- if the task is to evaluate the risks due to potential accidents the approach with the seasonal mean values is applied and if the task is a prediction or backward trajectories- information from oceanic model (with a few different possible sources freely available online).The total current in the upper mixed layer is obtained as the vector sum of the wind driven current and the current due to termohaline circulation. The second component models the spread of the pollution. The second component of the model simulates the spread of the pollutant modeling the movement of the droplets taking into account the currents, the wind (important if we model an object such as container or carcass part of which is above the sea surface due to partial immersion), turbulence and buoyancy. The model also takes into account the processes of transformation of the pollutant- if it is an oil spill it contains a module containing parameterization of processes such as emulsification, evaporation, weathering, degradation etc. The model was used in the frame of the European projects ECOPORT8 (Galabov et al, 2012a) to evaluate the risks of oil pollution of the terminals of Bourgas Bay (see example on figure 6) and in the frame of TEN ECOPORT project expanded to other ports and improved (for more details Galabov et al, 2015a). The model was also used recently for rather unusual task. During the summer of 2015 more than 250 harbor porpoise dolphins (Phocoena Phocoena) stranded dead on various locations along the Bulgarian coast. Their locations and the time of stranding were recorded by many volunteers and reported online. A team of Romanian biologists examined the carcasses (with a special permission granted by the Ministry of Environment and Waters of Republic of Bulgaria) and estimated the period of drift of the dead bodies between the time of death and the stranding. Using this information we simulated the backward trajectories of all bodies for which the time of death may be reliably estimated. In order to set up MOTHY for such task we received important help from the author of the model Dr. Pierre Daniel from METEO FRANCE. Significant convergence of the trajectories was obtained in an area of the Black Sea in the Ukrainian exclusive economic zone close to the Romanian zone (Rusev et al, 2016).

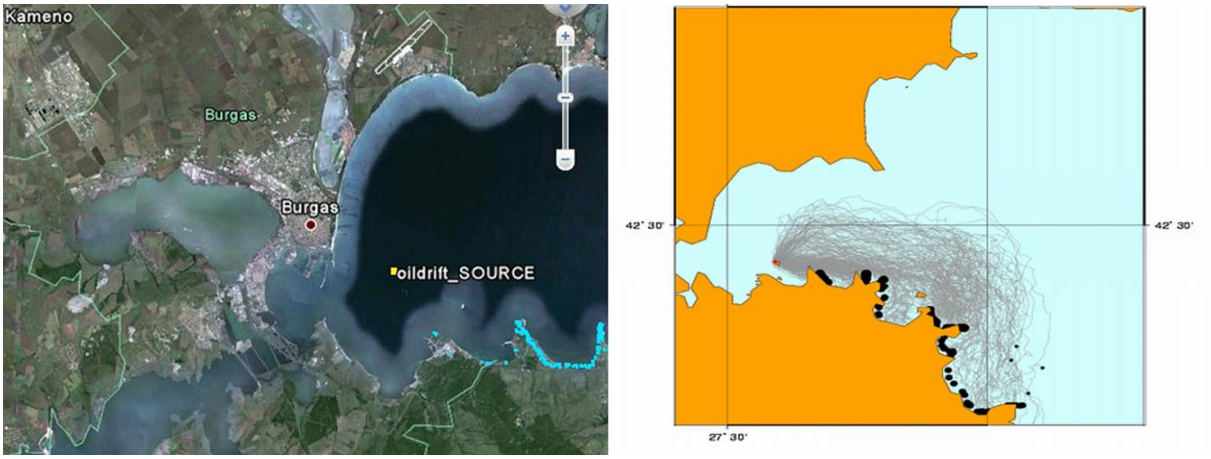


Figure 6. Left- Visualization of an oil pollution simulation based on the model MOTHY in the aquatory of the Bourgas port. Prevailing wind direction from SE. (blue points denote beached). Right- Visualization of the trajectories of oil droplets.

The study of the carcasses performed by the Romanian scientists excluded as possible reason of the dolphins death any actions of the navy (trainings etc.) or seismic surveys of the Black Sea performed by companies searching for oil and gas reserves. It was found that the reason for the death of these dolphins without any doubt is asphyxiation in the fishing net of young dolphins because of illegal turbot fishing. Recently (June 2016) the Romanian coast guard arrested a number of Turkish ships fishing illegally with gillnets (more than 45 km net was found in just one case) and dead dolphins were found on board. This confirmed our conclusions, because the locations were all these ships were arrested is very near the location that we determined (Figure 7).


Figure 7. The area of the death of more than 250 dolphins that stranded along the Bulgrarian coast during July and August 2015 obtained by use of MOTHY model

Let repeat the main conclusion of this study: the reason of the death of the dolphins during the summer of 2015 was definitely NOT geologic surveys or any NATO activity in the Black Sea (despite the pseudoscientific propaganda of some media sources and unfortunately even some scientists).

As a conclusion the model MOTHY that is a part of our system helps to solve some tasks related to technogenic disasters, ecological disasters and investigation of ecological crimes. This makes it important in the frame of the mission of NIMH- BAS to serve the society especially when it comes to security related tasks (which includes the ecological safety as well).

## Communication of the warnings to the general public and other users

In order to facilitate the provision of the results of the modeling system to the general public (especially in the coastal municipalities) we included the marine weather warnings into the METEOALARM system, which is a web based service to warn the European people of severe weather. METEOLARM uses color codes (green, yellow, orange and red) in order to make the communication of the level of danger easy and quick. Presently the coastal waters are divided into three sectors (the coasts of Varna, Dobrich and Bourgas provinces) and different color code depending on the magnitude of the dangerous events may be selected for each area (see http://weather.bg/0index.php?koiFail=RM01opasni2&ci=9&nd=0&lng=1) and Figure 8. For the specialized users of our warnings more detailed warnings are prepared based on the information from the numerical models described in the article.


Figure 8. Example forecast of the dangerous weather events in the METEOALARM system. The case is without dangerous coastal events (green color coding).

## Conclusions

The Marine Forecasts division of NIMH-BAS implemented an operational forecasting system for the Black Sea, which is constantly improved. Because of the reliability of the system in operational mode and the achieved fault tolerance, it is also a fully functional early warning system for the hydrometeorological hazards in the Western Black Sea. NIMH-BAS is the only organization in Republic of Bulgaria providing operational marine forecasts for the Black Sea, follow the standards and regulations of the World Meteorological Organization (WMO), serving in various ways the society and the public authorities.

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# M & S SUPPORT TO DISASTER MANAGEMENT AND HUMANITARIAN LOGISTICS IN INTERAGENCY INTERACTION: CHALLENGES AND OPPORTUNITIES

***LTC Walter David***

*The number and impact of man-made and natural disasters are increasing, threatening citizens' lives and the resilience of the society. Disaster management and humanitarian logistics are extremely complex interagency processes, involving civilian and military organizations who have to work together to prepare and respond. This paper addresses the challenges in interagency interaction and the opportunities offered by modelling and simulation (M&S). While NATO and national military routinely use simulation in training, exercises and support to operations, the M&S in civilian organizations is still limited due to availability of time, budget, skills, and manpower. However there is a new interest from both emergency agencies and industry for emergency simulations. Realistic M&S with logistic functionalities and the sharing of information, best practices and lessons learned between civilian and military can enable better training and preparation of operations of emergency staff and first responders.*

*Keywords*: disaster, climate change, disaster management, humanitarian logistics, training, planning, modelling and simulation (M&S), Information sharing, lessons learned, architectural framework

## Introduction

The number and impact of man-made and natural disasters are increasing, largely due to global terroristic attacks, conflicts and climate change implications, threatening properties, citizens' lives and even the resilience of the international community. Key threats including health risks, asymmetric and hybrid warfare, terrorism, water and food scarcity, urbanization, mass migration are shaping the new security environment and have the potential to significantly affect NATO and coalition planning and operations.

The impact of a disaster can be so great that the governmental agencies may be overwhelmed and the assistance operations may be ineffective. The ability to deal with the threats and devastating consequences after 9/11, the London bombings in 2005, recent Paris and Istanbul terrorist attacks and the growing impact of climate change on food security, mass migration, and coastal megacities, raise the question of the

promptness of civil authorities and the international community to deal effectively with the major disasters (Kapucu, 2010).

Efficiency of humanitarian relief in response to natural disasters (such as earthquakes, tsunamis, hurricanes, tornadoes, cloud bursts, floods, landslides, droughts and famines), man-made and technological disasters (such as terrorist attacks, mass migration, and chemical accidents, large-scale explosions) or complex emergencies with different simultaneous disasters is largely dependent on humanitarian logistics and the capacity of trained emergency operations centres's staff and first responders to work as a team (Kapucu, 2010).

## Disasters

### Man-made disasters

The analysis shows an exponential growth in disaster frequency, largely due to an increase in traditional hazards such as fires and explosions (Coleman, 2006). The category of man-made disasters includes a wide range of disasters, which have a big impact on citizens and local communities. The national governments face increasing challenges due to the variety of emergency situations that require effective response. The possibility of new threats and devastating consequences after the 9/11 terrorist attacks and the experience of 2005 London bombings raise the question about the readiness to effectively deal with large disasters and mass casualties (Kapucu, 2010). The destruction of a dam is another event that can generate losses and carry disastrous consequences. It can create longer-term economic difficulties compared with those of cyber-attack, bioterrorism and chemical terrorism (Doro-on and Miller, 2015). Despite most engineers and security experts do not believe that terrorists could possibly destroy dams constructed with strong reinforcement, we should not underestimate our enemies (Howe and Mitchell, 2013).

### Natural disasters

Over the past decade, the world has witnessed many disasters. There is strong evidence that natural disasters are increasing in frequency and impact. These can occur with little or no warning. The most common natural disaster is flooding, followed by earthquake/tsunami and then the drought/food insecurity (IFRC, 2009). Recently, due to the increased number of disasters, emergency relief operations have received more attention (Sangiamkul and van Hillegersberg, 2011).

### The impact of climate change

In the near future the effects of the climate change are likely to become significantly negative, with large-scale extreme events expected by the end of the century. Climate change is likely to influence the frequency, intensity, duration and geographic distribution

of the extreme events, threatening key natural resources and basic needs such as food, water, health, and shelter due to the increased temperatures, sea level rise, changes in precipitation. Conflicts, mass migrations, health impacts, or environmental stresses could raise national security issues (NRC, 2010), (USGCRP , 2009). The biggest challenges are the threats to food security and to regional and national security as a result of tensions, conflicts and mass migration. Most of the countries are not ready to deal adequately with the variability of climate but some nations will experience more negative effects than others. Food inequalities will increase, as the degree of climate change will be different from one region to another and between rural and urban areas, Communities who are already vulnerable to the effects of extreme weather will become vulnerable in the future and less resilient to new climate shocks. Extreme weather events are likely to become frequent in the future and will increase risks and uncertainties within the global food system (Wheeler and von Braun, 2013). Climate change can affect the migration of people within and between countries. Different reasons, such as ethnic conflicts or scarcity of resources, and extreme events such as floods, droughts and hurricanes can oblige people to migrate to other regions or states. Extreme events move many people, especially those living in areas where there are no resources to recover and rebuild after disasters. Coastal settlements are particularly vulnerable to the effects of climate change such as rising sea levels and extreme storms. When the coastal habitats are destroyed, human settlements may become more vulnerable to flooding from storm surges. Both developing and developed countries are vulnerable to the impacts of sea level rising. The Netherlands, Guyana and Bangladesh and many small island nations are particularly at risk.

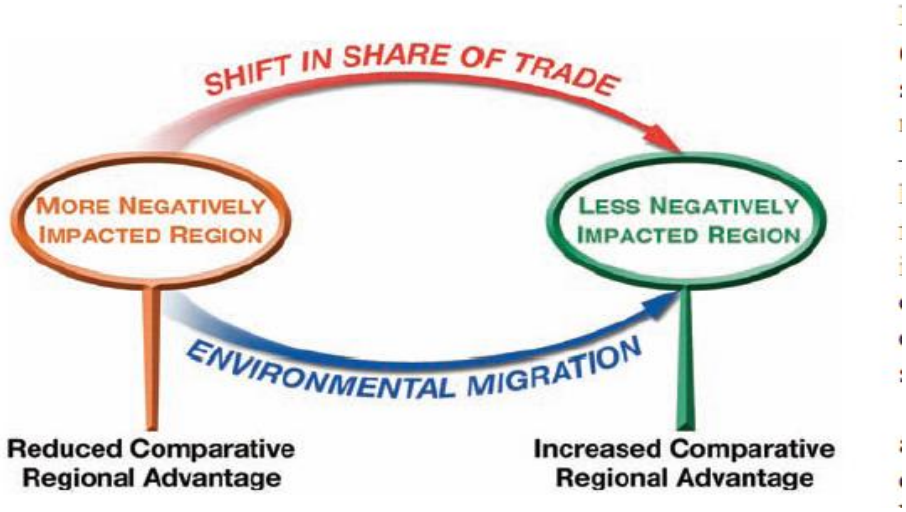


Figure 1 General effects of climate change on international trade: greater net benefits from climate change are likely to show trade benefits, along with environmental in-migration. *(Source: IPCC, 2007)*.

Megacities. For the first time in history, since 2008 more people live in cities than in rural areas. 15 of the world's 20 mega-cities (cities with populations over 10 million) are

susceptible to rising sea levels and increased coastal storm surges. A study by the Asian Development Bank, the World Bank, and the Japan International Cooperation Agency examined the effects of climate change on Asia's megacities. In Manila, for example, a big flood could result in the loss of nearly a quarter of gross domestic product (GDP) of the metropolitan area. The study concluded that these climate-related risks must be an integral part of urban and regional planning for sensitive megacities.

## Disaster management and humanitarian logistics

Disaster management and humanitarian logistics are extremely complex interagency processes, involving many civilian and military actors and decision-makers who have to work together in order to prepare and respond by performing difficult tasks in a wide variety of scenarios.

### Disaster management

An emergency is an event that can be answered at local level using the available resources without need to require external assistance. A disaster is characterized by impacts that exceed the capabilities of local responders and place demands on resources that are not available at the local level. Therefore an event is declared as a "disaster" when there is the need for outside assistance to cope with its consequences. A national government declares a state of emergency or national disaster as a way to require international humanitarian assistance and support of the international community to cope with the consequences of the disaster (UN-SPIDER, 2015).

Disaster management is commonly described in terms of four phases: mitigation, preparedness, response, and recovery. In the Disaster Management Cycle (figure) several emergency agencies and organizations have to collaborate to mitigate, prepare, respond, and recover from heterogeneous and dynamic sets of hazards. The decision making processes are extremely difficult, due to the presence of multiple actors (decision-makers) which are involved, and the complexity of the tasks that they have to address. In particular, the first phase, response, is a complex process that involves severe time pressure, high uncertainty, many actors and stakeholders (Vitoriano et al, 2013). Many nations established policies to ensure timely and coordinated response and recovery efforts. In most cases the nations established a National Emergency Commission or Management Agency or an Emergency Operations Centre (EOC), and a command line in order to coordinate efforts. An EOC gathers decision-makers from ministries, government

agencies, Non-Governmental Organisations (NGO) and companies form the public and private sectors. It facilitates the coordination of response in the affected regions (UN-SPIDER, 2015).

## Humanitarian logistics

Humanitarian (or emergency) logistics is a special type of logistics dealing with emergency or disaster events. The Humanitarian Logistics Conference, 2004 (Fritz Institute, 2004) defined humanitarian logistics as "all the process of planning, implementing and controlling the efficient, cost-effective flow and storage of goods and materials as well as related information, from the point of origin to the point of consumption for the purpose of meeting the end beneficiary's requirements and alleviate the suffering of vulnerable people.

Humanitarian logistics can operates in contexts different from disaster management; for example the World Food Programme (WFP) and the World Health Organization (WHO) conduct humanitarian logistics operations that are not always a response to a specific disaster but it is in disaster management where the application of humanitarian logistics is more complex and where more differences with business logistics appear. In fact, the main difference between humanitarian and business logistics is that in the business world logistics usually deals with predetermined suppliers and relatively predictable demand while in emergency logistics is concerned with a large and changing set of suppliers and very low predictability of demand (Cassidy, 2003).

In humanitarian aid operations, logistics have always been an important factor and logistics efforts account for 80 percent of the total costs in disaster relief efforts (Trunick, 2005), logistics makes the difference between a successful and a failed operation, (Van Wassenhove, 2006).

"*Since disaster relief is about 80 % logistics it would follow then that the only way to achieve this is through slick, efficient and effective logistics operations and more precisely, supply chain management*" (Van Wassenhove (2006) p. 475) in (A. Cozzolino, 2012).

The business logistics has long exploited the power of the information management to achieve the '*5 rights*' (the right goods are available, in the right place, at the right time, in the right quantity and quality, at the right cost), but humanitarian logistics has additional challenges in identifying the demand whilst simultaneously supplying across a challenging and impacted physical environment (Tatham, 2014) According to (Howden, 2009), Humanitarian Logistics Information System (HLIS) must be able to operate across the entire disaster management cycle. They must be scalable to manage the large number of suppliers during the response phase, as well as the high diversity of supplies across the recovery and mitigation phases and manage the flow of information from the preparation phase to the response phase.

## Interagency interaction

While humanitarian assistance (HA) is primarily a mission for the affected nation and its governmental organisations including the national military and the responsibility of the UN (in geographic areas outside Europe, North America, Australia, Russia) the presence of NATO forces conducting military operations in a host nation may result in the Alliance having to provide rapid response to civil requirements. In that case, the military assets will be given finite tasks, within means and capabilities, through the military chain of command, and according to the operational plan (OPLAN) approved by the North Atlantic Council (NAC). However even in the case of a disaster relief operation (DRO) or other civil emergency, not connected to any NATO military operation, military capabilities may be deployed in support of the civil authority overseeing the emergency. In such a case, NATO policy of Military support for International DRO is outlined in MC 343, which describes the use of "Military and Civil Defense Assets" (MCDA). The NAC will have to authorise the use of collective Allied military resources for such civil activities. All response efforts on behalf of the United Nations (UN) are coordinated by the Office for the Coordination of Humanitarian Affairs (OCHA). At the request of the affected nation, OCHA may dispatch a United Nations Disaster Assessment and Coordination team (UNDAC) to provide technical services, principally in on-site coordination and information dissemination and may activate its structure of clusters to deliver a coordinated humanitarian assistance (HA) (UN-SPIDER, 2015). Humanitarian and military logistics clearly looks very close or even overlapping and in a complex emergency the two communities will meet. Therefore, achieving an improved mutual understanding of the motivations and approaches that are employed in advance of a disaster event is very important and can help reduce the challenges when both are engaged in responding to a crisis. Therefore both communities have to engage and develop ways of working together (Tatham, 2014).


Figure 3: The UN Clusters

As coalition partners move to NATO Federated Mission /Networking FMN and US Mission Partner Environment (MPE) Coalition and Joint Forces commanders must ensure that these framework support and enable the planning and execution required for the timely establishment of effective information sharing, cooperation, coordination and collaboration with civilian entities, including support to onsite disaster.

Gaps have been identified by MCDC FMCM in the Information exchange requirements/standard for support of the Civil - Military operations. The desired end state is one with military forces who plan and train to effectively perform in an unclassified environment with civilian entities. Military will be able to execute crisis action planning to include Civil-military information exchange.

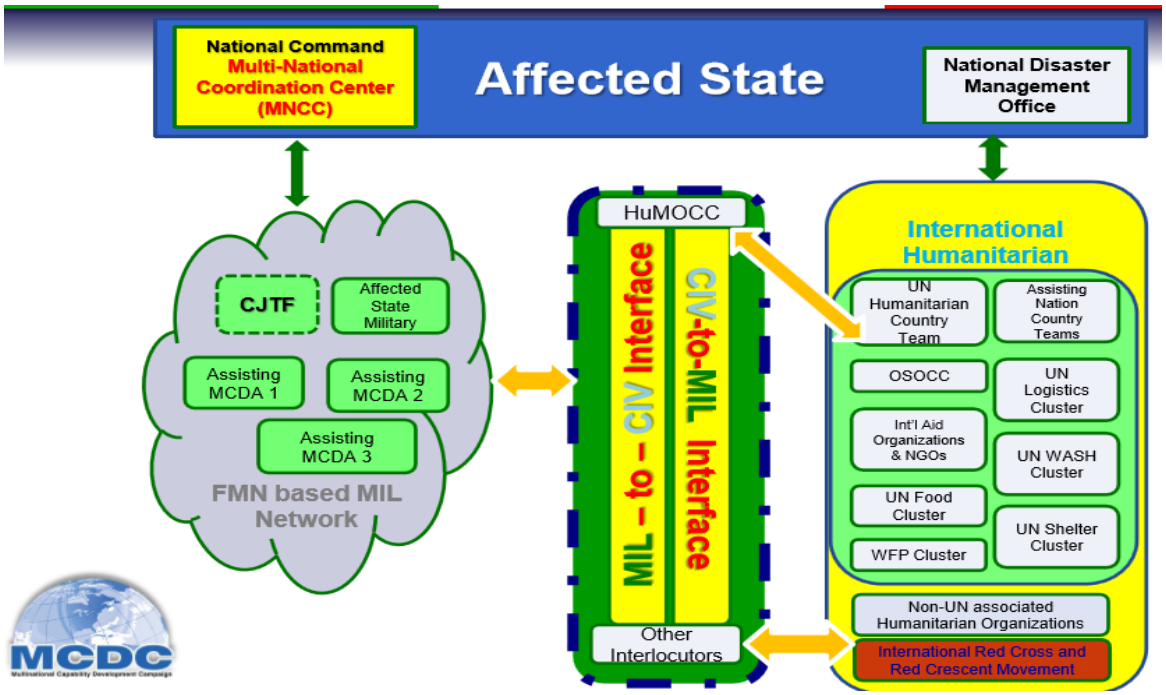


Figure 4. FMN CM Operational view (*Source: MCDC Multinational Concept Development Campaing -Stato Maggiore Difesa III Reparto - Centro Innovazione della Difesa* )

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## Modeling and Simulation (M&S) Support

### Military simulation

Almost every soldier in NATO nations has used or experienced Modelling and Simulation (M&S) applications, during training and exercises, in procurement projects or analysis at the strategic, operational, or tactical level and NATO and nations established training centres supported by M&S, as for example the Joint Warfare Centre (JWC) in Stavanger, Norway (Cayirci, 2006). In fact the NATO Modeling and Simulation vision is to exploit M&S

to its full potential to enhance both operational and cost effectiveness. This vision leads to a cooperative effort guided by the following principles:

- **Synergy,** to capitalise on, leverage, and share the existing NATO and national M&S to enable more effective and affordable capabilities.
- **Interoperability:** direct the development of common M&S standards and services for simulation interoperability and interoperability between command and control (C2) and simulation systems.
- **Reuse**: to increase the visibility, accessibility, and awareness of M&S to foster sharing and ensure its best exploitation across all NATO M&S application areas.
- **Affordability**: employ and develop readily available, flexible and cost-effective M&S to improve NATO effectiveness to address the changing nature and increased complexity of the Alliance strategic environment.

The military M&S application areas include the Support to Operations, Capability Development, Mission Rehearsal, Training and Education, and Procurement.

The new security environment is increasingly complex and rapidly evolving. New threats originate from weak states, asymmetric conflicts, cyber-attacks, energy and climate challenges, natural and man-made disasters. In a Comprehensive Approach (CA), civilian and military crisis management activities need to be coordinated (Gabellone, 2011, p 28). Therefore the increasing importance of international cooperation demands a new approach to employing and developing military M&S applications that have traditionally concentrated on the kinetic effects of conflicts must now also focus on new aspects such as multiple futures, human behavior modeling, asymmetric threats, hybrid warfare, information superiority, and high readiness forces.

NATO and national military have routinely used simulation for many years, in training, exercises and support to operations. NATO has categorized simulations into: *live, virtual* and *constructive*. (See Table)

A live simulation involves real people operating real systems, a virtual simulation involves real people operating simulated systems, a constructive simulation involves simulated people operating simulated systems. Real people stimulate (make inputs) to such simulations, but are not involved in determining the outcomes. Constructive simulations offer the ability to analyse concepts, predict possible outcomes, and stress large organisations. (See Table)

| Category | People | Systems |
|---|---|---|
| Live | Real | Real |
| Virtual | Real | Simulated |
| Constructive | Simulated | Simulated |

For several years, military applications have been a leading factor of the development in the M&S community. The NATO M&S Centre of Excellence (M&S COE) is dedicated to the promotion of M&S in support of operational requirements, training and interoperability.

The Centre acts as a catalyst for transformation through the involvement of NATO, governments, academia, industry, operational and training entities, by improving the networking of NATO and nationally owned M&S systems, the cooperation between nations and organisations through the sharing of M&S information and developments and serving as an international source of expertise for transformation in the related domain. In September 2015, the M&S COE hosted the Allied Command Transformation (ACT) led NATO Urbanisation Study Experiment, a conceptual study on the potential impact of Urbanisation and provide insights on the impacts of Urbanisation on NATO operations. With the aim of preparing NATO for the eventualities of urban and urban littoral operations. Its findings inform the NATO Defence Planning Process used by the Alliance to identify gaps in its defence capabilities to be ready to defend citizens against existing and emerging threats.

The basis of the Experiment was the Urbanisation world trend, identified in the Strategic Foresight Analysis, and three Urbanisation instability situations identified by the Framework for Future Alliance Operations: Disruptive impact of Mass Migration; Inner City Turmoil; and Large Scale Natural Disaster. A thick scenario on the 2035 city of 'Archaria' was created to provide a future operating environment. The 3D model of the future megacity, developed by the M&S COE, has been used for the visualization of Archaria urban characteristics. The event involved a cross-functional team from ACT and representatives from 18 NATO Nations, Allied Command Operations, other 16 Centres of Excellence, U.S. State Department, UK Foreign Office, The Netherlands Foreign Ministry, seven universities, International Organisations, Non-Government Organisations, the San Francisco Mayor's Office and National Research & Development Centres.

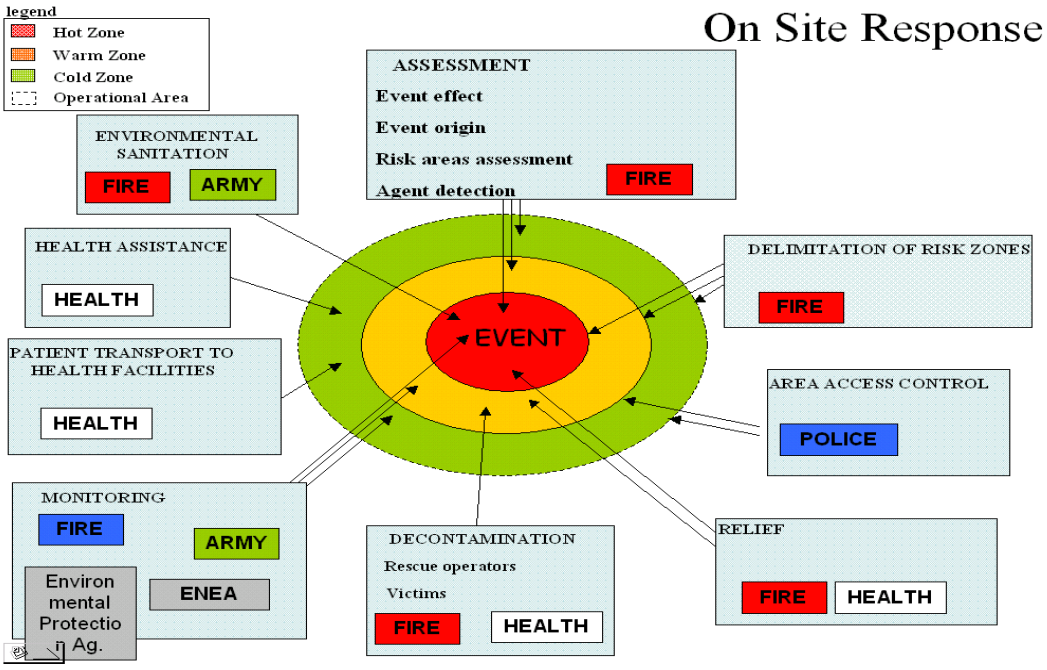
Figure 5. Urbanization Project (*Source: NATO M&S COE*)

## Capability gap in the use of M&S civilian agencies

There is a capability gap in the use of M&S in the civilian entities. Due to the constraints that many governmental agencies, NGOs and international organizations face in terms of limited budget, time, availability of skilled manpower, expertise. Efforts have been done to provide military simulation support to training and exercises involving emergency managers. For example, starting from 2002 the South-Eastern Europe Defence Ministerial (SEDM) has organised the SEESIM series of interagency exercises (David, 2007) with military, ministry of interiors including fire and police departments, civil protection departments of several countries of South East Europe.

SEESIM aimed at promoting cooperation, coordination and interoperability among the SEDM nations and the SEDM initiatives, among the others, the South Eastern Europe Brigade (SEEBRIG), through effective use of computer modelling and simulation (M&S). However the participation in the planning of exercises from civil protection and ministry of interiors has usually been limited during the planning phase of the exercises with more attendees during the exercise execution.

Figure 6. Simulated on site response to attacks with “dirty bombs” at the central railway station in the city of Milan, Italy. (*Source: David, 2007*)




According to Szayna et al. (2009) in ‘Integrating Civilian Agencies in Stability Operations’, while civilian agencies and organizations clearly have many of the capabilities required in Military Support for Stability, Security, Transition (SSTR) operations, they lack the capacity. Civilian agencies operate on the business model of a Police Department with a continuous full employment of resources, little slack in the system and focus on the steady

state whereas the military operates more on the business model of a Fire Department preparing for a contingency and with focus on contingency response.

## M&S for emergency

According to Pickl, (2012) in Future Role And Importance of Operations Research (OR) and Modeling and Simulation (PICKL, 2012, p 2357) Humanitarian Logistics and CIMIC are based on soft and hard Operations Research (OR) methods. M&S as part of OR together with information technology and high computational resources enables decision support in the initial phases by discovering critic areas that even analysis cannot always envision. Models and simulations for emergency are still young but with the focus on emergency response since the 9/11 destruction of the Twin Towers, a number of initiatives have been started with the aim of improving the security and the capability for response.

Sanjay Jain and Charles McLean (2003) in 'An integrating Framework for Modelling and Simulation for Emergency Response' provide a classification of the M&S tools for Emergency:

- Disaster Impact Modelling Tools;
- Emergency Response Planning Tools;
- Tools for Emergency Response Training;
- Tools for Identification and Detection.

However these tools need to be integrated together to reduce the time and effort for their use. Different challenges need to be addressed to reach a rapid integration and use of models. Interoperability between emergency response M&S applications is very limited; the cost of transferring data between different simulations is often very high, the model development process requires intensive work. Other challenges are also relevant: building models from "scratch" requires skilled staff and is time-consuming. Most of emergency agencies usually do not have the technical expertise or the time for building models. Model developers typically require considerable training and a diverse set of skills to be effective in their job.

## Decision Aid Models for humanitarians

In the last two decades the development of decision aid models and systems for humanitarian logistics has grown intensely but humanitarian logistics research remains highly fragmented. The most used systems have focused mainly on inventory control, due to the importance of inventory control and fleet management. Therefore these systems are mainly used in the phases of Preparedness and Response (Vitoriano et al. 2013 p. 33).

Many models combine several operations, while the scenario requires coordinated decisions to be taken. In general, these models are not incorporated into the Decision Support Systems (DSS) available to the humanitarian organizations (mostly focused on

the information management) and do not have optimization capability. It is necessary to shorten the gap between models developed by academics and the tools available to emergency staff in order to support the decision makers (Vitoriano et al. 2013 p. 39).

DMIS (Disaster Management Information Systems) is a web based tool developed by the International Federation of Red Cross (IFRC) allowing access to real time information on disaster trends, available resources and databases, in order to support an efficient disaster preparedness and response. It is accessible to Red Cross and Red Crescent staff, delegations and Geneva headquarters.

LOGISTIX was developed by Doctors without Borders as an inventory tool for medical needs. It focuses on medicines inventory and it is used in the organization's business. It is only accessible to Doctors without Borders.

## M&S Requirements to support training

In sudden-onset crises speed can mean lives saved however the operations theatre is often characterised by sparse and conflicting information and logistical, financial, and physical obstacles. In a disaster, the most effective responders are often those trained and capable to operate as a coherent team. UN World Food Programme (WFP) is the leader in the UN Clusters Logistics, Emergency Communications and Food Security. Its reputation as an effective agency has been built on many achievements, but above all on its ability to work as a team capable to mount a large-scale emergency response. Team work requires investment to get the team ready for the situations they will likely face therefore WFP expanded the use of exercises supported by simulation. Training events realistically simulate a disaster response, test plans, find gaps, familiarise teams with processes and information exchange, and with the tasks. Exercises are used as a tool to improve readiness: The keys to effective exercises are realism and a process to collect and exploit the lessons (Prior, 2010). A key component of the exercise methodology is the team building to let the team understand a common way of operating in crisis. All plans and teams need to be tested. "*This is major step forward for WFP's readiness and capacity to respond to emergencies,*" said WFP Asia Bureau Emergency Preparedness Advisor Tony Craig. "*We only have to look at the challenges we all faced in Haiti earlier this year to understand how important it is that WFP maintains our cutting edge capability in responding to disasters*".

## Examples of M&S for Emergency

DeMIST (Disaster Management Interoperability Simulation and Training) as reported by Marcus Prior, WFP, in his article Simulation software helps aid teams prepare for emergencies was designed by WFP/Philippines to prepare rapid response teams to respond quickly and cohesively to emergency situations. The tool simulates a wide range of emergencies, challenging team members with realistic situations. A small control team can manage an exercise from the initial concept through to the after action review. A

"storyline" can be build on an real contingency plan – to provide the training audience with information to which the team has to respond and draw up operational plans and situation reports (one of the challenges is the choice of which available information is actually relevant),

GRCM (Generic Response Capability Model) is a WFP corporate tool for comprehensive emergency strategic preparedness planning. It details a response scenario, outlining a realistic set of targets and then mapping out the capabilities required to meet the scenario parameters and targets. GRCM

- identifies the drivers and scenario features impacting WFP when facing a response;
- provides a platform for agreement on a realistic set of targets for WFP when facing a response; and
- defines WFP's response capabilities.

GRCM includes Requirements for Special Operations (aviation and logistics), as well as the WFP-lead three clusters – Logistics, Emergency Telecommunications and Food Security –and assesses capabilities six key elements of corporate response: Food Assistance, Support Services, IT Services, Staffing, Logistics Services and Funding Requirements Within the six areas, questions are answered with respect to what it means to be ready to respond. These include identifying and elaborating on the necessary and plausible response requirements using the scenario parameters.

CRISMA (Modelling Crisis Management for Improved Action and preparedness) provides a conceptual and technological framework to simulate complex emergencies and explore the potential effects of mitigation measures. CRISMA aims to improve preparedness and resilience by facilitating the manipulation and visualisation of complex crisis scenarios which usually produce multiple effects on communities. Complex emergencies cause extensive consequences and impacts and cannot be managed by local emergency agencies alone, therefore requiring interagency and even multinational cooperation and external humanitarian aid, CRISMA aims to support emergency managers and stakeholders in planning activities related to large-scale crises. with applications that help them:

- to model and simulate realistic crisis scenarios and consequences;
- to simulate, compare and evaluate the outcomes from possible alternative courses of action;
- to make strategic decisions, to optimise deployment of resources;
- to prepare better action plans for the preparedness and response.

One of the main achievements of the CRISMA project is a common methodology for decision support, which is applicable to all these applications and beyond and the integration of various models, the specifications and reference implementations of the software framework, and the "development practices. From the end users' perspective

(public and private crisis managers and other stakeholders), CRISMA provides a set of applications that can be used for multi organisational:

- short-term strategic planning and resource management;
- long-term infrastructure planning to support stakeholders by helping to visualise the impacts of their decisions and enabling the comparison of various options;
- training and cooperation of decision makers in a more flexible way (Heikkilä A et al., 2015).

## Examples of available simulations for emergency and disaster

An increasing number of manufactures are proposing specific tools, often derived from the military applications. Manufacturers with long presence in the military simulation have designed new constructive simulation tools to fill the gap in the emergency market, with products like JTLS, GESI-EM and MASA Sword.

JTLS (Joint Theater Level Simulation) is an interactive, internet-enabled constructive simulation that models multi-sided air, ground and naval civil-military operations with logistics, Special Operation Force (SOF), and intelligence. JTLS has been used for many years in NATO JWC and national military training centres as a training support model. The primary focus of the system is conventional joint and combined operations at the operational level. The simulation supports limited nuclear and chemical effects, low-intensity conflict, pre-conflict operations, as well as Humanitarian Assistance and Disaster Relief (HA/DR) operations including the response to chemical or nuclear contamination, wildfires, floods, earthquakes, hurricanes, and disease outbreaks. It can simulate the damage caused by a natural disaster, the movement of civil/military assets, the movement, distribution, and consumption of supplies by civil/military and civilian units. JTLS has been used to train leadership to more effectively deal with HA/DR events at the regional and national levels and to produce contingency plan analysis focused on strategy, decision-making, policy/resource issues and lines of authority that require participation of senior-level leadership.

Training may be designed to address single or multiple disaster scenarios with a variety of disaster relief and recovery operations. For example, major area flooding that results from a dam breach, or a hurricane affecting a coastal environment, can be simulated to represent weather conditions, geographical areas, terrain characteristics, weather disruption to aviation schedules, crop or fire damage, earthquakes, landslides, and major facility or power grid failures, therefore relief efforts using various tactics, techniques and procedures can be attempted and assessed. Personnel, land vehicles, watercraft, and aircraft can be used for rescue or assistance; medical support for and evacuation of civilians can be evaluated; logistics issues such as supplies, stock levels, and availability of food and medicine may be represented; civilian and military forces can be deployed.

Exercises provide a better understanding of how to plan for these types of disasters and how to use the available resources. JTLS can help to analyze and develop appropriate contingency plans and courses of action. JTLS Version 5.0 is a major improvement release and replaces the traditional hexagon-based terrain with a multi-level world-wide grid terrain system and an unclassified world-wide database repository from where the users can select data for their own scenario.

Flooding scenario includes the evacuation by railway, busses, helicopters, amphibious vehicles, police patrols, chemical contamination caused by derailed cargo tank.

Big Scale Forest Fire includes people evacuation by busses, animals evacuation by trucks, police patrols fire suppression using water of Fire Service trucks, delivery of water from a lake, transport of victims to hospitals, diseases (skin burns, carbon monoxide poisoning, etc.)

Catastrophes at Railroad Crossing includes contamination of ammonia, people evacuation by busses, police patrols, by-pass of place of accident, transport of victims to hospitals, disease.

MASA Sword is Artificial Intelligence (AI)-based Modelling & Simulation (M&S) software built for the defence, emergency preparedness, serious games and game development markets, it is an automated, aggregated, constructive simulation designed to improve training, analysis, and decision support for both military commanders and crisis managers in the emergency preparedness. It offers users highly realistic scenarios as well as an open simulation platform interoperable with other simulations and Command & Control (C2) systems. It can be deployed via distant servers in the cloud. Sword was used by WFP, the United Nations Development Program (UNDP), the National Institute for Civil Defence in Peru (INDECI) and the Peruvian Red Cross, in an exercise which took place in October 2012 in the Trujillo Province with the objective to improve the operational capacities of the local authorities in case of an earthquake and/or a tsunami. The improved cooperation between the public and the private sectors allowed a more efficient distribution of humanitarian aid and food relief to the populations in the affected littoral areas. Short workshops took place in several cities of the area during which. Scenarios corresponding to one-day crises were played on laptops in accelerated mode. The outcome was an important improvement in coordination between the public and private actors of food relief distribution chain.

GESI-EM (Emergency Management) simulates comprehensive emergency situations, providing an environment to efficiently and realistically prepare plans and train emergency managers and staff. Decision makers can be trained to anticipate the consequences of disasters and to use their resources effectively to respond to different threats. The best measures to be prepared for crisis situations are emergency plans that answer the question “what if” and are supported by a team of well-trained crisis and emergency

managers. The essential factors of an event such as security and rescue forces, affected civilians, the terrain, weather conditions, and other entities are mapped as simulation elements. The user can change their parameters during the exercise, Civil and military forces can be displayed down to the single unit and logistics (fuel consumption, supply, repair and medical care, etc.) are influenced by the response capability of the emergency forces. The tool simulates the orders of the disaster managers. They can see the impact produced by their decisions, thus allowing to adjust plans. The system offers a spectrum of threat scenarios to plan, test, and train strategies in a wide variety of threats and disaster scenarios involving police, fire services, rescue services, technical assistance services, and military for very complex scenarios which require close cooperation of national and international organizations such as in natural disasters (earthquakes, hurricanes, wildfires, flooding) and man-made disasters, (accidents in chemical plants, train or plane crashes), acts of terror ( poison gas attacks or bomb attacks). CAE's GESI-EM simulation system interfaces to C2I systems, other simulations, and gaming environments, including Bohemia Interactive VBS2.

## CDEM architectural framework model

A Crisis Disaster Emergency Management (CDEM) architectural framework model integrating different Costructive, Live, Virtual simulations (L, V, C) could be implemented in a federation by using DIS, HLA standards or web services via direct connection trough the systems API's in a Service Oriented Architecture (SOA). The architectural framework model could be developed with the use of a management scenario in a large city or even a megacities. The concept development includes the use of LVC simulators such as the constructive ONE SAF, VBS 3 and the CDEM IA models like Urban and Crowd Ambience. Live simulation should provide real-time sync and more realism to the simulation scenario. The training audience (disaster managers, military commanders and other decision makers) could be trained remotely in a Virtual Emergency Operations Centre (EOC).

In fact, the Architecture model supports applications for emergency management simulation.in a comprehensive innovative framework implementing Virtual Command and Control capabilities to support an agile Emergency Management approach. Remote users participate within a common synthetic environment where the situational awareness is updated in near-real time, using existing intelligence sources supplemented by an additional layer of crowdsourced information and social media feeds (for example twitter), while addressing security, bandwidth and network reliability issues during the disaster..

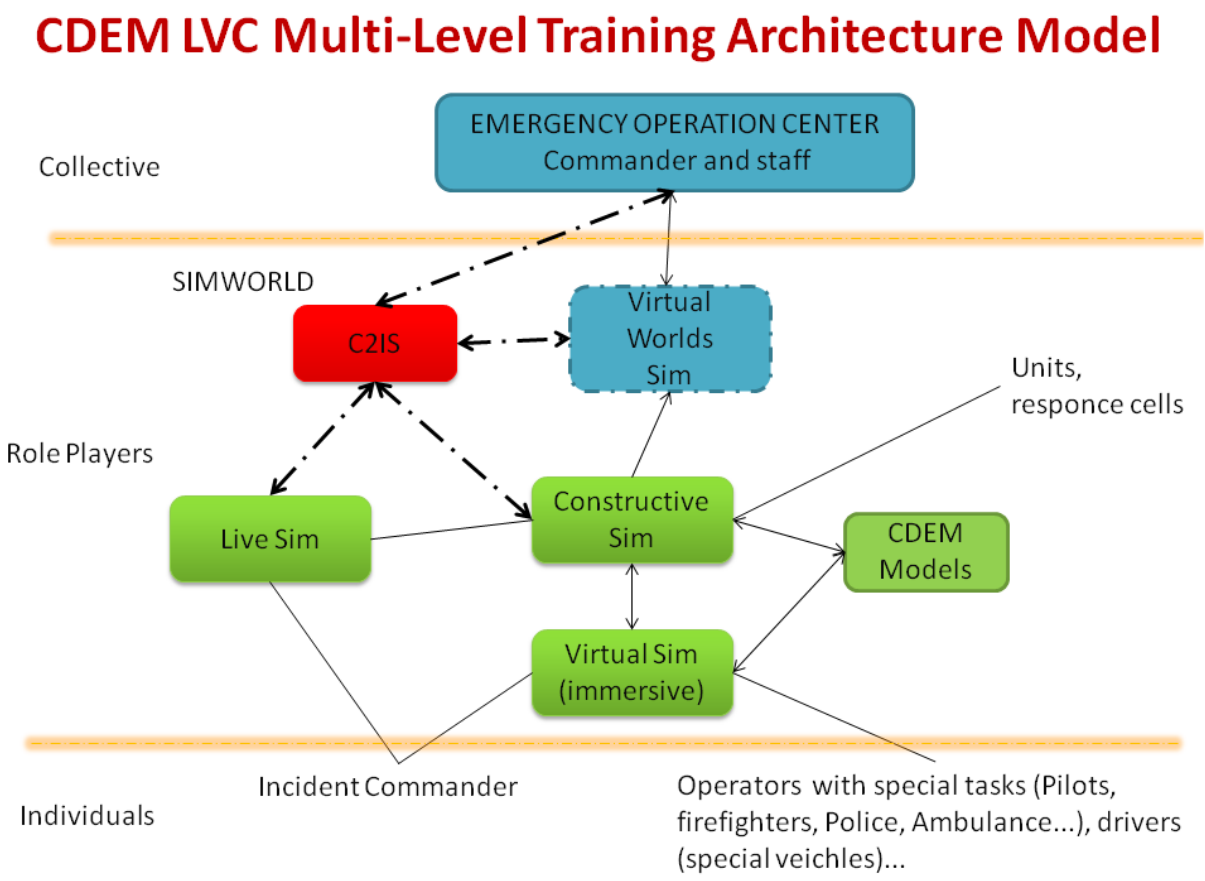



Figure 7. CDEM LVC Architectural Framework Model
(*Source: Biagini M. Architectural Framework Models for Immersive Virtual Simulation Applications to Support Individual and Collective Training in Defence and Emergency Management domains*)

## Conclusions

Realistic modelling and simulation with accurate humanitarian logistics functionalities and the sharing of information, best practices and lessons learned between civilian and military are proposed to enable effective interagency interaction for training of emergency operations centres' staff and first responders and in preparation of operations (for planning and mission rehearsal).

A comprehensive approach should: support the development of M&S capabilities for emergency organisations by allowing them to access a collaborative environment for sharing of information, best practices and lessons learned on the use of M&S applications for emergency. The model of the NATO M&S Lessons Learned Community of interest (M&S COI) on the unclassified portal of NATO Joint Analysis and Lessons Learned

Centre (JALLC). This community is administered by NATO M&S COE and accessible to International Organizations and NGOs who have a memorandum of understanding with JALLC.

Federated Mission Networking (FMN) Civil–Military (FMCM) project end state should provide standardized information exchange and information sharing procedures and allow military forces to train in an unclassified environment on realistic disaster scenarios and establish common ways of working together in advance prior of the occurrence of the disaster events.

The potential of M&S as a service (MSaaS) on cloud architectures from military to emergency domains could be exploited in a new and challenging business model to provide M&S capabilities and training to those agencies or organizations that do not have the resources, skills and manpower to develop and run their own or to buy commercial M&S tools. This concept is going to be investigated by the M&S COE to evolve the Urbanization Project applying a CDEM Architectural Framework Model under the MSaaS paradigm.

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# THE CMDR COE OVERVIEW FOR MIGRANTS INFLUX IN EU 2015

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*The CMDR COE Overview for Migrants Influx in EU 2015 presents a survey of political and social implications for Europe in result of mass migration from Africa and Middle East, along with some theoretical opinions, in order to support NATO expertise. The displacement of tens of thousands humans in the aftermath of war conflicts and ideological violence requires well-founded knowledge and continuous surveillance by the Alliance as it will likely have more heterogeneous impacts on the security environment in the years ahead. Some public voices are describing the 2015 migration influx –and particularly the unauthorized border-crossing – as a "security threat" and are turning to military to deter or manage the human flows, a trend that is likely to grow.*

*This paper contains both quantitative data and public-related information on the migration within and to Europe. It wrap-ups three discourse patterns – (1) a chronicle retrospective, (2) theoretical aspects of the phenomenon and (3) some causative assumptions.*

*The survey lays (or manage to trace) some thoughts for further analysis concerning Pan-European challenges and actions. As the EU States' position on the issue of mass migration is being transformed, new questions have arisen about the policies on migration and immigration. It envisages key risks in handling the impact of these challenges as capsulations into social subgroups lead by misunderstandings, mistrust and even hostility. Marginalization of the communities both European and Non-European is pointed as a problem arisen by their differences of expectations. Another problematic issue is set by the lack of reliable all-European tracking control for people who already are sheltered.*

## Background

The 'refugee crisis in Europe 2015' has been described as the worst of its kind since World War II, at the end of which there were more than 40 million refugees in the continent. Then crisis led to the creation of international laws and organizations that would become the foundation of the world's refugee response today.

In 1943, the U.N. established a branch to provide humanitarian aid to refugees liberated by Allied forces. It was soon replaced by the International Refugee Organization, which became the U.N. High Commissioner for Refugees in 1950.

After the war, hundreds of thousands of Jews who survived the Holocaust were living in displaced-persons centers in Allied-occupied parts of Germany, Austria and Italy. They were transported to France, Belgium, and Greece.

In Eastern Europe, Germans either fled or were expelled from their homes as Yugoslavia removed nearly 500,000 Germans from its territory, Romania reduced its pre-war population of 780,000 by more than half and Czechoslovakia expelled 2.2. million Germans. At its peak, in July 1946, more than 15,000 people a day were being dumped over the frontier in Germany. By 1950, 11.5 million Germans had left Eastern Europe.

Polish communities were also forced out. The Soviet Union expelled almost 2 million Poles, 500,000 Ukrainians and others from parts of the country it had annexed. Meanwhile, the Allied nations returned more than 2 million Soviet citizens to areas under Soviet control in exchange for citizens of Western countries.

According to UN reports in 2014 approximately 219,000 refugees crossed the Mediterranean into Europe. The total number increased in 2015 to 300,000 people made that risk journey, many of them from fleeing Syria and Libya to escape civil wars.

In June 2015, the U.N. reported that the global number of refugees worldwide, people seeking asylum, and people displaced within their own countries had exceeded 50 million people. The distinction becomes important because the world is witnessing the worst refugee for the first time since the post-WWII era.

Here's how the U.N. High Commissioner for Refugees defines refugees:

*Refugees are persons fleeing armed conflict or persecution. … Their situation is often so perilous and intolerable that they cross national borders to seek safety in nearby countries, and thus become internationally recognized as "refugees" with access to assistance from States, UNHCR, and other organizations. They are so recognized precisely because it is too dangerous for them to return home, and they need sanctuary elsewhere. These are people for whom denial of asylum has potentially deadly consequences.*

Migrants, on the other hand, the agency says, "*choose to move not because of a direct threat of persecution or death, but mainly to improve their lives by finding work, or in some cases for education, family reunion, or other reasons.*"

Unlike refugees who cannot safely return home, migrants face no such impediment to return. If they choose to return home, they will continue to receive the protection of their government. Countries grant refugees certain protections under their international treaty obligations. This is why some states are reluctant to grant those people who are fleeing unrest in their home countries refugee status. Conflating refugees and migrants can have serious consequences for the lives and safety of refugees. Blurring the two terms takes attention away from the specific legal protections refugees require. It can undermine public support for refugees and the institution of asylum at a time when more refugees need such protection than ever before.

## Domino Effect/Trigger the Wave

In January 2011, the term “Arab Spring” was invented by the political journal Foreign Policy. It tended to sound like a PR phrase, encouraging people in Europe and North America to expect that this would be an essentially peaceable series of uprisings by people against longstanding corrupt elites. It suggested that the old systems would simply collapse in the face of the popular will.

Started in 2011, only days after the Tunisian street vendor Tarek al-Tayeb Mohamed Bouazizi burned himself to death, goaded beyond endurance by petty tyranny in the town of Sidi Bouzid, the Tunisian government started to collapse. Within a month the president Zine al-Abidine Ben Ali escaped to Saudi Arabia after 23 years of autocratic power.

Soon the regimes in Algeria, Jordan and Oman had announced reforms or even changes of government. Ali Abdullah Saleh was chased out of power in Yemen. Demonstrations in Tahrir Square in Cairo encouraged the feeling that something akin to the fall of the Berlin Wall might happen in Egypt and the president Mubarak was overthrown quickly.

*Yet after that the hope for an Arab version of Europe`89 faded.*

People from Tunisia to Yemen were united in a desire for greater freedom but unlike Europe in 1989, there was no single outmoded political orthodoxy to be overthrown. As an example, in Egypt the Muslim Brotherhood was elected to fill the power vacuum, disrupting the delicate balance between Islamic faith and the principles of a secular state. Besides the police and army, institutions which remained supporters of Mubarak have protected the secularism stronger than ever. Eventually they staged a coup against the Muslim Brotherhood, and brought Egypt back to heel. The bitter divide remains.

The upheavals in North Africa and Middle East brought cross-road principles into play: the belief that secularism had to be defended on one hand, and the desire for a more fundamental implementation of religion (Islam) on the other.

The result has been great bitterness and violence.

Libya has been ruined by the continuing chaos which followed the revolution against Gadaffi. Egypt is back in a condition of stasis; Lebanon has held together, Algeria and Tunisia have settled down. The political system in Jordan has been under threat, but it is still surviving.

In Syria and Iraq it has brought about the rise of Islamic State, (IS), the most aggressive and violent political and religious movement of modern times. At first, its extraordinary brutality seemed to work, as IS murdered its opponents in cold blood and rejoiced in it. Quickly, though, it became clear that there was no point in surrendering to IS. Since then, its enemies have fought with far greater determination.

More than 11 million people have been forced from their homes as forces loyal to Syrian president Bashar al-Assad and those opposed to his rule battle each other - as well as jihadist militants from Islamic State.

The anti-government protests erupted in March 2011 in the southern city of Deraa after the arrest and torture of some teenagers who painted revolutionary slogans on a school wall. After security forces opened fire on demonstrators, killing several, more took to the streets. The unrest triggered nationwide protests demanding President Assad's resignation. The government's use of force to crush the dissent merely hardened the protesters' resolve. By July 2011, hundreds of thousands were taking to the streets across the country. Opposition supporters eventually began to take up arms, first to defend themselves and later to expel security forces from their local areas.

Violence escalated and the country descended into civil war as rebel brigades were formed to battle government forces for control of cities, towns and the countryside. Fighting reached the capital Damascus and second city of Aleppo in 2012.

By June 2013, the UN said 90,000 people had been killed in the conflict. However, by August 2014 that figure had more than doubled to 191,000 - and continued to climb to 220,000 by March 2015, according to activists and the UN.

The conflict became more than just a battle between those for or against President Assad. It has acquired sectarian overtones, pitching the country's Sunni majority against the president's Shia Alawite sect, and drawn in neighbouring countries and world powers. The rise of the jihadist groups, including Islamic State, has added a further dimension.

One of the direct effects of the crisis in the region is the heavy influx of refugees to European countries. The vast number of asylum seekers has serious security implications for host countries ranging from economic difficulties to social tensions.

Almost 4 million people have fled Syria since the start of the conflict. It is one of the largest refugee exoduses in recent history. European countries have borne the brunt of the refugee crisis, along with Lebanon, Jordan and Turkey struggling to accommodate the flood of new arrivals. The exodus accelerated dramatically in 2013, as conditions in Syria deteriorated.

A further 7.6 million Syrians have been internally displaced within the country, bringing the total number forced to flee their homes to more than 11 million - half the country's pre-crisis population. Overall, an estimated 12.2 million are in need of humanitarian assistance inside Syria, including 5.6 million children, the UN says.

In December 2014, the UN launched an appeal for $8.4bn (£5.6bn) to provide help to 18 million Syrians, after only securing about half the funding it asked for in 2014.

A report published by the UN in March 2015 estimated the total economic loss since the start of the conflict was $202bn and that four in every five Syrians were now living in

poverty - 30% of them in abject poverty. Syria's education, health and social welfare systems are also in a state of collapse.

For the purpose of current paper we stress our focus on migrant tide following the conflicts in Middle East and North Africa.

## Chronicle In Brief

First, for the period 2012-2014 Turkey, Jordan, Lebanon and Egypt were the countries which have been most severely affected by the crisis. They have experienced serious difficulties in managing the refugees on their territory which was confirmed by the appeal for funding to UNHCR, international financial organisations and governments worldwide. The financial burden on these countries was the most evident effect of the crisis and it has further aggravated the situation in countries like Iraq which has been struggling to recover from the devastation of war. Moreover, the discontent of refugees with living conditions in refugee camps sometimes leads to riots and creates complex security challenges for local authorities. The frustration of local populations with the increasing number of Syrian refugees also poses a serious challenge for host countries' governments.

Due to the escalation of violence in the Syrian Arab Republic, the number of Syrian refugees in neighbouring countries has been increasing rapidly since the beginning of 2012. Based on the number of refugees who have registered or are pending registration, Syria's neighbours were hosting more than two million Syrian refugees, which is further aggravating the growing strains on these countries' infrastructures and economies.[1]

Lebanon has been the most seriously affected neighbouring country from the refugee crisis. The number of Syrian refugees in Lebanon in January 2012 was 6,290 and it has been growing rapidly to reach 129,106 in December 2012 and 832,005 as of 28 November 2013. According to government estimates, the total number of Syrians in the country was 1,000,000 up to end of 2014.[2]

The economic and social repercussions of having such a rapid increase of refugee inflow to Lebanon have been devastating and have created huge pressures on the local populations. The number of Syrians registered as refugees or pending registration was equal to more than 18 per cent of the country's population, with groups of refugees scattered across 1,400 localities. The impact was alarming, especially on the demographic structures in those regions, and has serious security implications. Health, education, and water and sanitation systems have all exceeded their capacities.

According to UNHCR data, the number of registered Syrian refuges in Turkey was 8,000 in December 2011. Their number quickly reached 144,755 by December 2012. The UNHCR data as of November 27, 2013 shows that the number of Syrian refugees in Turkey was already 527,307. According to government estimates, the total number of Syrians in the country was 700 000 in the middle of 2014. The Turkish government has

responded to the Syrian refugee influx with US$2 billion in support. Refugees are spread across 21 camps where they receive shelter, health care, security and other services. Almost a quarter of a million Syrians are documented living outside of camps in urban locations, with much more pending registration.

In Jordan, the number of Syrian refugees in January 2012 was 2,749 and reached 117,321 by the end of December 2012. The UNHCR data as of 28 November 2013 sets the number at 560,059.[3] The Syrian refugee influx has swollen the population size by 11 per cent, with 140,000 in camps. This increase has constituted an enormous pressure on Jordanian resources, services and infrastructure and it must be kept in mind that a sudden increase in a population by 11 per cent constitutes a serious security threat for any country. The cost of hosting refugees in 2013-2014 solely in relation to electricity, water, education, health, municipalities, subsidised goods, and protection and reception reached $2.016 billion.[4]

In Egypt, the number of Syrian refugees in June 2012 was 924 and reached 13,001 by the end of December 2012. The data as of 26 November 2013 sets the number at 128,158. According to NGOs estimates, the total number of Syrians in the country was 300,000 by the end of June`2014.[5]

At that time many organisations as UNHCR and Médecins Sans Frontières alarmed that by the end of 2014 more than half of the Syrian population will be in need of aid. This data included an anticipated 3.45 million Syrian refugees and 6.8 million Syrians inside the country, many of whom eventually would be displaced from their homes.

The inability of neighbouring countries to respond to the needs of the Syrian refugees led to a growing frustration and discontent among the refugee community. Sometimes it took violent forms as for example were the clashes in the Zaatari refugee camp in Jordan in October 2012. Dozens of Syrian refugees rioted over living conditions in the camp which led to clashes between the refugees and Jordanian security forces.[6]

The discontent however was not only on the side of refugees but also local populations show a growing frustration over the situation. A survey conducted by Jordan's leading research centre found large majorities of Jordanians in favour of closing the borders to Syrians altogether.[7]

The necessity to provide shelter, food and security to so many people puts enormous pressure on host countries' infrastructures and economies. However, the financial repercussions were only part of the problem. The social tensions in host countries were another serious concern for their governments and the international community since they might have serious security implications. However not only neighbouring countries in the Middle East region faced serious challenges due to the increasing number of Syrian refugees.

## Influx in European Union

The European Union is an economic and political union of 28 member states and it has a population of over 500 million. From the very beginning of the Syrian crisis, the EU states like Italy, Greece and Bulgaria also struggled to alleviate the tensions that stem out of the influx of migrants. Although the impact on EU member states initially have not been as severe as on Syria neighbouring countries, it should be noted that the capacity of countries to respond varies depending on preparedness and financial resources.

The increased numbers of illegal immigrants from the Middle East and Africa crossing land frontier between Turkey and EU (Bulgaria and Greece), led the European Border Protection agency Frontex to upgrade border controls.

In 2013 Bulgaria built a fence along its border with Turkey to prevent migrants from crossing through its territory in order to reach other EU countries. The fence has been equipped with infrared cameras, motion sensors, wire and is monitored by the army. Additionally Bulgaria has deployed dozens of police officers, including at its borders with FYROM and Serbia.

The Bulgarian State Agency for Refugees (SAR) presented a data in the middle of December 2013; according to it the migrants in the country were 9,347 and many of them had requested a refugee status. The SAR's housing capacity was 4,060 but were accommodated 4,686 persons (3,540 of them Syrian citizens). Thus 4,661 took temporary external addresses to settle down in country's urban areas.

In the period 2012-2013, immigrant influx into Greece by land decreased by 95% after the construction of a fence on that part of the Greek-Turkish frontier which does not follow the course of the river Marica (Evros).

Furthermore, a flare-up of conflict in Libya in the aftermath of the civil war there has contributed to an escalation of departures from that country to Europe.

On October 18, 2013, the Italian government commenced an operation – "Mare Nostrum" led by Italian Navy – which prolongs a year and was in order to tackle the increased immigration to Europe during the second half of 2013. During the operation at least 150,000 migrants, mainly from Africa and the Middle East, arrived safely to Europe [International Organization for Migration. 31 October 2014, retrieved 16 April 2015]. The European Commission provided financial support for the operation with €1.8 million from the External Borders Fund. However the operation was politically unpopular and extremely costly for just one EU state. The Italian government had requested additional funds in order to continue the operation, from the other EU member states, but they did not offer the requested support.

The operation ended on 31 October 2014 and was superseded by Frontex[8]'s Operation Triton, which operates a smaller search and rescue capability. The termination of Mare

Nostrum has been criticized as a cause of the increased death rate among migrants to Europe in the Mediterranean, which increased between 2014 and 2015.

Over half a million migrants have entered into Europe for 2 years. In August`2015 the number exceeded 150,000 and totally 2015 is in a drastic increase compared to 2014. Also the monitoring data showed serious shift of the main flows to the Eastern Mediterranean.

After the start of the EU operation to stop trafficking from North Africa to Malta, Italy and Spain immigrants headed to Turkey, Greek Islands and the Balkan route to Hungary and Western Europe. Over 300,000 entered through Greece, according to the International Organization for Migration. Only in July and August 2015 on the island are descended 150,000 people.

In the summer of 2015 the wave of thousands of migrants from countries in the Middle East and Africa is transmitted more clearly from the Balkans to the north and submerge dramatically Central Europe, especially Hungary, Austria and Germany.

After being deluged with tens of thousands of migrants who came along the Balkan Route from Greece through FYROM and Serbia, initially Hungary allowed them to travel by train in the direction of Austria and Germany. On September 1, 2015, however, the Hungarian authorities stop the access of migrants to the train station in Budapest.

Because of the closure of the International Railway Station, hundreds of angry migrants began to protest, demanding to board the trains for Germany. They claim to have paid hundreds of euros for tickets after earlier Hungarian police assured them they would be passed to travel.

At the same time, Germany announced that continues to apply the so-called Dublin Regulation, which requires migrants to apply for asylum in the first EU country they entered. This is a step to stop the flow of people from Hungary and Austria.

Hungary states to apply European Union law that requires only a valid passport and Schengen visa for anyone who travels within the EU.

The closure of the station for migrants was supposed to be due to the pressure from other EU countries who are trying to cope with the influx of migrants coming from Hungary.

As of September 2, 2015 allegedly by train from Budapest - 3650 migrants have arrived in Vienna - a record for a day! According to the Austrian police statement only six people (citizens of Afghanistan) from this group of 3650 migrants have applied for asylum in Austria.

In response to the influx of Hungary, on September 2, 2015 the Austrian authorities introduced controls on the main crossings of the border.

On September 13, 2015, the government of the Federal Republic of Germany ordered police to begin checking travel documents from anyone entering from the southern frontier with Austria. Migrant arrivals have soared since Chancellor Angela Merkel effectively opened German borders to refugees a week ago. The aim of the measures was to limit the inflows to Germany.

Meanwhile Deutsche Bahn, the Germany's national railway company, announced it had suspended service from Austria to Germany for 12 hours at the orders of authorities as most new arrivals have arrived by train.

About 450,000 migrants have entered Germany by the middle of September 2015 and a total of at least 800,000 are expected.

## European Respond and Reactions

At their meeting in Luxembourg on June 22, 2015, the EU foreign ministers agreed to launch the EUNAVFOR Med mission to disrupt the business model of migrant smugglers in the Mediterranean. This was considered as a step of a wider EU approach to respond.

In the 14-15 September`2015 meeting in Brussels, EU ministers have failed to agree unanimously on a plan to relocate 120,000 asylum seekers with mandatory quotas. Instead, a majority agreed in principle and negotiations will now take place ahead of another meeting in October`2015. The German government appealed for European unity after one of its ministers called for financial penalties against countries that refused to accommodate their share of the migrants, provoking anger in central Europe. This followed the collapse of efforts led by Germany to force EU member states to accept mandatory quotas of refugees. A Czech official described such threats as empty but nonetheless "damaging" while Slovakia said they would bring the "end of the EU".

Slovak Interior Ministry spokesman Ivan Netik announced his country would accept a small number of Syrian refugees — so long as they're Christian. He said Slovakia would not take in Muslims because they would not be happy in a country with no mosques. Slovak Prime Minister Robert Fico later reiterated that point in an argument against quotas suggested by the European Union.

When thousands of asylum-seekers crowded Budapest's Keleti train station in an attempt to get to Germany, government officials rejected calls to find a more permanent Hungarian solution to their needs.

In Denmark, looking to stop asylum-seekers from trekking to Europe before they even begin, Danish authorities placed advertisements in Lebanese newspapers that described tightened protocols and reduced social benefits in Denmark. Inger Stojberg, the immigration and integration minister, posted on Facebook that Denmark could not handle the growing number of migrants and "there is good reason for us to tighten rules and get that effectively communicated."

The British Prime Minister David Cameron, who once referred to migrants and asylum-seekers as “a swarm of people coming across the Mediterranean,” has tried to mitigate the arrival of refugees by instead redirecting resources to underfunded refugee camps in the Middle East. Although the UK has agreed to accept 20,000 refugees, Cameron was under internal scrutiny for not doing more to aid those who have already traveled across the Mediterranean and need a new final destination in Europe[9]. The UK has promised more than $1 billion to the crisis in the Middle East, but British politicians have repeatedly come under fire for what was called “grossly excessive” comments regarding the migrants.

The French Prime Minister Manuel Valls announced Paris’s intention to build a holding camp in Calais, where large numbers of migrants and refugees are sleeping in makeshift tents near the entrance to the British Channel.

The French, British and German statement specifically called for reception centres to be set up urgently in Italy, Greece, Bulgaria and Serbia to register new arrivals, and for a common EU list of “safe countries of origin” to be established, which would theoretically allow asylum applications to be fast-tracked for specific nationalities. The EU has promised the Greeks government additional €33 million to cope with migrants while Athens demanded early in September`2015 for €730 million in order to build infrastructure for accommodation facilities.

However, more European countries already have introduced temporary border checks after Germany imposed controls on its border with Austria.

Hungary's government shut the main land route for migrants into the European Union, taking matters into its own hands to halt Europe's influx of refugees. Tough new border controls came into force on September 14, 2015. The Hungarians have completed a fence designed to stop thousands of migrants who have been crossing the border from Serbia. The new laws came into effect and allow police deployed along the border to arrest anyone considered an illegal immigrant or who tries to breach the new fence.

Out of the frying pan - into the fire as migrants have shifted their route into the EU after Hungary sealed its southern borders. Trying to find a new path through the Balkans, more than 6,000 migrants have entered Croatia in just two days.

## The EU Resettlement Agreement and Problem of Diversity

Meanwhile, on September 22, 2015, the European Union's interior ministers have agreed on a plan to distribute 120,000 people between the member states. The agreement comes despite protest from several eastern European countries. A majority of ministers voted in favor of the plan to relocate migrants across the Union as the Czech Republic, Slovakia, Romania and Hungary voted against the proposal, while Finland abstained.

The official communiqué from the meeting stated the relocation deal covered 66,000 refugees who would be moved from Greek Islands and Italy plus another 54,000 who had

previously been earmarked to be relocated from Hungary before it refused to back the plan. In concern of the agreed quotas the UNHCR claimed even if the 120,000 resettlement programme is implemented, this would be the equivalent of just 20 days' worth of arrivals at the current rate.

Simultaneously the Organisation for Economic Co-operation and Development (OECD) released a report claimed that an estimated 350,000 to 450,000 people could be granted refugee or similar status in Europe in 2015, more than in any refugee crisis in Europe since World War II. It said 700,000 asylum seekers had been registered so far this year, and that this figure was going to climb to 1 million by the end of 2015. This compares with the 630,000 asylum registrations in 2014.

The report emphasized that the current refugee inflow was unprecedented not only in numbers, but also in the diversity of the source countries, saying that this diversity would make it more difficult to process asylum applications and also to integrate accepted refugees in the long term. Although Syrians, Afghans, Iraqis, Serbians, Kosovars, and Albanians made up some 60% of refugees, a great number of people are also fleeing from a range of African countries, in particular Eritrea, Nigeria and Somalia, the report said.

The number of unaccompanied children making the journey to Europe had also grown another characteristic setting this crisis apart from other previous ones, the OECD said. It said child asylum seekers posed a particular problem, as they require special housing, care and education. The OECD warned that the situation in the main source countries was unlikely to stabilize in the near future, meaning that continued large inflows can perhaps be expected in the years to come[10].

In concern of the security aspects raised by the migrants tide, the EU countries preserved the right to refuse applications if they consider that some individuals are a threat to national security. This subject to the resettlement agreement from September 22, was provided by explanations of the European Commission regarding the approved quotas for the displacement of thousands of asylum seekers.

The EU Council agreed that the scheme would benefit only Italy and Greece, and cover displaced citizens from Syria, Iraq and Eritrea. The countries adopting the displaced migrants would receive €6,000 per person, with half of this amount paid in advance. In addition Italy and Greece get €500 per displaced man to cover the costs of transportation to the host country. The European Commission stated to separate €780 million pre-financing for implementation of the agreement.

The EU Council approved the proposal of the Commission in case of exceptional circumstances any EU country temporarily not to apply quotas adopted. Such interim period will last up to 12 months where the state have to submit to the EU budget equal to 0.002% of its gross domestic product to help financially the other EU countries that host displaced migrants.

These host countries gain the right to consider whom to shelter. Host countries may reject a candidate if they perceive as a threat to security and public order. One displaced will have the right to live only in an EU state where he/she agreed to be transmitted. If this requirement is violated, after arrest he/she shall be forced back to host state where only has the right to reside. Prior being displaced, all migrants must be registered and they will be taken fingerprints.

The first step of the plan commenced with the displacement of 50,400 migrants from Greece and 15,600 from Italy as according to some non-official sources Bulgaria will shelter immediately 852 refugees. Since Hungary refused to participate in the agreed scheme, the remaining quota of 54,000 would be distributed in the second step of the plan. Hungarian "backup" quota would be in use to reallocate refugees if no other country has been facing immigration crisis in the immediate future.

Considering the resettlement agreement on 40,000 immigrants, the European Commission announced that EU has capabilities to allocate a total of 160,000 asylum seekers in the next two years.[11]

## Recent Trends

Since the beginning of 2016 (January 01 – February 12), round circle 91,232 migrants, including asylum seekers are reported to have arrived to Europe by land and sea routes (tragically 411 of them are known to have drowned or are missing). In comparison - in 2015 arrived approximately 1,046,599 migrants. As last update of present CMDR COE topic of the 15th February 2016 ***c***ountries of first arrival to Europe look in digits as follow:

| Country | Arrivals | | Percentage Change |
|---|---|---|---|
| | Previous week 3rd – 10th Feb | Current week 10th – 17th Feb | |
| Italy | 117 | 553 | 373% |
| Greece | 8,638 | 6,175 | -29% |
| Bulgaria | 156 | 82 | -47% |
| *Weekly arrivals* | 8,911 | 6,810 | -24% |

Italy reports 553 newly registered arrivals of migrants and refugees; representing an increase of **373%** in comparison to arrivals in the previous two weeks; overall 6,451 arrived since January 2016. Greece declares 6,175 newly arrived migrants and refugees, representing a decrease of **29%** in comparison to arrivals in the previous week; overall 84, 130 arrived since January 2016. Bulgaria reports 82 newly arrived migrants and

refugees, representing a decrease of 47% in comparison to arrivals in the previous week; overall 742 arrived since January 2016. Weekly arrivals to Europe: 6,810 newly arrived migrants and refugees, representing a decrease of 24% in comparison to arrivals in the previous week; overall 91,232 arrived since January 2016. [12]

Other countries on the route:

| Country | Arrivals | | Percentage Change |
|---|---|---|---|
| | Previous week 3rd – 10th Feb | Current week 10th – 17th Feb | |
| FYROM | 16,717 | 7,286 | -56% |
| Serbia | 16,426 | 7,819 | -52% |
| Croatia | 17,966 | 11,045 | -39% |
| Slovenia | 16,744 | 11,557 | -31% |
| Hungary | 376 | 456 | 21% |

From the start of 2016 to 11 February 2016, Bulgarian authorities apprehended a total of 742 migrants and asylum seekers entering the country irregularly from the land borders with Turkey. The most prominent nationalities in descending order were Iraqis, Syrians, Afghans, Pakistanis and Iranians. The vast majority, 85%, were apprehended on irregular land borders, while only 14% were apprehended on checkpoints. Unlike other Balkan states, Bulgaria does not have a policy to facilitate the migration flow to Western Europe. Therefore, numbers from Bulgaria are not of registered arrivals but rather of apprehensions by the Bulgarian authorities of irregular migrants on entry, within the country, and on exit. This makes dating the exact entry of arrivals difficult, as someone apprehended in 2016 might have entered the country in 2015. Furthermore, only apprehensions on entry from the Turkish-Bulgarian border are counted.

Known entry points are border checkpoints Kapitan Andreevo, Lesovo, Malko Tarnovo and territories nearby on the green border between Turkey and EU (Bulgaria). Known exit points are border checkpoints Kalotina, Vrashka Chuka, Bregovo and territories nearby on the green border between EU (Bulgaria) and Serbia; and green border nearby Gyueshevo border checkpoint on border between FYROM and EU (Bulgaria). Most irregular migrants enter Bulgaria from green border on foot. Migrants coming from border checkpoints usually enter by hiding in buses or other vehicles. Undetected migrants continue their journey via taxis and private transportation to external borders or to big cities to find a means of onward transportation out of the country.

The cumulative arrivals to Greece for 2016 reached at approximately 84,000 in mid-February 2016. Over the week (11-17 February) it is estimated that 6,175 migrants

entered EU (Greece) via sea and land borders. This is sharply below from two weeks ago, which saw 16,723 arrivals by sea, and a week before, which saw 8,525 arrivals by sea. Numbers of arrivals by land for 2016 became available during the reporting period 11-17 February. Since January 19, standard operating procedures for crossing the EU (Greece) – FYROM border have changed several times. Stamped declaration of destination country in the police registration paper provided by the Greek authorities was a pre-condition for migrants (of the three nationalities allowed to cross) to be allowed entry to FYROM. On February 5, this policy was suspended, but by 16 February the policy was reported active again. According to the Hellenic Coast Guard, there were 15 incidents off the coasts of Lesvos, Chios, Symi, Samos, Agathonisi, Kalolymnos, and Megisti, requiring the Hellenic Coast Guard (HCG) to search and 1,208 migrants and asylum seekers in the first two weeks of February 2016.

The known landing points are the islands of Lesvos, Kos, Samos, Rhodes, Kalymnos, Megisti, Leros and Chios. The known exit point is Idomeni (border with the Former Yugoslav Republic of Macedonia).

In Italy from the beginning of 2016, an estimated 6,088 migrants and asylum seekers were registered arriving on EU territory. These figures are reached by adding numbers circulated by the Italian authorities, which go up to 31 January 2016, to numbers of arrivals from 1 February 2016 onwards, which are estimated in the landing areas. The known entry points are in the Channel of Sicily where migrants are usually rescued in international waters and brought to the ports of Lampedusa, Sicily (Catania, Augusta, Pozzallo, Porto Empedocle, Trapani, Messina, Palermo), Calabria (Crotone, Reggio Calabria, Vibo, and others) or Apulia (mainly Taranto). Sometimes migrants are also brought to Sardinia (Cagliari), or Campania (Salerno). The known exit points are irregular and therefore little is known about them. Ongoing research by the International Organization for Migration estimates that most Syrians and Eritreans and many Sudanese tend to move on to other European countries within 24-48 hours after reaching Italy, while most Sub-Saharan Africans remain in Italy. According to the official figures provided by Italy's Ministry of Interior there are relocations up to mid-February date. Some 526 individuals have been relocated from Italy to Belgium, Germany, Netherlands, Finland, France, Spain, and Sweden.

The European Commission has made available an overview of EU States' support to the Union relocation mechanism (to date 15 February 2016) – 18 out of the 31 participating countries have pledged to make places available. Namely they are Belgium (30), Bulgaria (1,302), Cyprus (30), Finland (220), France (1,100), Germany (40), Ireland (20), Latvia (481), Lithuania (100), Luxembourg (90), Malta (131), the Netherlands (100), Poland (100), Portugal (130), Romania (315), Spain (50), Sweden (300) and Liechtenstein (43), with an overall number of only 4,582 places.

## Theoretical aspects of mass migration

Current migration influx in Europe is ordinary shown vigorously in story lines even clichés derived from mass media coverage. Terms as "*migrant*", "*refugee*" and "*asylum seeker*" (less commonly) have been used daily since the appearance of fleeing tides from South and East. Just to mean similar facets, but however, precisely speaking, each term has a distinct meaning that carries different obligations and consequences. At the very beginning of this chapter it is necessary to stipple – where is the difference between?

Someone who moves from a place to another in order to live there (for more than a year) is a migrant. The International Organisation of Migration (IOM) estimates that 232 million people a year become international migrants and another 740 million move within their own countries. There are many reasons that people become migrants, but those who move to work or seek a better life are generally termed as *economic migrants*. There are, however, also international students, those who move for family reasons and those who migrate because they are fleeing war and persecution. An individual case can be a mixture of all those things. Migrants (in the EU) are subject to immigration controls and may need permission (a visa) to enter certain territory. They do not have immediate access to social housing or benefits, but may have an eventual pathway to settlement and citizenship. They can also be detained or deported if they fail to comply with immigration laws. Before "*immigrant*" has meant someone who intends to settle in a new country. Currently "migrant" is adopted to cover those who come to work for a short period then return home. "The migrant population" is used to describe foreign nationals resident in a country, but also those who are foreign-born residents even if they have become citizens[13].

A person who has fled armed conflict or persecution and who is recognised as needing of international protection because it is too dangerous for him/her to return home – is a refugee. He/she is protected under international law by a convention (signed in 1951) where its basic principle is that a refugee should not be expelled or returned to situations in which would be under threat. Once someone has been recognised as a refugee, it is supposed to receive an access to social welfare and assistance to integrate into society (school, job, culture). The United Nations High Commissioner for Refugees (UNHCR) estimates that there are almost 60 million forcibly displaced people around the world, including those displaced within their own countries.

An asylum-seeker is someone who has left his home in search of international protection, but is yet to be recognized as a refugee. States[14] are under international obligation to consider claims for asylum and not to immediately return asylum seekers to the countries they have fled from. The refugee convention states that they must be given access to fair and efficient asylum procedures and measures to ensure they live in dignity and safety while their claims are processed.

## Legal basis

### United Nation Refugee Legislation

The key legal document that defines refugee rights and legal aspects of asylum is The Convention Relating to the Status of Refugees[15]. Also known as the 1951 Refugee Convention, this is a United Nations multilateral treaty that defines who is a refugee, and sets out the rights of individuals who are granted asylum and the responsibilities of nations that grant asylum. It gives the legal definition of the term “refugee”:

*A person who owing to a well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group or political opinion, is outside the country of his nationality and is unable or, owing to such fear, is unwilling to avail himself of the protection of that country; or who, not having a nationality and being outside the country of his former habitual residence as a result of such events, is unable or, owing to such fear, is unwilling to return to it.* [Article 1, as amended by the Protocol, 1967]

It also sets out which people do not qualify as refugees, such as war criminals. The Convention also provides for some visa-free travel for holders of travel documents issued under the convention. In the case of a person who has more than one nationality, the term “the country of his nationality” shall mean each of the countries of which he/she is a national, and a person shall not be deemed to be lacking the protection of the country of his nationality if, without any valid reason based on well-founded fear, he/she has not availed him/herself of the protection of one of the countries of which he/she is a national.

The 1951 Refugee Convention is based on Article XIV of the Universal Declaration of Human Rights (1948), which recognizes the right of persons to seek asylum from persecution in other countries. A refugee may enjoy rights and benefits in a state in addition to those provided for in it. He/she has the right to be free from penalties pertaining to the illegality of their entry to or presence within a country, if it can be shown that they acted in good faith. This right is protected in Article 31[16] of the Convention.

Amendments were made in 1967. Where the Convention from 1951 had restricted refugee status to those whose circumstances had come about "*as a result of events occurring before 1 January 1951*", as well as giving States party to the Convention the option of interpreting this as "*events occurring in Europe*" or "*events occurring in Europe or elsewhere*", the 1967 Protocol removed both the temporal and geographic restrictions. However, it gave right those States which had previously ratified the 1951 Convention and chosen to use the geographically restricted definition the option to retain that restriction.

### European Union refugee legislation

The asylum in the European Union (EU) was formed by its then members in application of the Convention on the Status of Refugees (28 July 1951). Since then the Union strongly have stated at the perception that asylum is a fundamental right and is an international obligation to protect and shelter people fleeing persecution or serious harm in their own

country. The Union proclaims itself as an area of open borders and freedom of movement, where States recognize the need to have a joint approach to guarantee high standards of protection for refugees. This shaped through the years the EU attitude towards cross-bordering – the process evolved as a result of common policies appearing in the 1990s in connection with the creation of the Schengen Agreement on the suppression of internal borders. It began with the Dublin Convention in 1990 and continued through the implementation of the European Dactyloscopy[17] (EURODAC) and the Dublin Regulation[18].

Since 1999, the Union has been working to create a Common European Asylum System (CEAS) and improve the legislative framework. Several measures harmonizing common standards for asylum are adopted and imply EU States to have a shared responsibility to welcome asylum seekers in a dignified manner, ensuring they are treated fairly and that their case is examined to uniform standards so that, no matter where an applicant applies, the outcome will be similar. In addition also important is the financial solidarity among EU states with the creation of the European Refugee Fund. Elaboration and adoption of The Temporary Protection Directive and The Family Reunification Directive allowed for a common response to a mass influx of displaced persons unable to return to their country of origin.

The EU States envisaged a common system to deal with a number of specific problems stemming from the large differences in asylum practices among them. The so-called "*Asylum shopping*"[19] was pointed out as a problem while another aspect is that asylum seekers were perceived to gravitate towards countries with higher recognition rates and social benefits.

The differences between the laws of different EU States are the main cause of the desire of refugees to choose their host country. In example, some states give refugee status to the majority of applicants, while others give it to less than 1%. The Dublin Regulation enables a state to return an asylum seeker in the first Member State where he/she transited or so-called "readmission". Such provision was implemented to put pressure on "border states", so that they exercise better control on the external borders of the Union.

Four pillars[20] duly underpin the development of the CEAS as were based on the European Commission's Policy Plan on Asylum. In short:

- The Asylum Procedures Directive (Revised) – aims at quicker and better quality asylum decisions. Asylum seekers receive support to explain their claim and in particular, greater protection of unaccompanied minors and victims of torture.
- The Reception Conditions Directive (Revised) - ensures that there are reception conditions (such as housing) for asylum seekers across the EU territory. It also ensures that detention is only applied as a measure of last resort.

- The Dublin Regulation (Revised) – enhances the process of establishing the EU State responsible for examining the application, and clarifies the rules governing the relations between states.
- The EURODAC Regulation (Revised) – for law enforcement access to the EU database of the fingerprints of asylum seekers in order to prevent, detect or investigate the most serious crimes, such as murder, and terrorism.

The core idea is to bring more harmonization to standards (1) by aligning the EU States' legislation; (2) by enhancing effective and practical cooperation; (3) by increasing solidarity and sense of responsibility among the EU States in the light of migration influx challenges.

Furthermore in details, the Asylum Procedures Directive (APD) establishes common standards of safeguards and guarantees to access a fair and efficient asylum procedure. It creates a coherent subsystem, which ensures that asylum decisions are made more efficiently and more fairly and that all Member States examine applications with a common quality standard. The APD sets clarification of rules on how to apply for asylum – as to be specific arrangements, i.e. at borders, to ensure that everyone who requests asylum can do so quickly and effectively. Normally, asylum procedures have to be not longer than six months as it requires better expertise for decision-makers and more early assistance for the applicant, so that the claim can be fully examined quickly. These efforts are overseen in order to save time and money overall, because asylum seekers will spend less time in state-sponsored reception systems and there will be fewer wrong decisions, so fewer costly appeals. People in need of special help – because of age, disability, illness, sexual orientation, or traumatic experiences – have to receive an adequate support, including sufficient time, to explain their claim. Unaccompanied children will be appointed a qualified representative by the national authorities. However cases that are unlikely to be well-founded can be dealt with in special ("accelerated" and "border") procedures. These are clear rules and point out when can be applied to avoid well-founded cases being covered. In result, currently rules on appeals in courts are much clearer than prior 00's.

The Reception Conditions Directive was developed to standardize common conditions for living of applicants. It ensures that they have access to housing and food, health care and even employment. Detailed common rules have been adopted on the issue of detention and in particular, it includes a list of detention grounds in order to avoid arbitrary detention practices. It limits detention to as short a period of time as possible and introduces specific reception conditions for detention facilities, such as free access and communication with lawyers, NGOs and family members. This Directive also clarifies the access to employment for an asylum seeker. It must now be granted within a maximum period of 9 months since application.

Additionally there is also the Qualification Directive that establishes common grounds to grant international protection. Its provisions also foresee a series of rights on protection

from refoulement[21], residence permits, travel documents, access to employment, access to education, social welfare, healthcare, access to accommodation, access to integration facilities, as well as specific provisions for children and vulnerable persons. It approximates to a large extent the rights granted to all beneficiaries of international protection (recognized refugees and recipients of so-called "subsidiary protection") on access to employment and health care. It also extends the duration of validity of residence permits for beneficiaries of subsidiary protection.

The widely discussed Regulation No.604 from 2013 (Dublin Regulations) establishes the EU State responsibilities for the examination of the asylum application. The criteria for establishing responsibility run, in hierarchical order, from family considerations, to recent possession of visa or residence permit in a Member State, to whether the applicant has entered EU irregularly, or regularly. The newest amendments (up to June 2014) contain sound procedures for the protection of asylum applicants and improve the system's efficiency through an early warning, preparedness and crisis management mechanism. A series of provisions on protection of applicants, such as compulsory personal interview, guarantees for minors (including a detailed description of the factors that should lay at the basis of assessing a child's best interests) and extended possibilities of reunifying them with relatives. The possibility for appeals to suspend the execution of the transfer for the period when the appeal is judged, together with the guarantee of the right for a person to remain on the territory pending the decision of a court on the suspension of the transfer pending the appeal. It stresses the obligation to ensure legal assistance free of charge upon request as well as a single ground for detention in case of risk of escape and strict limitation of the duration of detention.

During the 2015 Summer migrant crisis in Europe, Hungary became overburdened by asylum applications to the point that it stopped on 23 June 2015 receiving back its applicants[22] who later crossed the borders to other EU countries and were detained there. On 24 August 2015, the Federal Republic of Germany decided to suspend the Dublin Regulation as regards Syrian refugees and to process their asylum applications directly itself[23]. On 2 September 2015, the Czech Republic also decided to defy the Dublin Regulation and to offer Syrian refugees who have already applied for asylum in other EU countries and who reach the country to either have their application processed in the Czech Republic (i.e. get asylum there) or to continue their journey elsewhere. Other member states such as Hungary, Slovakia and Poland officially stated their denial to any possible revision or enlargement of the Dublin Regulation, specifically referring to the eventual introduction of new mandatory or permanent quotas for solidarity measures[24].

However the entire "Dublin" procedure cannot last longer than 11 months to take charge of a person, or 9 months to take him/her back (except for absconding or where the person is imprisoned). The possibility for asylum seekers that could in some cases be considered irregular migrants and returned under the Directive 2008/115/EC (Return Directive)[25], to

be treated under the Dublin procedure - thus giving these persons more protection than the Return Directive.

The EURODAC which stands for European Dactyloscopy, is a fingerprint database for identifying asylum seekers and irregular border-crossers. Asylum applicants and irregular border-crossers over the age of 14 have their fingerprints taken as a matter of European Community law. These are then sent in digitally to a central unit at the European Commission, and automatically checked against other prints on the database. This enables authorities to determine whether asylum seekers have already applied for asylum in another EU member state or have illegally transited through another EU member state ("principle of first contact"). The automated fingerprint identification system is the first of its kind on the European Union level and has been operating since 15 January 2003. All EU States currently participate in the scheme, plus three additional European countries: Norway, Iceland and Switzerland.

Until now, the EURODAC database could only be used for asylum purposes. The new Regulation now allows national police forces and Europol to compare fingerprints linked to criminal investigations with those contained in EURODAC. This will take place under controlled circumstances and only for the purpose of the prevention, detection and investigation of serious crimes and terrorism. No data received from EURODAC may be shared with third countries.

## Migrants or refugees

The term refugee is familiar broadly to most people. Common notions of refugees include people fleeing for their lives to escape a natural disaster or war zone. Past examples of mass refugee flows include the World War II, Balkans war and Rwandan genocide. The concept of seeking refuge has been present in the cultures and societies of the mankind for a long time. The most widely used legal definition of a refugee is contained in the Convention Relating to the Status of Refugees (1951), which has been signed by one hundred and forty seven countries. These states recognise the right of a person to flee their country because they have a "well-founded fear of being persecuted" due to their race, religion, nationality, membership of a particular social group or political opinion.

Other definitions can be found in international treaties such as the Convention Governing the Specific Aspects of Refugee Problems in Africa (signed by forty five countries) and the Cartagena Declaration on Refugees, Colloquium on the International Protection of Refugees in Central America, Mexico and Panama (signed by thirty five countries).

### Distinguishing refugees from migrants

Refugees are by no means the only people living outside their country of origin. In current global village people are constantly leaving their homelands/regions in search of new opportunities. Migration across borders or within a state[26] is a daily reality for many societies across the world. In public debates the distinction between refugees and other

people on the move often seems blurred. However it is important to remember that refugees have a distinct legal status. Refugees are forced to leave their country because their lives are in danger, directly and immediately. Migrants and other "groups on the move"[27] often make a conscious decision for economic and other reasons. Refugees do not have such choice where and when to go.

The United Nations High Commissioner for Refugees (UNHCR) estimated that in 2014 there were over 14 million refugees under their mandate and a combined total of approximately 19.5 million refugees globally.

As a recapitulation for the purpose of this CMDR COE editorial – refugees are:

- *fleeing persecution as defined in the 1951 Convention and have a distinct legal status;*
- *that cross an international border and are given protection by a host country;*
- *not migrants or other groups on the move, led by economic and welfare reasons.*

Furthermore the migrant is a dynamic phenomenon increasingly requiring diversified policy interventions. Thus required by in order to maximize its potential benefits and minimize related costs for both countries of origin and destination. Better knowledge is essential to ensure the process of handling migrants' impact – the facilitation of their legal presence, the integration into the societies of destination, the support for voluntary return eventually. Nowadays all the aspects cluster the greater interlinking between migration and growth (economic development, population balance, cultural awareness and etc.).

The great challenge still remains in translating basic understandings into a feasible policy and functional practice on the ground. Obviously worldwide the governmental capacities for managing migration are limited. Legal frameworks may need to be updated or overhauled to focus on new areas of migration, or to handle new influxes or outflows of migrants. Moreover the frontier staff working may need equipment, training and support. Host society and migrants themselves may not be adequately integrated into the "get-to-know-me" process. In addition, vulnerability factors and health risks inherent to the migration process need to be managed but to the highest possible standard.

The cross-bordering migration is likely to transform in scale, reach and complexity, due to growing demographic disparities, the effects of environmental change, new global political and economic dynamics, technological revolutions and social networks. However these transformations can be associated with increasing opportunities for well-being while exacerbate existing problems on other hand.

The word *migrant* is defined by the Oxford English Dictionary as "a person who moves from one place to another in order to find work or better living conditions"[28]. Generally it comes for one who moves, either temporarily or permanently, from one place, area, or country of residence to another. Migrant has traditionally been considered as a neutral

term while there is some criticism upon mass media for using the word when implies something voluntary, and should not be applied to people fleeing danger[29].

International Organization for Migration (IOM) officials suggest "*the term should be understood as covering all cases where the decision to migrate is taken freely by the individual concerned, for reasons of 'personal convenience' and without intervention of an external compelling factor*"[30]. Nomadic movements of minorities (as the Gipsy in Europe, the Bedouin in Africa), are not regarded as migration as also, the movement of people for the purpose of travel, tourism, pilgrimages, or the commute in absence of an intention to settle in the visited places. Probably it is imperative to distinct voluntary and involuntary migrant, or between migration well-founded by natural obstacles (environmental disasters, ageing) versus economic/labour migration. Such distinctions are difficult to make and partially subjective, as the motivators for migration are often correlated.

Seeing the world map, structurally there is South-North trace as from low-income countries people migrate to high-income countries, and a substantial part (estimated at 43% by the United Nations Population Fund) of migrants are from developing countries in South and migrate to developed countries in North. Among the Top 10 of the destination countries are four EU States – Germany, United Kingdom, Spain and France[31].

### Why to move?

There are a number of theories for the reasons why people migrate. In general, current economic development of the mankind (aka Globalisation) has increased the demand for workers in order to sustain national economies which are worldwide oriented. Recruitment often goes beyond national borders and leads to "economic migrants" delivery. Such individuals are usually from impoverished or low-developed regions migrating to obtain sufficient income. Earned money is usually sent home to family members in the form of remittances and has become an economic staple in a number of developing countries[32].

Another reason to move is "to gain access". It encompasses allegedly opportunities to ascent strata and to reach wealthy services or allowance. Some escape from extreme weather conditions as such type of movement is usual from rural to urban areas[33]. Socio-cultural and geo-historical factors also play a major role, i.e. in North America being an "overseas commuter" in Europe is considered a sign of social prestige status. Moreover, there is geographical proximity of North Africa and Middle East to Europe and the historical ties between Northern and Southern Mediterrean countries that also prompt many to migrate.

A wide-spread idea states that the main reason for migration is labour and in addition, the wage differences between geographic locations. It is so-called *Neoclassical economic theory* and is used mainly to describe transnational movement in the labour market, which is not confined by international laws and inter-governmental regulations.

Another version assumes that migration is in result of a gap created by the market of the developed countries where migrants are needed to fill the lowest rung of labour (predominantly non-degree qualification and non-qualified work) because the natives do not want to do these jobs.

The New Economics of Labour Migration theory proclaims that migration flows cannot be explained solely at the level of individual economic impulses, but that wider social entities must be considered as well. Such social entity is the household and the economic migration can be viewed as a result of risk aversion on the insufficient income. The household, in this case, is in need of extra capital that can be achieved through remittances sent back by family members who participate in labour abroad[34].

The World Systems theory looks at migration from a global perspective and explains that economic interaction between societies can be an important factor in social change within them. Thus trade with one country, which causes economic decline in another, may create incentive to migrate to a country with a more vibrant economy. This view of international trade is controversial. It is argued that even after decolonisation, the economic dependence of former colonies still remains on former realm center. However, some scientists state that free trade can actually reduce migration between developing and developed countries. Tier of such idea is that the export of capital-intensive goods from rich countries to poor countries also equalises income and employment conditions and then slowing migration. This theory is often used to explain migration between countries that are geographically far apart[35].

Some researches[36] claim migration occurs because individuals search for food, sex and security. Their rationale stands that improved cooperative relationships among human beings and high technology interact together to cause a higher concentration of people into well-developed towns and cities. These towns and cities meet easily the basic needs of food, security and the reproduction of the human species. Therefore, migration occurs because of human survival and pleasure.

### Recognition

The term “migrant” have quite a neutral connotation as it says nothing about the entitlement to cross a state’s border. Presently broad understandings[37] argue that the word has an inadequate note and is being used to mean “not- a-refugee”. Vice versa it seems the term “refugee” implies attitude that natives have an obligation to newcomers as to let them on to their own territory (neighborhoods, villages and even sport venues) and give them the chance to seek asylum or moreover, a bright future. Anyway, there are many people who would be wary of labeling someone a refugee until that person has gone through the legal process of claiming asylum. Claims for “refugee status” are examined before being either granted or denied in the EU States.

Furthermore, expressions for "seek asylum/asylum seeker" are also often used about those trying to get to a particular country to make a claim. Indeed the word is very old and as the Oxford English Dictionary (OED) defines it, an asylum initially was "*a sanctuary or inviolable place of refuge and protection for criminals and debtors, from which they cannot be forcibly removed without sacrilege*". Over the next 200 years, the word became more general in its sense of "refuge" and nowadays, it has again narrowed to political and humanitarian rather than religious or psychological aspects.

Nevertheless while these usages describe someone who has gone through a well-defined process, there are less specifically applied terms. One of the more controversial ones is "humanitarian status" along with illegal migrant/immigrant. The Migrants Rights Network states that these terms may mislead and propose to say *irregular* or *undocumented* because "calling someone an illegal immigrant associates with criminal behavior"[38].

Without questioning the validity of one's narrative the moment at which a person can officially say whether he/she is a refugee or migrant is when the EU State makes its decision on his/her case. To successfully seek asylum every person must match the definitions as set out in the 1951 Convention on the Status of Refugees. This stipulates that have a well-founded fear of persecution in the country of nationality on the basis of at least one of five grounds – (1) race, (2) religion, (3) nationality, (4) member of a social group and (5) political opinion. Success depends on whether the host officials believe such an account. Additionally whether they believe that there is a reasonable risk for the applicant and may receive serious harm.

The burden of proof is on the applicant as to show that he/she will face persecution if returned to the country he/she fled from. However, the standard of proof is relatively low[39] as merely have to show that there is a real risk or serious possibility of it occurring. The applicant may claim under the European Convention on Human Rights (ECHR) as he/she has right of freedom from torture, inhuman and degrading treatment. The ECHR also gives a right of freedom of security and a right to privacy and family life, although these rights can be restricted with some valid justification. Credibility is at issue and rights under the ECHR are assessed together with the asylum claim. Both these claims overlap significantly and in the majority of cases, if one fails in claim under the 1951 Convention he/she will also fail under the ECHR.

At the screening interview, the authorities also consider following aspects:

- If another EU country may be responsible for considering the asylum application;
- If application for asylum is as soon as it could be after arrival in the EU;
- If the applicant is cooperative with the authorities when they made enquiries;
- If the answer is 'NO', the authorities are likely to refuse application for help with accommodation and living expenses[40].

The repercussions of the current European migratory crisis are falling in broad areas from legislative facets and financial affairs to social services and even promulgation of terminology. Nevertheless the development of international regulations and interstate institutions aligned to “people on the move” [ISSN 2192-6921] the in-between correlation and dependence still remains in exertion as it can be seen in the ambiguity of the definitions in use.

## Conclusions

The disputed consequences of the 2015 migration tide in Europe include concerns over European societies and their everyday life – predominantly Christian-cultured and secularized. While some voices point to migrants' economic and labour contribution, many raise concerns about pressures on traditional ethics, cultural principles, historical distinctions and common life mechanism.

These are concerns about the impacts on social cohesion and diversity. In theory, they can be defined and measured in different ways, e.g. by ethnicity, religion, place of birth, nationality and so on. In practice, most empirical studies define the social life by the culture and welfare status of the neighborhood/area/region/state, rather than racial and ethnic compositions (which are basically measured by data on foreign-born or foreign nationals). The CMDR COE analysis assumes that relative features of one national distinction and identification are consider to be – shared formal educational system; cultural and daily life homogenization; linguistic standardization; extensive bureaucratic control; central monitoring of the polity; life-existence similarity as a basis for political legitimacy.

Therefore one national body is herewith considered as cohesion where 'solidarity' and 'togetherness' create social orders. Frequently it is simply defined as ‘organization of society’ and somewhat interchangeably used together with the term 'community'. The dynamics of life in Europe have changed significantly in the last three decades – Berlin Wall is torn down, NATO and EU are enlarged, cellphones and Internet cover every street corner and etc. Communities and families became smaller and smaller, more people live alone, and work commands more of people's time, impacting on their associations within and beyond work. Social relationships are under siege by the demands of work and consumerism, which could also undermine parental authority and continuum of educational tradition.

Some opinions claim that basic values are increasingly under pressure and combined with the demands of professional realisation and better standard, deteriorate the 'solidarity' and 'togetherness'. Simultaneously nowadays newcomers – distinct by ethnicity, religion, place of birth, nationality – are challenging the European neighborhood and it brings a matter of disorganisation at large. It creates a social pressure which may goes even beyond individual`s ability to cope with.

There is an old European thesis that claims "We Know the World" and based on it Europe struggle to cope with all challenges through ages when meeting other civilizations and cultural models. One prominent theoretician, Edward Said proclaimed in his “Orientalism” (1978), that European understanding apprehends the area outside Europe as an irrational and depicts it as barbaric. This ‘Non-European’ is contrasted with the rational and sophisticated ‘West from Bosphorus’. Such a binary relation, in a hierarchy of weakness and strength, derives from the European psychological need to create border lines – in order to protect the private as it is essential to keep its supremacy in area where are shortages of land, distances etc. Therefore European apprehensions implicit the difference between Us & Them to be tenable, just to know *where-I-am*, *where-others-are*, *who-we-are* and *what-we-can-do*. If there is no answer then comes a mental disorder – newcomers are here, then what? What do they want? Who are they? What are we doing? How to cope with them?

## The probable inconveniences

The CMDR COE present analysis tends to state that lack of quick and digestible answers by EU policy leads perception for disorder. Attributable to a binary relationship, it reinforces the stereotypes for inequality invented with literary, cultural, and historical (history, travelogue, anthropology, etc.) texts. There is a probability of capsulation of the parties as it will keep the alienation between them.

In sociology there is a theory called ‘of broken windows’ first explicitly laid out by James Wilson and George Kelling. According to it, minor forms of public disorder, if unchecked, lead to a downward spiral of decays and malfunctions in a society. This concept has also penetrated social psychology; social disorder has been linked to declines in community health and individual well-being.

“*A stable neighborhood of families who care for their homes, mind each other’s children, and confidently frown on unwanted intruders can change, in a few years or even a few months, to an inhospitable and frightening jungle. A piece of property is abandoned, weeds grow up, a window is smashed. Adults stop scolding rowdy children; the children, emboldened, become more rowdy. Families move out, unattached adults move in. Youngsters gather in front of the corner store. The merchant asks them to move; they refuse. Fights occur. Litter accumulates. People start drinking in front of the grocery; in time, an inebriate slumps to the sidewalk and is allowed to sleep it off. Pedestrians are approached by panhandlers. At this point it is not inevitable that serious crime will flourish or violent attacks on strangers will occur*”[41]

Such images may occur in many Europeans and hold persistent beliefs linking migrants to images, including misbehavior to gender and religious rights, intolerant attitude towards social norms and welfare, and as a consequence – presence of ‘undesirable neighbor’.

Stereotypes about origin (place of birth, religion, ethnical group) may loom especially large when one party has uncertain or ambiguous information about the other party as a whole. The stereotypes may lead to actions by members of the stigmatized group that seem to confirm the association between origin and social behavior. Moreover if welcoming party, unconsciously or not, uses ethnical compositions as a gauge of the level of acceptance/rejection, it may reinforce the mechanisms that link origin and attitude.

When welcoming party's communities identify themselves as 'people from here' (i.e. that the locality – stores, streets, parks, stadiums, etc. – belong to them in particular), migrants are tended to be held responsible for problems which often may had a long story background. This happened mainly in communities where migration impact is not well acknowledged. In the mixture with newcomers as part of everyday living together, locals expect their manners at all to be accepted by people 'from elsewhere'. At the same time arriving party vindicates to apply own original behavior to locality and would brook no interference in newcomers` life choice.

In such diametrical opposition, persistence of stereotyping stigma does not necessarily mean that people are personally hostile to those of the other party. However it may plant the roots of animosity. Thereafter one border is delineated between the welcoming and arriving (locals and newcomers) parties, who are even subdivided into own minorities and communities.

### To meet the criteria

Every party comes on play with its own rules and expectations – at one stake it is '*Si fueris Romae, Romano vivito more'* while others insist on '*We are humans and have rights'*. In present situation there is no unique criterion what has to be the result of such match. However Europe faces the biggest challenge since Cold War division – if you do not meet the 'requirements' of the other side what will be the consequences for me, for you, for us both?

The CMDR COE states that Europe may face risks as:

A. Capsulation of parties – it is a curtain risk to lead misunderstandings, mistrust and even hostility and aggression.
B. Rivalry among newcomers – e.g. Africans vs Asians, Arabs vs Blacks, Iraqis vs Afghans and etc. to struggle for the benevolence of the locals

Constitution of point A stands from where people are grouping based on a shared idea – "we are protecting" (goals, rights, grounds). This is a sense that 'my party' is aware of me and that we together are identifiable to others. In result people tend to lose a sense of their individual identity and take on the identity of the mob. This can make them commit aggressive behavior towards other parties while they wouldn't normally commit but sounds reasonable in cases when feel under pressure. Such factor decrease in de-individuation and bend the perception for the other side – now he/she is not a human who has abilities

to learn, work hard, and create goods but a member of group that is saddled with prejudice.

Prejudice is traditionally defined in social psychology as a mental rejection towards a particular group and its members. There are different kinds of prejudices and different prejudices towards different groups—and these prejudices have very different emotional components to them. For instance, towards some groups, the prejudice is characterized by disgust, others by anger, yet others by fear.

What underlies prejudice against newcomers? An individual is highly dependent on people in our own groups. In fact, one could argue that European highly secularized, interdependent forms of living may be the most important human attainment. People tend to be invested in members of their groups, to have ongoing histories of fair exchanges and reciprocal relations, to treat one another reasonably well, to create and follow a set of agreed-upon norms, and thereby build up trust and shared standard. Outsiders/newcomers/foreigners are not going to have that same built-up investment and because of this, natives tend to believe that someone foreign is more likely to pose certain kinds of different behavior. Usually outsiders/newcomers are apprehended as intruders in one's daily routine life.

Thus the welcoming party builds a belief they may be more interested in taking locality resources, more likely to cheat locals in exchanges, to violate domestic norms and values, to take more than their fair share, and the like. These perceptions of threats are linked to negative emotions such as anger and disgust that contribute to capsulation of one party.

Sounds normal to over-perceive threats; human mind is designed to err. It's also normal when confronted with the kinds of threats the public has been discussing, an individual to experience emotions like anger, disgust and fear. But just because men stereotype groups as posing certain threats, and hold certain prejudices against them, does not mean that people act on these stereotypes and prejudices in extreme ways.

However the Point A challenge entails interacting between parties. Probably in result many of the threats initially expected to exist may not be there after all while others may arise. With the interaction and relationship comes the sense that other men are like me and that we can work out together whatever it comes. Relations on individual level among members of parties provide good inclinations – a model on either side of the barricade that men may not actually be apprehended as a homogeneous non-faced threat. As more members of parties come to interact individually with one another, the likelihood that they will overcome the suspicions is higher. And aftermaths will accelerate the reduction of malcontent.

## Marginalization of migrants` communities

The malcontent is the other side of the coin. The arriving party proclaims its choice to move freely wherever it likes and if not welcomed with open arms at least not to be treated

with condescension and disparagement. If one is a prominent professional in his place of origin, he demands being treated with same respect in the place of arrival. Being underestimated a man is very likely to enclose himself only to the frames of his counterparts. Hereafter the risk will be that such people may refuse totally to interact and this provides good turf for extreme attitude versus opposite party. At higher stakes for Europe's future is to diminish probabilities of radicalisation of attitude and behavior.

A business study[42] run by one of the biggest construction company in Bulgaria shows similar outputs for the welcoming of different professional skills no matter of origin. A good welcome received cooks, hairdressers and carpenters in contrast with drivers, mechanics, builders, physicians. Nevertheless all newcomers are regarded as cheap labor hand, unskillful but titbit for the black market. However this creates another social trench in the potential antagonism between the two parties – hiring undocumented migrant from street corners affects locals' money for healthcare and insurance. Consider a scenario – a contractor hires a black-market worker to do some landscaping, unfortunately he cuts himself using a hedge trimmer. Now, here lies the burden that annoys locals – such worker does not have any insurance. Roughly speaking, the local taxpayer is paying the bill for treatment and then comes an attitude towards the 'culprit', his counterparts and compatriots.

Many arrivals weighed their working life in European countries against the limited economic opportunities they left behind. Thus many are prepared to gulp down poor pay and conditions. Being illegal worker is seldom the migrant's deliberate choice as the underground economy is the only means of finding 'something to eat' for most of them. Some 'arrivals' struggle to get better jobs suited to their skills as they become more proficient speakers of the local language. The longer some stay in Europe the more informed they became about their rights as workers, while others remain exploited by their status as casual black-market workers. Staying on the basement of the society – aiming only shelter and food – they may create another risk factor for radical expressions.

With today's modern conveniences, a man can physically survive in a solitary existence as a person can be rejected on an individual basis or by an entire community. The rejection can be active, by bullying, teasing, or ridiculing, or passive, by ignoring a person, or giving the 'silent treatment'. Humans are social beings and some 'closed doors` are an inevitable part of daily life.

Nevertheless, rejection can become a problem when it is prolonged or consistent, when the relationship is important for the living standard, or when the individual is highly sensitive. Rejection by an entire group of people can have especially negative effects, particularly when it results in social isolation[43]. It can also lead to a number of personal and social consequences as one of them are aggression and crime aptitude. Sociologists see strong links between crime and social exclusion in high-industrialized societies such as the EU`s. The socially excluded groups are in favor of illegal means of fulfilling their

goals in life as they have no other way to fit into a society that will not accept them. The fact that a huge mass do not feel valued in a place of residence, can cause a sense of willingness to turn to illegitimate means of sustaining desired aims.

Laboratory researchers have found that even short-term rejection can have powerful effects on an individual. In several sociological experiments, people chosen at random to receive messages of exclusion become more aggressive, more willing to cheat, less willing to help others, and more likely to pursue short-term over long-term goals. It appears to lead very rapidly to marginalization and antisocial behavior[44].

Considering the 2015 migrant influx issue we may expect that such aggressive and antisocial behavior would turn into rivalry among members of the arriving party. It would be kind of struggle between migrant for the benevolence of the locals. Moreover it may become a problem for the welcoming party to penetrate into newcomers' communities since they are mobilized and solid in order to survive and overwhelm the contenders. The content analysis of crime chronicles in Bulgaria for the period May-October 2015 show increasing number of scuffles and skirmishes between mobs of Afghan, Syrian, Libyan and Central Africa origins.

**Marginalization of migrants` communities is the highest risk for Europe's stability and security.**

## Pan-European issue

The history of European civilization has been shaped by several migration waves. For centuries, merchants, craftsmen and intellectuals crossed the continent to practice their trades or start new lives. Millions emigrated from Europe, first to the colonies and later to the Americas. Also Europe has a long history of forced migration: from the Gypsy reached the Balkans in early 12$^{th}$ century and the expulsion later of the Jews from Spain to the population shifts in Southeast Europe caused by the wars between the Russian, Austro-Hungarian and Ottoman empires. In 60s and 70s of 20$^{th}$ century, the number of foreign workers in Europe doubled from 3 to 6% of the workforce. It was highest in England and France, which were relatively open access for citizens of their former colonies; and in West Germany, too, where the number of foreigners (nearly half Turks) rose to 3 million in 30 years after 1960. Although they seldom became citizens, the newcomers has continued to grow, not least because most countries still issue thousands of permits each year for the purposes of family reunification. Since the 1990s, the number of people applying for asylum has increased sharply. In comparison – in 1984 there were only 104,000 applications in Western Europe while this figure grew to 692,000 in early and mid-1990s as the asylum has become one of the principal means of migration into the EU.

The end of the Cold War lifted the lid on a number of hidden reasons for mass migration around the continent. Notably many people applying for asylum fled their homes after civil wars in former Yugoslavia in 1990s. Also, with the end of communist regimes many

Eastern Europeans believed that their aspirations for a higher living standard can only be served in that time EU countries (European Economic Community). Thus many have tried to emigrate westward and as a result in the period 1990-1993 a problem arose when tens of thousands Eastern Europeans tried to use the asylum process to do so. Some searches claim round figure 5 million people moved across the continent at that time.

All in all it led to a backlash, in some circles, against all types of migrants. In some EU states, asylum has become a highly controversial issue as it overlaps with other social matters. Presently the European narrative apprehends the migrants in domestic terms (rather selfishly indeed), but it is obviously a Pan-European issue.

Across Europe, the debates are remarkably similar, no matter that some countries have experienced much larger impact than others. However the stress everywhere is on reducing the flow, while trying to distinguish genuine asylum-seekers from purely 'economic' migrants. The public opinion obviously states that currently it is beyond the immediate power of the welcoming party to eradicate the roots of migration. As 'a moral of the story' if the EU wants to reduce migratory pressure, it will have to provide more answers and practical steps in nearest future. Over a short period of time, the Union needs to prepare capabilities for preventing mass disturbances on its borders.

- To organize All-European measures for precisely tracking human movements, which are outside the scope of legal means. Presently, no one entity knows what is really happening across borders; one reputable search estimates the number of migrants smuggled into the EU as tens of thousands in 2015 while some others claim the influx is approximately half a million.
- To suppress the unfounded expectations of newcomers, the EU must establish reasonable policy for broadcasting worldwide its requirements for granted asylum and/or work permission. Those who dream on European 'Promised Land' have the right to get to know what really can expect from the Welcoming party.

The CMDR COE overview envisages

- The probability that political conflicts in the regional vicinity and urbanisation tendencies in the Old Continent will keep the migrants pressure high.
- The probability Europe to shift to more likely conventional labour recruitment, based on its population of over 500 million.
- The probability that there will be no return to the 'open door policy' of the post-WWII era and EU will impose a selective immigration rules of engagements.

## Acknowledgements

The Overview is prepared by a team from CMDR COE for educational purposes of NATO training courses as well. All information is provided in the utmost good faith based upon unclassified information releasable to broad audiences.

[1] http://data.unhcr.org/syrianrefugees/syria.php
[2] http://data.unhcr.org/syrianrefugees/country.php?id=122
[3] http://data.unhcr.org/syrianrefugees/country.php?id=107
[4] http://www.unhcr.org/522747799.html
[5] http://data.unhcr.org/syrianrefugees/country.php?id=8
[6] http://www.unhcr.org/cgi-bin/texis/vtx/refdaily?pass=463ef21123&id=506a7f925
[7] http://www.unhcr.org/cgi-bin/texis/vtx/refdaily?pass=463ef21123&id=506a7f275
[8] Frontex (from French: Frontières extérieures for "external borders") is the agency of the European Union (EU) that manages the cooperation between national border guards that is undertaken to secure the external borders of the union, including from illegal immigration, human trafficking and terrorist infiltration. The agency was established in 2004 and has its seat in Warsaw, Poland.
[9] http://www.independent.co.uk
[10] http://www.oecd.org/migration/comprehensive-and-co-ordinated-international-response-needed-to-tackle-refugee-crisis.htm
[11] http://ec.europa.eu
[12] All data is according to official presented updates to IOM (http://migration.iom.int/europe/)
[13] Alan Travis, (2015). Migrants, refugees and asylum seekers: what's the difference?*, The Guardian*, Sep 22
[14] Nonphysical juridical entities that are represented by one centralized government which has sovereignty over a geographic area.
[15] Although, like many international treaties, the Refugee Convention was agreed in Geneva, it is incorrect to refer to it as “the Geneva Convention” because there are four treaties regulating armed conflict known as the Geneva Conventions.
[16] The Contracting States shall not impose penalties, on account of their illegal entry or presence, on refugees who, coming directly from a territory where their life or freedom was threatened in the sense of article 1, enter or are present in their territory without authorization, provided they present themselves without delay to the authorities and show good cause for their illegal entry or presence. (Article 31, (1))
[17] European fingerprint database for identifying asylum seekers and irregular border-crossers. All EU member states currently participate in the scheme, plus Norway, Iceland and Switzerland.
[18] Adopted in 2003 and replacing the Dublin Convention in all EU member states except Denmark. Its principal aims of is to prevent an applicant from submitting applications in multiple Member States.

Another aim is to reduce the number of "orbiting" asylum seekers, who are shuttled from member state to member state. The country that the asylum seeker first applies for asylum is responsible for either accepting or rejecting asylum, and the seeker may not restart the process in another jurisdiction.

[19] In the jargon of European institutions, asylum shopping is the practice of refugees wanting to choose a country other than that prescribed by the regulations to apply for political asylum, in order to choose the one which will offer the best reception conditions, or to lodge an application in another country after being dismissed. Such definition appears in official documents, newspaper articles, analysis, etc. Asylum shopping is practised by 12% of asylum seekers, according to former European Commissioner for Justice Franco Frattini.[Interview by Deutsche Welle]

[20] Additionally, the revised Qualification Directive clarifies the grounds for granting international protection and therefore makes asylum decisions more robust. It will also improve the access to rights and integration measures for beneficiaries.

[21] Refoulement means the expulsion of persons who have the right to be recognised as refugees. The principle of non-refoulement has first been laid out in 1954 in the UN-Convention relating to the Status of Refugees, which, in Article 33(1) provides that: *"No Contracting State shall expel or return ('refouler') a refugee in any manner whatsoever to the frontiers of territories where his life or freedom would be threatened on account of his race, religion, nationality, membership of a particular social group or political opinion."*

[22] http://uk.reuters.com/article/2015/06/23/uk-europe-migrants-austria-hungary-idUKKBN0P31ZB20150623

[23]http://www.independent.co.uk/news/world/europe/germany-opens-its-gates-berlin-says-all-syrian-asylum-seekers-are-welcome-to-remain-as-britain-is-10470062.htm l

[24] http://www.bbc.com/news/world-europe-34155701

[25] Overall the Directive on Return, which was adopted in December 2008, falls short of a principled policy on the return of migrants.

[26] An organized political community living under a single system of government (*Concise Oxford English* Dictionary (9th edition). Oxford University Press. 1995)

[27] Jean Asselborn, Migration: Drawing Up Robust Solution, ISSN 2192-6921. 2015.

[28] http://www.oxforddictionaries.com/definition/english/migrant

[29] http://www.bbc.com/news/magazine-34061097

[30] https://www.iom.int/key-migration-terms

[31] The Global Commission on International Migration (GCIM) Report, 2003-2013

[32] Jason Parle, *"A Good Provider is One Who Leaves"*. New York Times, April 22, 2007.

[33] Also known as "internal migration"

[34] Roel Jennissen, "*Causality Chains in the International Migration Systems Approach*", Population Research and Policy Review 26(4). 2007.

[35] Paul Halsall, Modern History Sourcebook: Summary of Wallerstein on World System Theory. 1997.

[36] Alamveabee Efihraim Idyorough

[37] The 2015 on-line searches for “migrant” are at their highest since Google started collating this information in 2004 [Google Inc. press release, Aug 21, 2015]

[38] Don Flynn, director of Migrants Rights Network, BBC Interview, 2015.

[39] Julia Koval, immigration lawyer and partner of the British Legal Centre, BBC Interview, 2015.

[40] Therefore some countries and entities across EU recognise the outcome as “giving a humanitarian status” for to settle the case.

[41] J. Wilson and G. Kelling, “Broken Windows: The Police and Neighborhood Safety,” Atlantic Monthly, March 1982.

[42] Presented on 29 Sep 2015, Bulgarian Red Cross Conference, Trace Group Hold PLC Presentation.

[43] Williams, Kipling D.; Joseph P. Forgas; William von Hippel; *The Social Outcast: Ostracism, Social Exclusion, Rejection, and Bullying*. Psychology Press. (2005).

[44] JM Twenge, Catanese, Baumeister; "Social exclusion causes self-defeating behavior". 2002.

# THE CONFLICT IN UKRAINE

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*Political crisis and the latest events in Ukraine, which shook world politics in 2014, represent a symbol of change in the international architecture of the 21st century. According to many international researchers Russia's actions in Ukraine categorically prove the shift from a unipolar World, dominated by the West and the U.S. in particular, to a multipolar World, where several centers of power would outline. The crisis in Ukraine, which broke out in November 2013 initially as an internal political turmoil quickly grew into a conflict of international importance at the beginning of 2014. In this geopolitical situation between Russia and the West (dominated by the U.S. and EU) emerged. This report aims to explore the dynamics of the conflict and to determine the effects and problems facing European institutions and countries with respect to the crisis situation in Ukraine. In order to achieve better understanding of the problem this paper starts with a brief introduction presenting the historical background of the conflict and providing some geographical data on and information about Ukraine's natural resources. Then an analysis methodology known as PMESII has been used. The abbreviation PMESII stands for an analysis of the Political, Military, Economic, Social, Infrastructure, Information aspects of a problem. PMESII was developed by the US Department of Defense and the US Army to serve as an analytical tool and, with slight modification; this tool completely fits the purpose of this study. Finally, the paper will conclude with some key findings and a forecast for the future of the Ukrainian conflict. Various open information sources, listed in the bibliographic part the document, were used during the development of this research.*

## Historical background

The historical destiny of Ukraine has always been controversial and predetermined by its geostrategic position. In the 9th century on some parts of the lands of present-day Ukraine appears Kievan Rus. It gradually became a regional power as a federation of several East Slavic tribes under the reign of the Rurik dynasty. The modern peoples of Belarus, Ukraine, and Russia all claim Kievan Rus' as their cultural ancestor[1]. In the following centuries, the territory of Ukraine is divided between various powers, mostly between Poland and Russia. The fall of the Russian Empire in October 1917 led to profound changes that would trace the history of Ukraine for next century. Several Ukrainian states briefly emerged at that time: the internationally recognized Ukrainian People's Republic (UNR, the predecessor of modern Ukraine), the Hetmanate, the Directorate and the pro-Bolshevik Ukrainian Soviet Socialist Republic (or Soviet Ukraine) successively established territories in the former Russian Empire; while the West Ukrainian People's

Republic and the Hutsul Republic emerged briefly in the Ukrainian lands of former Austro-Hungarian territory.

In the 1930s occurred one of the greatest tragedies of the 20th century – named "Holodomor" (a man-made famine). Starting from the Communists' idea for a centrally planned economy, Ukraine was involved into Soviet industrialisation while the peasantry suffered from the programme of collectivisation of agriculture. It was enforced by regular troops and secret police. Many Ukrainian farmers, refused to join the collective farms. Over the extended period of collectivization, armed brigades forcibly confiscated land, livestock, and other property, and evicted entire families. Close to half a million individuals in Ukraine were dragged from their homes, packed into freight trains, and shipped to remote, uninhabited areas such as Siberia where they were left behind, often without food or shelter. The agricultural productivity greatly declined. As members of the collective farms were not allowed to receive any grain until sometimes unrealistic quotas were met, millions starved to death in the "Great Famine". Nowadays researchers are divided as to whether this famine fits the definition of genocide, but the Ukrainian parliament and other countries have declared it as such[2].

The Nazi German invasion of Poland on September 1, 1939, marked the beginning of World War II, Western Volhynia and most of Galicia, both previously under Polish rule, were occupied by Soviet troops in accordance with the secret protocols of the German-Soviet Non-aggression Pact (Molotov-Ribbentrop Pact). Soon after the German invasion of the USSR on June 22, 1941, Ukraine falls under Nazi control. In these conditions, the situation in Ukraine could be characterized as a conflict between two major groups. On one side were Ukrainian nationalists and anti-Bolsheviks, who supported Nazi Germany and hoped to establish an independent state, and on the other side were the Communist supporters of the Soviet Union.

Soon after the end of WWII, in 1954, that time Soviet supreme leader Nikita Khrushchev administratively affiliated Crimea to the Ukrainian Soviet Socialist Republic. Soviet Ukraine became a European leader in industrial production[3], and an important centre of the Soviet arms industry and high-tech research. Such an important role resulted in a major influence of the local elite. Many members of the Soviet leadership came from Ukraine, most notably Leonid Brezhnev.

After the collapse of the USSR, in a referendum on 1 December 1991 an overwhelming majority of 90.3% supported the Act of Declaration of Independence issued by the Verkhovna Rada (the Ukrainian Parliament) on 24 August 1991. Even in the East (Donetsk and Luhansk) regions 83% of the voters said "YES" to an independent state, and in Crimea, while the turnout was the lowest in the country (67%), 54% of votes were pro-Ukraine. Moreover, 55% of the ethnic Russians living in Ukraine voted for Ukraine's independence[4].

Nevertheless, nation-building in Ukraine faced a number of political, demographic and cultural challenges from the very beginning. Unlike in the Baltic States, the anti-communist opposition in Ukraine in the 90s was too weak to establish a political and ideological hegemony. The political regime was the result of a compromise between the "national-democrats" stemming from a broad opposition movement aimed at national emancipation (Narodnyi Ruch) and the so-called "sovereign communists", an opportunistic group formed by members of the local Communist Nomenklatura.

As a result of this compromise the historical Ukrainian symbols were accepted by the indifferent former communist who found themselves in the position of state-builders. The yellow-blue flag, the coat of arms (the trident) and the anthem borrowed from the Ukrainian tradition of national liberation struggle became the official symbols of post-Soviet Ukraine despite the resistance of the orthodox Communists. However, the Soviet Ukrainian identity was not dismantled, especially in the east regions.

The so-called "Orange Revolution" (series of political protests and street unrests in the period November 2004 – January 2005) marked a cornerstone in Ukraine's present situation. In 2004 Ukraine held a presidential election, won by Viktor Yanukovych, who was supported by pro-Russian former communists and heavy-industrial circles from Ukrainian East. Lately appeared that the elections were rigged and mass protests erupted throughout the country bringing Viktor Yushchenko to power. These events reshaped the traditional configuration of political forces. The identity politics of President Viktor Yushchenko was supposed to legitimize Ukraine's pro-Western geopolitical choice and end the post-Soviet ambiguity.

Yushchenko saw Ukraine as a postcolonial nation, struggling to emancipate itself from Russia's political and cultural influences. He sought to rehabilitate Ukrainian nationalism, for a long time seen through the hostile Russian and Soviet lens. Among the most resonant initiatives in the field of identity and memory were the establishment of a Museum of Soviet Occupation, the commemoration of the Holodomor[5], and the posthumous decoration of UPA (Ukrainian Insurgent Army) leaders Roman Shukhevych and Stepan Bandera as official "Heroes of Ukraine".

However, some critical engagements turned out to be problematic due to weak institutions, lack of rule of law, and the political manipulations. The public discontent with some controversial decisions was instrumentalized by the Party of Regions, which turned into a leading opponent of the national-democrat policies. Fierce debates on historical memory polarized public opinion and deepened the demographical division in Ukraine. The affirmative nationalism alienated a significant part of the Ukrainian public which disagreed with the heroization of the UPA. In addition, it antagonized Russia which did not accept the definition of the Holodomor as genocide. From today's perspective, these were the events that trigger the watershed of Ukrainian conflict.

## The political landscape 2013-2016

Ukraine's political landscape has changed significantly in a short period between November`2013 and May-June`2014.

Protests[6] started in November 2013 when then president, Viktor Yanukovych, began moving away from an association agreement the European Union and instead chose to establish closer ties with the Russian Federation. Some Ukrainians took to the streets to show their support for closer ties with Europe. Meanwhile, in the predominantly Russian-speaking east, a large portion of the population opposed these protests, instead supporting the Yanukovych government. Gradually, protests (Evromaidan) turned into violence and escalated drastically after mid-January 2014, when the government accepted new Anti-Protest Laws.

Owing to the violent protests, the parliament voted on 22 February to remove the president Yanukovych and set an election for his replacement. A supporter of a pro-European Union platform, Petro Poroshenko won in May`2014 with over fifty percent of the vote. Upon his election, Poroshenko announced that his immediate priorities would be to take action in the civil unrest in Eastern Ukraine and mend ties with Russian Federation.

Meantime, from the end of February 2014, demonstrations took place in major cities across the eastern and southern regions of Ukraine. These were a reaction by pro-Russian and anti-Evromaidan groups in the aftermath of the pro-European movement in Kyiv and Ukrainian West. During that time, Crimea was annexed by the Russian Federation.

On 23 February 2014, using the Russian naval base at Sevastopol as cover, Russian President Vladimir Putin directed troops and intelligence agents to disarm Ukrainian forces and take control of Crimea. A controversial referendum was held there on 16 March 2014 and the official result was that 97% wished to join with Russian Federation[7]. The UN general assembly responded by passing Resolution 68/262 stating the referendum was invalid and supporting the territorial integrity of Ukraine.

The internationally criticized referendum and protests in Donetsk and Luhansk regions (oblasts) escalated into armed clashes between pro-Russian separatist and Ukrainian nationalists. This led the Ukrainian government to launch a military counter-offensive called ATO (Anti-Terrorist Operation), which resulted in the ongoing war conflict.

The first parliament elections since Russia's annexation of Crimea in March 2014 established a clear pro-European majority in the Ukrainian Rada (parliament), reflecting the increasing anti-Russian sentiments caused by Russia's interference. With 288 out of 450 seats in the Rada, the pro-European parties formed a coalition government in December 2014. The coalition set out a range of clear political goals supported by all parties, including NATO membership, EU integration, regaining Crimea and establishing a new anti-corruption bureau.

On the other side of the Ukraine's political spectrum stand clearly pro-Russian groups. One is the Communist Party of Ukraine which fell below the 5% threshold for the first time since it was founded in 1993 as the direct heir of the Communist Party of Ukraine, a branch of the Communist Party of the Soviet Union. The Opposition Bloc remains the only pro-Russian opposition party in the Rada nowadays. Founded in September 2014, this coalition comprises six groups with strong ties to the Yanukovych regime and his Party of the Regions.

In November 2014, Russian proxies in Donbas held elections in the self-proclaimed Donetsk and Luhansk National Republics (DNR and LNR), although it was stipulated the local elections to be held in December. In both “republics,” the Russian proxies claimed victory and their local leaders were sworn in as presidents. Ukrainian government condemned the elections as illegitimate.

As a 2016 update we can underline that the administration of the Ukrainian President Petro Poroshenko encounter many difficulties resulting in a new political crisis in Ukraine. The government failed to secure the necessary support in the parliament for a decentralization reform. This in turn raised new doubts about the feasibility of the Minsk process[8] aimed at settling the conflict in eastern Ukraine.

The country was rocked by several scandals involving corruption allegations against Poroshenko’s team and charges that the president was turning a blind eye to corruption. The government adopted the 2016 budget necessary for the International Monetary Fund (IMF) to deliver the next tranche of its financial assistance, but the aid was delayed pending resolution of the corruption scandals.

The cabinet of Prime Minister Arseniy Yatsenyuk was accused of inaction and corruption, but survived the parliamentary vote of February 16. Two months later on April 10 he announced his decision to resign as Prime Minister of Ukraine. The Parliamentary Speaker Volodymyr Groysman was nominated as his successor by Mr Poroshenko's party (Petro Poroshenko Bloc "Solidarity") and almost certainly he will become the new Prime Minister of Ukraine.

However, according to many experts, no positive changes are likely to happen there. Yatsenyuk’s resignation has no effect on the real balance of political forces in Kiev. The new government will rely on the coalition of two parties: Yatsenyuk’s party, People’s Front, party and the Petro Poroshenko Bloc, but this coalition will not have a constitutional majority.

President Petro Poroshenko could now consolidate his power but in turbulent times. The President and a new government will be under intense pressure, both from Ukraine's European and American partners, and from the Ukrainian people, to implement real reforms. President Poroshenko himself came under attack after leaked documents

suggested he had set up an offshore company as a tax haven using Panamanian legal firm Mossack Fonseca.

In conclusion, we can summarize that Ukraine faced a multitude of very difficult tasks, which had to be solved within a short period of time: a new political system had to be built; new statehood principles based on law had to be introduced; a new system of national security and defence had to be created.

Despite a history of strong protest movements and two revolutions (2004–2005 and 2013–2014) during its nearly quarter of century independence, Ukraine has yet to entirely break with its Soviet past and overcome the oligarch-dominated political system of the present.

## Main players in the conflict

The situation in Ukraine is far more complicated than it usually appears, so let us explore the main groups of players involved in the conflict and examine the needs and claims of each.

### The Oligarchs

With the breakup of the Soviet Union, a small group of people, many of them members of the so-called Soviet Nomenclatura, managed to acquire title to most of the wealth of Ukraine. Launching successful new enterprises, they obtained country's power from the strength of their new-found positions and influence. Ukraine's oligarchs are very active politically, so it is no accident that every government has called on them to back the regime.

Rinat Akhmetov, allegedly the richest man in Ukraine (money from iron and steel and thermoelectricity) is former supporter of ousted president Viktor Yanukovych and MP for the Party of the Regions now backs the new government, calling for national unity. His influence in the Russian-speaking east makes his support particularly important.

Victor Pinchuk is Ukraine's best-known oligarch. He offered belated support to the protesters after Yanukovych fled, but then turned down the new government's request for assistance. The son-in-law of former president Kuchma, he made his money selling steel pipes. Claims that he has engaged in dumping[9] in the USA and Russia.

Dmytro Firtash financed Yanukovych until his downfall. This bruiser from post-Soviet times fought his way up from the street; he has made billions through RosUkrEnergo, a natural-resources and energy giant.

Igor Kolomoiskyi is the founder of PrivatBank. A fierce opponent of the Yanukovych regime, Kolomoyskyi is using his financial and organizational resources not only to prevent an armed pro-Russian separatist coup according to the Donetsk and Luhansk scenario. He has also helped the active pro-Ukrainian minority to change the atmosphere

in the city of Dnipro, a typical Soviet-type industrial city which until recently had voted for the Party of Regions, now has become a bastion of civic Ukrainian nationalism[10].

Petro Poroshenko, known as the "Chocolate King", he made his billions by trading cocoa beans, before diversifying into media. He backed the Orange Revolution and fought Yanukovych and became a head of state.

Sergey Kurchenko have made billions through gas sales. This friend of the Yanukovych family has fled the country for Belarus. He says he faces no criminal charges in Ukraine and the corruption allegations are motivated by competitors.

These people together formed a level of influence, controlling both the wealth and the politics of Ukraine. Many of the Ukrainian oligarchs are mostly ethnically Russian, others Ukrainian, many are mixed Ukrainian-Russian, and few are Jews, Bulgarians, or other minorities.

The oligarchs are now divided between those who support the new Ukrainian government and its efforts to join the European Union, and those who support closer ties with Russia. Regardless, the oligarchs are not particularly eager to rid the country of corruption. Any money that the international community allocates to helping Ukraine risk diversion at their hands. While the nationalistic group of Ukrainian oligarchs and the Russian-oriented group appear to be on opposite sides in this conflict, they share a commitment to their own ever-increasing wealth and power that is in contrast to the interests of the Ukrainian population, including the Ukrainian-Russian population.

### Maidan

The name Maidan (Square, in English) comes byword for all protesters consisted of a temporary alliance of ordinary citizens, who were disgruntled with corruption, intellectual's, eager to improve ties with Europe and help their country achieve greater independence from Russia, and far-right ultra-nationalists. All three wanted an end to corruption, independence from Russia, and to bolster their identities as European. That's why it is popular also as Evromaidan (Euromaidan)[11].

### Pro-Maidan Intelligentsia

Most of the protesters at Maidan were intelligentsia or ordinary citizens coming together in hope of launching their country on a path to integrity, freedom, and economic well-being. Pro-Russians entirely ignore the existence of this group, although it actually comprises most of those who favor the Ukrainian side of this conflict. According to Russian media, the Maidan protesters consisted entirely of fascists and neo-nazis elements, supported by the West countries, especially by the USA. The Western media coverage, on the other hand, ignores the existence of far right groups at Maidan and insists that the Ukrainian side consists entirely of ordinary citizens and intelligentsia.

### The Ukrainian nationalists

The so-called "Banderovtsy" are not a homogeneous group. The Pravyj Sektor, Svoboda, Patriot of Ukraine, Bratstvo are extreme at different extend, nationalist parties. They regard Stepan Bandera, a leader of the Ukrainian movement in collaboration with Nazi Germany (1941-1943). In fact, when Bandera declared a Ukrainian independent state, he was arrested in September 1941 and later imprisoned in a concentration camp. In 1944, Bandera was released, in the hope that he would deter the advancing Soviet forces. After the war, in 1959, in Germany, Bandera was assassinated by the Soviet security agency KGB.

The right-wing extremists are a variegated combination of fascist admirers as well as people so weary of Post-Soviet Russian influence over Ukraine. They have embraced far-right ideology to resist those whom they perceive as communists as the Soviet Ukrainian identity was not dismantled in the 90's and the beginning of 21st century. The pantheon of Soviet Ukrainian memories was not subject to radical revision; rather, it was slowly expanded to incorporate the state-builders of the past such as the first president of the Ukrainian People's Republic Mykhailo Hrushevskyi and Hetman Ivan Mazepa[12]. Naturally, after the Russian takeover of Crimea the influence of "Banderovtsy" expands among low classes of the Ukrainian society.

Some political analyses claim the "banderovtsy" are so marginal that one can ignore them. Ukrainian propaganda also plays down the neo-Nazi element among their supporters. The Russian propaganda, on the contrary, is amplifying the fascist influence on the government. In fact, the oligarch Kolomoyskyi, who is Jew, offered a bounty for the capture of Russian-backed militants and incentives for the turning in of weapons. He also is believed to have spent $10 million to create the Dnipro Battalion, and also funds the notorious Azov Regiment and Donbas volunteer battalions[13]. Despite the differences in opinions, West and Russia both shared sadness if neo-Nazis elements succeed in taking over the parliament majority.

### Pro-Russians

The disintegration of the Soviet Union launched a long process of mental and symbolic delimitation between Ukrainians and Russians. The Russian Federation remained much more than a neighbour state for a vast majority of the population especially in Donbas region vicinity. Family ties, labour migration flows, a largely common media space and the dominance of Russian mass culture made the clear cut Ukrainian identity difficult in the east and south. This diffuse nostalgia and related attitude towards the past and "artificial present" were often publically articulated by the orthodox communists and Russians in Ukraine. Meanwhile, Moscow's policies always envisage Ukraine to remain close ally as far as possess considerable economic and political leverage over Kyiv. The large Russian-speaking population has also considered as a powerful instrument for political pressure and influence since the decay of USSR. Pro-Russian Ukrainians consist largely

of working-class people, Russian speakers, who are fear that Ukraine's economy will collapse without closer cooperation and alignment with the Russian Federation.

### The Militant Separatists / Federalists

The militant separatists/federalists share similar concerns as well, but predominantly stay a resistance to the central power of Kyiv. Some insist their territories to become part of Russia; others claim a loose federal structure with a weak central government, while others want full independence. Such people are taking over local governments in southern and eastern Ukraine. According to West, they consist primarily of Russian citizens; according to Russia, this is an entirely home-grown, Ukrainian movement. In fact, it consists primarily of Pro-Russian Ukrainians, supported by Russian guerrillas and logistic.

### Russia

The Russian Federation is obviously a major player in the conflict. Russia clearly supports the irredentism; although Russian President stated several times he does not wish to conquer foreign territory. If this is so, the reasons are in part financial; bailing them out will not be cheap. The Kremlin is seeking to discredit the Ukrainian pro-Western elites as archaic nationalists and to present even the moderate and democratic Ukrainian nationalism as “fascism” threatening Russians living in Ukraine. The Russian mission is to prevent the spread of Ukrainian nationalism and protect Russian “compatriots” was at this stage already present in Russian public. Mainstream media represent Ukraine as a hopelessly divided country, an artificial state consisting of civilizations with incompatible mentalities and cultures, an entity without a political future. Furthermore, Russia policy suggests alternative identities instead. These are largely based on the concept of the so-called “Russkiy mir” (Russian space) which made a rapid career from a marginal intellectual discourse to a new state ideology supported by the Russian authorities and the Moscow Orthodox Church. This imaginary political space is an ambivalent doctrine that comes to signify Russian diaspora beyond the international borders. Even more it became a synonym for an Orthodox/Slavic civilisation as it intends to refer to a supranational community united by Slavs languages (apprehended as dialects of Russian), culture, specific historical memory (common living in USSR, war against Nazi Germany) and related values.

Russia is clearly interested in seeing the Russian language enjoy equal status with Ukrainian in those parts of Ukraine where Russian speakers predominate, in ensuring that Russian speakers not face discrimination, and in restoring Russian hegemony to the region. Above all, Russia wants to ensure that Ukraine will not permit the expansion of NATO on East and economic influence of EU. The current crisis has led to a huge propaganda drive in Russia against the Western states and culture in particular. Such discourse appeals to traditional family values and gender roles, considers Europe’s “sexual deviance” a result of democracy and liberalism, and presents Russia as the “last bastion of normality”[14]. Russian coverage tried to compromise the Ukraine independence,

by reducing European values to the issue of sexual minorities. In Russian media Ukraine's pro-West choice has been often discussed in sexual terms, as a sexual deviation and an abandonment of gender norms.

### The West

The West supports the pro-European groups and is offering some support to the government in Kyiv. According to some political researchers, it stands to gain a strategically located ally and a trading partner with intellectual and natural resources open for exploitation. Western multinational companies have an obvious interest in the region, and an equally obvious influence on pro-Western Ukrainian politicians[15].

### The common interest

The West's will for political influence and economic exploitation parallels Russia's interests in Ukraine, but the more legitimate interests of both external parties actually are similar. Both stand to benefit from resolving the conflict, restoring stability, and responsible government. Pro-European and pro-Russian groups have more interests in common than at odds.

Reconciliation is needed if Ukraine is to achieve internal stabilization. However, the goal of reconciliation is hardly compatible with the fundamental demands on de-Sovietisation, lustration of the state apparatus and punishment of officials responsible for the bloodshed in Kyiv in February 2014. The Ukrainian political life must find uncontroversial symbols and narratives to replace both the neo-Soviet symbolic politics (such as the Saint George Ribbons, associated with pro-Russian separatism) and radical nationalist ones that can easily be reduced to "fascism". Even scholars of Ukrainian studies have been discussing for years how much nationalism Ukraine needs and can take. Moreover, if a political solution for the conflict will be found, an ideological reconciliation between Kyiv and the current separatist leadership of the "republics" of Donetsk and Luhansk embracing neo-Stalinism is difficult to apply. A strong popular demand for reforms and anti-corruption policies, for peace and stability in all regions of Ukraine could become a unifying agenda for the country, whereas polarizing issues as ideology, historical memory or the status of the Russian language should be put aside.

## Social Background

Ukraine is a multi-ethnic, multi-lingual and multi-cultural country. According to the latest census, it is home to almost 130 nationalities[16]. Twenty-two percent of Ukraine's population is made up of ethnic minorities. The Russians are the largest among them, 17 percent of Ukraine's population, who historically lived in the southern and eastern part of the country. Since the first day of its independence, the leadership of Ukraine faced a challenging task of building a national identity that would unite various regions with

ethnically diverse populations. The Euromaidan protests and the February revolution exacerbated historically rooted divisions between the Ukrainian East and West.

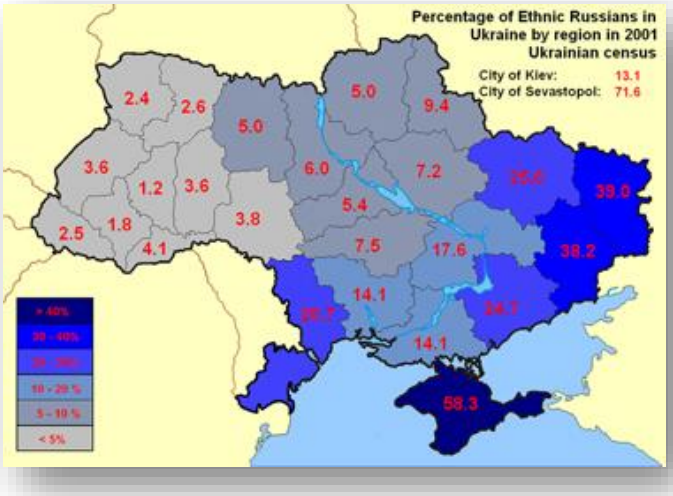
Ethnic divisions in Ukraine go back several centuries and are a result of imperial fighting between Russian Empire, Austro-Hungarian Empire and the Polish-Lithuanian Commonwealth. The southern and eastern parts of the country have historically been a part of the Russian Tsardom and mostly populated with ethnic Russians and predominantly Russian-speaking Ukrainians. These regions have always had a very close cultural and economic relationship with Russia. Some western areas were part of Habsburg Austria until 1918; others were brought into Ukraine only after the Second World War. The west has always been the land of Ukrainian nationalism with strong pro-European feelings.

These long-standing divisions and lack of effective state policy regarding Ukraine's diverse regions, after it became independent, are at the core of today's crisis. Ukrainian government officials failed to address these problems and even now some of the political leaders often confuse nationalism with patriotism, consequently further dividing the country.

Ukraine has a history of political and cultural divide, with the West leaning more towards Europe and the East towards Russia.

First of all, we would not overemphasize the divide. There are differences, but any large country with diverse regions will have differences and this is natural. Let's consider three basic regions:

The center, including Kiev is what some people recognize historically as Ukraine. Influences include Christianity from the Byzantine Empire and the early Slavic alphabet from the First Bulgarian Empire, all serving as reference points for Ukrainian identity. Around the 16th and the 17th centuries, this area was most affected by the frontier military society called the Cossacks (eastern Slavs). This area was briefly under the rule of Poland and Lithuania, and was gradually taken piecemeal by Russian Empire by the end of the eighteenth century.




The Ukrainian west is a much smaller region. It shares many religious and linguistic influences with the center. Yet, for a long period of time (from the 13th to mid-

18th centuries), it was controlled by Poland and it was influenced by the Polish language and culture, and Roman Catholicism. After Poland, it was taken over by the Austrian Empire in the 19th century. This strengthened its connection to Europe.

The southeast is the third region. Asian nomads migrated to this flat grassland, and the Slavs expanded into this area in the 17th and 18th centuries. This region has very little in common with the West. In the nineteenth century, industry developed widely and urbanized the area, attracting Russians.

Considering these major regions we can determine the major ethnic groups in Ukraine. Russian is widely spoken in parts of the east and south. In some areas, including the Crimean peninsula, it is the main language. In western regions – closer to Europe – Ukrainian is the predominant language and many of the people identify with Central Europe.

There is a whole spectrum of attitudes, identities, and relationships among Ukrainians. Some are fervent nationalists, and some feel they are somehow under the wrong influences and would like to be Russians themselves. And of course there is everything in between. Many Ukrainians have adopted this Russian mentality as their own too. They want to be urban and sophisticated, learn Russian, and drop their Ukrainian accent.

It's very difficult for many Russians to disentangle their own history from Ukraine's and to acknowledge the equality and legitimacy of the Ukrainian culture alongside their own. Crimea is particularly pro-Russian facing in terms of its language and ethnicity.

According to the 2001 Ukraine census, while most Ukrainians identified themselves as Ukrainian, most residents of Crimea identified themselves as ethnic Russians.

The census also showed that while most of Ukraine's population said they regarded Ukrainian as their native language, most of those in Crimea said their native language was Russian.

However, there are still large populations of ethnic Ukrainians and Tartars.

Many ethnic Ukrainians have natural loyalties to Kiev, while many of Crimea's indigenous Tatar community - deported in large numbers by Soviet leader Joseph Stalin in 1944 after some collaborated with the Nazis – boycotted the referendum. Some have also expressed fear at being once again under Moscow's rule.

## Information and media coverage of the conflict

As a result of the pro-European Maidan movement and subsequent Ukrainian political changes, the Russian media was accused of propagandizing, and of waging an information war via its coverage of the events. Portrayals in the Ukrainian, Western and Russian media created narratives of the Ukrainian crisis that often appeared to be entirely antagonizing. Russian channels were repeatedly criticized for the use of misleading

images, false narratives and misrepresentation, and fabricated news stories. For many public relations specialists these activities could be part of a coordinated "informational-psychological war operation".

## Media in Russia

The Russian media consistently portrayed the crisis as having been instigated by the interim Ukrainian government, and represented Euromaidan as being controlled by "ultra nationalist", "fascist", "neo-Nazi", and "anti-Semitic" groups such as Right Sector. The revolution was depicted as a "violent coup" fomented by the West in order to overthrow an elected government. Comments by the Russia state media were generally close to those by the Russian government; they presented western countries, particularly the United States, as coordinating events in Ukraine in order to harm Russia. The Ukraine-European Union Association Agreement was depicted as a weapon against the Russia, protesters as paid comedians. The head of “Rossiya Segodnya”, Dmitry Kiselyov, said, "*Information war is now the main type of war, preparing the way for military action*"[17]. Even news published in mainstream media and presented as actual events were frequently based on rumors, anonymous blogs, selectively quoted materials, usually skipping any opinions critical to Russia. Social media were also used in a coordinated way in an attempt to influence public opinion in Russia and other countries.

## The Western media

Many described Ukrainian society as deeply “divided”. Most reported the Euromaidan as a protest movement against corruption and for democracy, with a minority presence of far-right groups; although some suggested that they played the decisive role in armed confrontations. Moscow's claims of fascism and western conspiracies were often included for balance. The referendum on Crimean independence was considered “illegitimate”, “controlled”, and “under the barrel of a gun”. Many western sources state that the anti-government groups were actually Russian special forces incognito, referred to as “urbane green men”, and that the unrest was intentionally fomented by the Russian government.

## Media in Ukraine

Ukrainian media stated the unrest is manufactured by Russia. They have consistently accused Russia of being a provocateur, and of controlling the anti-government groups behind the scenes. The annexation of Crimea was viewed as illegitimate and illegal. Following the start of the Donbass War Conflict, the Ukrainian government and some media described the armed groups of the self-proclaimed Donetsk People's Republic (DPR) and Luhansk People's Republic (LPR) as “terrorists” and “separatists” and referred to the military operation against them as an “Anti-terrorist operation” (ATO).

## Officials

Furthermore, the Ukrainian government introduced some urgent initiatives to combat "Russian aggression”. In addition to banning certain Russian films for “distorting historical

facts", the Ukrainian Ministry of Culture has also come up with a list of 500 Russian performers and artists who will not be allowed to perform in Ukraine. The State Television and Radio Committee asked all Ukrainians (not just officials) not to speak to any Russian news agency. To give teeth to what have so far been merely requests, new legislation would allow the government to close media and block websites on national security grounds without a court order[18].

Recent legislation amendments give state authorities the right to confiscate the assets of any official, media entity or private enterprise that is deemed to have expressed separatist sentiments, or that might do so in the future.

We can state that all sides are using propaganda: Ukraine, Russia, the United States and other Western countries. But, for Russia, this task seems much easier to achieve, the centralization and the mobilization of information sources in the hands of the state, providing the Kremlin and President Vladimir Putin with the means to galvanize public opinion domestically and in the region. President Putin has succeeded in dominating the media landscape in his own country and parts of Ukraine. Now, the Kremlin has set its sight on a broader international audience and is rebuilding the media and propaganda structures that collapsed two decades ago, alongside with the Soviet Union.

## Impact of the conflict on the security of the Ukrainian gas transportation system

### Natural Gas Transportation


Today Ukraine is the largest natural gas transit country in the world. Ukrainian natural gas transportation system links the regions of the world's largest reserves of natural gas with European countries, which have significant amounts of natural gas consumption, and allows the country to be one of the key players in the natural gas business.[19]

Ukraine transports Russian natural gas to 18 European countries: Austria, Bulgaria, Bosnia, Greece, Italy, FYROM, Moldova, Romania, Germany,

Poland, Serbia, Slovakia, Slovenia, Hungary, France, Turkey, Croatia and the Czech Republic.

The transit of Russian natural gas through Ukraine is performed according to the long-term contract, and addendum signed April 21, 2010, between the National Joint-Stock Company Naftogaz of Ukraine and OJSC Gazprom concerning the volume and terms of transit for the period 2009 – 2019.

The reliability of natural gas transit and its supply to domestic consumers is ensured by reserves and inter-system natural gas pipelines, as well as by a developed system of underground storage facilities, the largest of which are located in the western region of the country.

The Ukrainian Gas Transportation System (GTS) is a crucial component of the European gas infrastructure, which accounts for supplies of up to a quarter of the total amount of natural gas consumed in Europe on an annual basis. A substantial portion of Ukraine's south-eastern regions has found itself in an instability zone caused by the conflict between Russia and Ukraine. This instability zone threatens the integrity of the Ukrainian GTS, as some of its structural elements could be damaged as a result of military activities, or the Ukrainian government could eventually lose control over some of its parts.

Currently, there is no direct threat to the integrity of the Ukrainian GTS. However, the creation of a special unit responsible for the protection of the Ukrainian gas transport infrastructure seems more and more relevant. Such a unit could be established on the basis of "Scorpion", an operational guards unit of the Ukrainian Special Forces that is responsible for the protection of the nuclear facilities on the territory of Ukraine.

Admittedly, the hostilities in the south-east part of Ukraine are not the only threat to the transit of natural gas through its territory, and the energy safety of Ukraine. A completely new challenge is the construction of the new pipeline project to transport natural gas from Russia to Western Europe bypassing Ukraine. The map below illustratesthe reason why this is important:


The majority of the natural gas pipelines connecting Russia with other parts of Europe pass through the territory of Ukraine. Over the last 10-15 years disputes between Russia and Ukraine have several times caused the interruption of natural gas shipments to Europe. This map illustrates several proposed pipelines that would, if built, bypass the pipelines in Ukraine and reduce Ukraine's strategic position in controlling the flow of gas to Europe.

North Stream has been built. The South Stream project has been cancelled, but the Oil Price article points at another named "Turkish Stream" that could go from Russia, through Turkey and to Greece. But other stakeholders are interested in a different project, the Trans-Anatolian Pipeline (TANAP) which would bring Azerbaijan's natural gas to the European market.

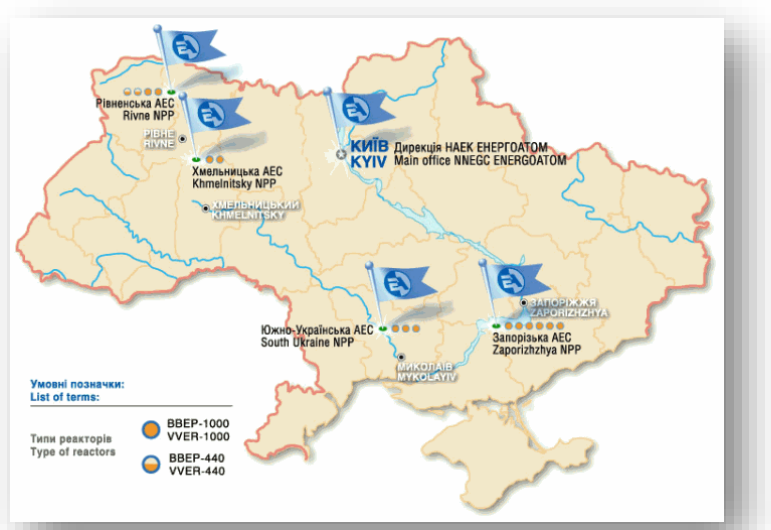
The European Union has also brought an antitrust case against Gazprom, because the company (widely believed to be a tool of Russia's foreign policy) is charging different rates to different countries depending on their cooperation with Russia on unrelated matters.

In conclusion the Ukrainian leaders understand clearly that in order to avoid any future Russian efforts to use energy supplies as a political weapon, Ukraine would have to reduce its dependence on Russian gas. This is the main reason why in 2015 Ukraine began to import significant amounts of gas from Poland, Hungary, and Slovakia.

In the long term perspective, Ukraine should improve exploitation of its conventional gas reserves and maybe to develop its own shale gas deposits. Other options could be the import gas from Azerbaijan, Central Asia, and elsewhere via pipelines through the EU's planned Southern Energy Corridor. Ukraine will also have to exert greater efforts on energy dialogue.

## Nuclear Power in Ukraine

The Ukrainian nuclear industry was closely involved with Russia for many years. It remained relatively stable during the changes that occurred when the country became independent from the former Soviet Union. In fact, during that period, and ever since, there were continuous improvements in the operational safety and output levels of Ukraine's nuclear reactors.




Ukraine is heavily dependent on nuclear energy – it has 15 reactors generating about half of its electricity and receives most of its nuclear services and nuclear fuel from Russia.

In 2004 Ukraine commissioned two large new reactors. The government plans to maintain nuclear share in electricity production to 2030, which will involve substantial new infrastructure.

The government is looking to the West for both technology for and investment in its nuclear plants as an attempt to reduce its dependence on Russia by buying nuclear fuel from US Company Westinghouse.

In March 2015 an agreement was signed by Ukraine's Ukrenergo distribution company and Polenergia, a Polish counterpart, to export electricity as part of the Ukraine-EU 'energy bridge', and related to the Baltic Energy Market Interconnection Plan.

## The missing link – conflicts in Syria and Ukraine

While the Syrian capital lies 3,000 km south of Kyiv, for some researchers these are two fronts in a same war aiming at blocking Ukraine's European integration. Publicly, no officials make such statement, but privately, a number of political analyses have claimed that the Russian leader's goal is at using the military intervention in Syria thus creating conditions for a refugee crisis in Europe. In such way, Russia expects to make a deal with

the West. It envisages the lifting of sanctions imposed on Russia and Western concessions regarding Ukraine, such as the recognition of Russian sovereignty over Crimea and the federalisation of Ukraine.

From the start of the Ukrainian crisis, Russia had three main goals. Firstly, Russia wanted to maintain dominance in Ukraine for both security and political reasons. Secondly, Russia needed Western economic sanctions to be lifted and thirdly, Russia needed to maintain its regime's stability. Breaking the economic sanctions imposed on Russia is its foremost priority in order to maintain the regime's stability.

By striving to implement its three main goals, Russia is demonstrating its military and organisational capabilities in Ukraine and Syria. Russia has demonstrated that it does not hesitate to use force in order to promote its interests. Moreover, Russia has demonstrated its ability to manage a new type of hybrid warfare, a high level of coordination and planning military operations. Additionally, Russia has used new types of modern weaponry. Many Western analysts and officials were surprised by Russia's military potential and the by the readiness of the Russian leadership's to use it.

So, the biggest question here is does Russia possess the necessary resources to deal with the West, fulfill its plans in the Middle East, and justify its title as a rising superpower?

At the present time, the Ukrainian conflict is causing Russia significant economic and political damage. The Western sanctions imposed on Russia, in combination with the Russian economic ineffectiveness, caused a contraction of its economy in 2015. However, it should be mentioned that the Russian economic stagnation began in 2013 before the imposition of Western sanctions, when energy resource prices were still very high. This fact demonstrates the Russian economy has serious structural problems.

An additional factor which weakens Russia's position in its confrontation with the West is the sharp fall of oil prices. As of the summer of 2014 until the end of 2015, oil prices have more than halved. Gas prices have also dropped. As a result, the Russian budget, which is greatly based on revenues from their energy resources, received much less capital. Russia's technological dependence (particularly in the oil production sphere) on the West is another factor which is weakening Russia's position. Thus, as with the current situation under Western sanctions, the possibility of significantly increasing oil production and developing new "difficult" oil fields is seemingly problematic.

Moreover, Russia will have to provide economic resources for the Donetsk and Luhansk regions of Ukraine, which have a population of about 3 million people and are currently controlled by pro-Russian militants. Additionally, Russia is providing significant economic support for Crimea, Abkhazia, South Ossetia and Transnistria.

It should also be mentioned that Russian intervention in Syria has caused the deterioration of Russian relations with Turkey, which is a considerable consumer of Russian gas and a potential hub for transportation of Russian gas to Europe. In addition, lifting sanctions

against the Iranian energy sector may push down oil prices. As a result, the Russian energy complex, which is responsible for much of the Russian government's revenue, will be forced to endure additional pressure.

So the answer of the question is that Russia is not apparently a rising superpower but rather a state which relative economic weight will continue too. Russia's ability to advance its interests depends largely on Western policy towards Ukraine and Western will to cooperate with Russia.

## Finding forecast

Ukraine's history has always been marked by the conflict between its East and West. Additionally Ukraine suffers from a deficiency of cohesive national identity and self-determination. Since the beginning of 21st century the sporadic internal destabilizations have been used by the pro-West streams to change the status of the Ukrainian territory – from a buffer zone to a territory integrated into Western sphere of influence, something which Russia identifies as a direct threat to its national security. The Ukrainian crisis, to a great extent, is a result of Russia striving to guarantee its trusteeship in Ukraine and prevent it from drifting towards the West.

Ukrainian territory has a strategic position in East Central Europe and the country is one of the natural resource leaders in Europe and the world in terms of the size of the explored coal resources. Ukraine's natural sources can ensure the country's independence of external energy suppliers (especially considering natural gas), what is equally important to guarantee its national security. The access to the existing and potential energy sources in Ukraine is one of the main reasons for political confrontations. The possible scenario is Ukraine not only to increase its gas production, but in particular the possibility to manage its gas fields and in the future gas hydrates in the Black Sea and Sea of Azov, may enable Ukraine to become a demanded gas exporter something that is completely unacceptable for Russia.

In terms of social politics, despite a history of strong pro-European movements (and two revolutions during nearly quarter century of independence), Ukraine has yet to entirely break with its post-Soviet attitude and overcome the oligarch-dominated political system.

The current competition to control Ukraine between Russia and the West has hardly any specific economic motives behind it. It is driven mainly by geopolitical interests. It's clear that the Russian government has done everything in its power to undermine Ukrainian government. Nothing that's happening in Ukraine is happening in a vacuum, and Russian policy has been consciously focused on maximizing economic pain and disorder. As result of this approach Russia regularly will deal heavy blows to Ukraine's certain industries and agriculture that further intensify the difficult economic situation. To date, the evidence unfortunately suggests that Russia's effort to economically strangle Ukraine's pro-

Western government is achieving its intended impact. The economic damage that Russia has suffered due to Western sanctions has been considerably compensated by the damage it has inflicted on Ukraine. The lesson that Russia has taken away from this experience is that if they just hold out a little while longer the aggressive Ukrainian government will simply collapse.

Keeping the regional division in current terms will draw Ukraine back several centuries ago. The southern and eastern parts of the country have historically been part of the Russian Empire and mostly populated with ethnic Russians and Russian-speaking Ukrainians. These regions have always had a very close cultural and economic relationship with Russia. Some western areas were part of Habsburg Austro-Hungarian state; others were brought into Ukraine only after the Second World War. The west has always been the core of Ukrainian national sense with strong pro-European inclinations. The continuous, long-standing social and ideological divisions and lack of effective state policy regarding Ukraine's diverse regions are at the core of every potential crisis. Ukrainian government officials have failed to address these problems for more than 20 years and still often confuse the public, consequently dividing the country even further.

Ukraine's advantageous geographical position makes it inevitable destination for transit of goods and passengers between Europe, Asia and Middle East. Through the territory of Ukraine pass a number of international transport corridors and one of the most extensive rail networks in Europe[20]. Today Ukraine is the largest natural gas transit country in the world. Ukrainian natural gas transportation system, which links world regions with the largest reserves of natural gas with European countries, with a high natural gas consumption, allows the country to be one of the key players in the natural gas business. On the other hand, Russia has been using its natural gas resources as a geopolitical tool for decades. Disputes between Russia and Ukraine over natural gas supplies, prices and debts have led to periodic interruptions in Russia's natural gas supply to the country. Ukrainian leaders understand clearly that in order to avoid any future Russian efforts to use energy supplies as a political weapon, Ukraine would have to reduce its dependence on Russian gas.

As a result of the "pro-" and "anti-" movements across the country the media interpretations create narratives of Ukraine that often appeared to be entirely different. Based on our research we can state that all sides to the conflict are using propaganda: Ukraine, Russia, the United States and other Western countries. But, for Russia, this task seems much easier to achieve, the centralization and mobilization of information resources in the hands of the state, providing the Russian foreign policy with means to galvanize public opinion regionally and overseas. Russian administration has succeeded in dominating the media landscape within his own country and parts of Ukraine. Next, the Kremlin will set its own narrative sights on a broader international audience.

We sustain the perception that the Syrian and the Ukrainian crises are two fronts in a same war that is aimed at blocking Ukraine's European integration. Many believe the Russian leader's aim is to use this military intervention in Syria to create conditions for refugee crisis in Europe. In this way, Russia expects to strike a deal with the West which will lead to lifting the sanctions imposed on Russia and Western concessions regarding Ukraine, such as recognition of Russian sovereignty over Crimea and federalising Ukraine.

Russia will have three main goals. Firstly, Russia is looking after maintain of dominance in Ukraine. Secondly, Russia will need Western economic sanctions to be lifted and thirdly, Russia will require stability of its presidential regime.

By striving to implement its three main goals, Russia will demonstrate its military and organisational capabilities in Ukraine and Syria. Russia has already demonstrated that does not hesitate to use force in order to promote its “tough enough” capabilities. Moreover, Russia will sustain its ability to manage types of hybrid warfare at any level.

It is very hard to predict the next move of the Russian President because of the nature of his rule. Russian decision-making process is not a result of an orderly standard that involves a number of key-actors whose positions are well-known. Decisions such as the annexation of Crimea or sending military troops in Syria are made by Putin himself. Starting his career in Russian secret services he is looking for every opportunity using the other side’s weaknesses. Therefore, whether Putin will escalate is determined by the resistance on the ground he meets, from Ukraine and from the EU and the United States. His overall goals are to control the post-Soviet space, to weaken EU cohesion, and to be treated as an equal by the United States.

The Russian leader may believe the war is undermining the Ukrainian economy and government much faster than Western sanctions and the economic crisis are weakening Russia’s economy. Putin also may believe that the Ukrainian President will eventually ask for some kind of a deal to end the conflict. Probably these provisions of agreement would include the resumption of Ukraine’s neutral status, significant autonomy for rebel-controlled territories, and a veto-right for those territories on issues of national importance such as applying for NATO membership or dealing with the EU. This approach seems to be more plausible if assumptions for the real Russian goals are correct.

Nevertheless, a Destabilized Ukraine further would make that price unaffordable. For that reason, further aggression by Russia appears unlikely at the moment. This is, however, a rational expectation, not a political guarantee.

Only one thing seems clear ahead – neither Russia nor the West can stand indifferently and look as a large state in Europe threatens to sink.

The EU’s credibility as a foreign policy player has been seriously dented, after the Dutch ‘NO’ vote in a referendum on Ukraine’s free trade and association deal on April 6, 2016.

This Association Agreement with the EU was at the heart of the crisis in the country in late 2013. The Association Agreement is part of a wider network of relations that Ukraine has with the EU. These involve a bargain: Ukraine gets greater access to the EU and aid money in return for commitments to often difficult and unpopular policy reforms. Ukrainians are in the process of being granted the right to travel visa-free as tourists within the EU after a process of reform in its border control systems.

In this regard many have said the Dutch 'NO' vote is a win for Russia's geopolitical game in Europe. "*The outcome of the referendum will not immediately influence the EU's relationship with Russia, but Russia will use the 'No' vote as part of its narrative and say that obviously the European people agree that Ukraine is run by corrupt criminals,*" said Rem Korteweg, senior research fellow at the Centre for European Reform, a think-tank in London, "*In so doing, it helps the Kremlin build support for its position in Europe*".

To sum up, since 2016, Ukraine's agreement on EU association has started to gain speed. However, despite average Ukrainian expectations, it is unlikely to bring them some form of improvement. Ukrainian products don't comply with European certification, so the markets of Western countries are closed. After the Russian sanctions, the East direction is lost too. The planned EU visa regime abolition would most likely not happen in 2016. It will encourage civil protest to grow and probably it will create a new radical nationalist coalition that will speak out against the current president and the government. In addition, it will increase the separatist movements. In other Southeast regions, some protests will occur more frequently, but a large-scale military movement is unlikely without support from Russia or the use of Donetsk and Lugansk republics as proxy actors.

The Russia-Ukraine relations at the political level should not expect a breakthrough in close future. As we discovered Russia chose a strategy of exhaustion, the economy of Ukraine is close to collapse. Kyiv is bankrupt, dependent on Russian energy resources and mutual sanctions regime. As for military intervention, Russia is ready to interfere in the territories of the DPR and/or the LPR, should it be provoked by Kyiv and their NATO allies' actions, but we can hardly expect Russian military intervention in the rest of Ukraine.

Freezing the situation in Ukraine by not fully implementing the 12-point Minsk Peace Plan but simply de-escalating the conflict, serves Putin well because it allows him to turn on and off the conflict at will. "A frozen conflict can always be unfrozen," said Jacek Saryusk-Wolski, a Polish center-right EU lawmaker active in Western efforts to integrate Kiev. "He wants to be able to control the conflict and block Ukraine in its European course".[21]

However, the more efficient mechanism for Russia is the influence through the EU, exploiting divisions between the member states. As the EU and Russia's official relations are minimized, it will not be so easy. It is likely that Putin will use his personal friends such as Silvio Berlusconi in Italy and Gerhard Schroeder in Germany, to influence the political situation in Europe.

Even in the context of his own ambitions, the West must certainly be prepared for all contingencies: if Russia were to commit acts of aggression beyond Crimea, or use military threats to intimidate or take any other steps to destabilise the situation, then wide-ranging, painful sanctions imposed by the West would become inevitable. For this reason, the West will make every effort to give Ukraine economic and political support on its chosen path and in doing so, will be dependent on some measure of cooperation with Russia. To that extent, the West must continue to engage with Russia. Ukraine needs to connect to Western markets, norms and ideas just as much as it needs continued access to Russian markets, reliable gas supplies and stable relations with its neighbour to the east.

However this is all but easy to accomplish. Ukraine developed a unique corruption model that affects the population. Understanding the fact that the country's European integration is only a slogan, and all funds allocated for earmarked projects immediately go into the responsible officials' pockets, a crisis of confidence for the EU is evident. Therefore, new loans and economic aid packages are unlikely because Ukraine is on the edge of default. The pragmatic, in terms of their own problems, Europeans would not want to see themselves too deeply involved with Ukrainian specifics.

Most likely, the solution for the Ukrainian crisis will be found during consultations between Washington and Moscow. Kerry arrived in Moscow 10 days after Putin announced he was withdrawing the majority of Russia's military force in Syria.

As already mentioned, the conflicts in Ukraine and in Syria are interconnected and this visit proves that some of Russia's military intervention goals in Syria are achieved. According to many observers, U.S. Secretary of State John Kerry's visit was different from the previous ones in its atmosphere, which was notable for the absence of the tension that used to characterise relations between the two countries in the last two years. With regard to Ukraine, Kerry repeated that the U.S. President Barack Obama is willing to lift the sanctions against Russia only if the Minsk Agreements - the road map to peace in Eastern Ukraine, were implemented. Experts underlined that Moscow and Washington have confirmed that there is no alternative to the Minsk process. Apparently, Russia and the United States have emerged as the two major external powers with a decisive say in what happens next in Ukraine and Syria. The others just will follow suit.

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# HYBRID WARFARE: THE COMPREHENSIVE APPROACH IN THE OFFENSE

***Christopher Kremidas***

*Traditional militaries find it hard to respond to hybrid warfare. The collective defense might find it hard to argue on the source of the conflict making response difficult. Also, to counter a hybrid threat, hard power is often insufficient. Often the conflict evolves under the radar and even a "rapid" response turns out to be too late. Overwhelming force is an insufficient deterrent. Many traditional militaries lack the flexibility to shift priorities, and objectives on a constant basis.*

## Introduction

Through the use of broad spectrum techniques and pathways to destabilize and weaken neighboring nations, Russia and China have been using hybrid warfare to expand their influence and gain territory. Alliances and nations have been unable to respond effectively due to this aggression being exercised just below the threshold of open warfare, while the aggressors achieve their political aims at limited expense.

NATO and EU efforts to address hybrid warfare, while promising, are unlikely to succeed since they are neither broad enough in scope nor sufficiently integrated. This is because they see hybrid warfare as a new set of techniques for aggression rather than what it really is; the comprehensive approach in the offense.

## The Comprehensive Approach

The Comprehensive Approach (CA) is a way to achieve a common understanding and approach among all actors of the International Community through the coordination and de-confliction of political, development and security efforts in solving an international crisis.

A strategic and operational level process was needed to build coherency among these many actors and it has been called the Comprehensive Approach (CA). CA focuses on building a shared understanding of the problem, developing a shared overarching vision of the solution and facilitating coordination of effort while respecting the roles and individual mandates of multiple entities.

At the Lisbon Summit in November 2010 and in its new Strategic Concept, the Alliance "*…decided to enhance NATO's contribution to a comprehensive approach to crisis*

*management as part of the international community's effort and to improve NATO's ability to deliver stabilization and reconstruction effects*".

The effective implementation of a comprehensive approach requires all actors to work together with a shared sense of responsibility and openness, taking into account and respecting each other's strengths, mandates and roles, not to mention their decision-making autonomy. In other words, the Comprehensive Approach is not hierarchical but rather it is a collaborative effort among equals.

NATO's experience from operations, including Afghanistan and in addressing piracy, has demonstrated that managing complex conflicts and crises requires a wide range of internal and external actors, including governments, civil society, the private sector and international agencies, to work together in a coherent and coordinated effort.

In a Comprehensive Approach, the security forces can provide a secure space to enable other actors to meet immediate humanitarian needs, build local trust, and address the root causes of problems causing the crisis. It is the expansion of this space, the enabling of governance, and the building of trust in a society that is at the very heart of the Comprehensive Approach.

## Hybrid warfare: the Comprehensive Approach in the offense

The concept of hybrid warfare is broadly defined as the mix of conventional and unconventional, military and non-military, overt and covert actions employed in a coordinated manner to achieve specific objectives while remaining below the threshold of formally declared warfare.

Since 2014, Russia has used these broad-spectrum tactics to wrest Crimea from Ukrainian control and subsequently annex it into the Russian federation. More recently, China has been employing a similar approach in the South China Sea and to a lesser extent; Da'esh has used a similar approach in Syria and Iraq.

Looking through the military and security lens, Hybrid Warfare appears to target critical vulnerabilities and seeks to create ambiguity in order to hinder swift and effective decision-making. Taking a broader perspective, Hybrid Warfare is actually the comprehensive approach (CA) in the offense. Where CA seeks to create space for friendly actors to strengthen governance, hybrid warfare seeks to shrink it.

Where CA strengthens and enables governance, hybrid warfare weakens it. Where CA seeks to build trust and societal cohesion, Hybrid Warfare seeks to sow mistrust and confusion between segments of the population as well as between the people and their government.

Where CA seeks to heal a society's divisions and seek reconciliation, Hybrid Warfare targets a society's deepest historical wounds to make them bleed again.

There are a wide range of measures applied as part of a hybrid campaign; from cyber-attacks on critical information systems, through the disruption of critical services, such as energy supplies or financial services, to undermining public trust in government institutions or exploiting social vulnerabilities. Once a state is weakened sufficiently, the aggressor's strategic aims can, if necessary, consummated by the use of conventional or paramilitary forces.

Both Russia and China have employed hybrid warfare in recent years, often successfully achieving their political aims. It was used by Russia against Estonia in 2007, Georgia in 2008, and eastern Ukraine in 2014. China has gradually expanded its control and influence in the South China Sea by constructing artificial islands, sending armed fishermen to patrol claimed territorial waters, and declaring and declaring an air identification zone in the same space. It is easy to surmise that their next steps will be to establish military bases on these islands, thus cementing their claim to the territory - without firing a shot.

In both cases, these states applied a full spectrum of economic, legal, information, cyber, and paramilitary means to achieve their objectives in a slow and ambiguous manner so as to not cross any threshold which would trigger collective military action in response. As recent history tells us, hybrid warfare lowers the political price for aggression, making regime change and territorial annexation possible "on the cheap."

In the Asia-Pacific region, the task of addressing hybrid warfare is more difficult given the lack of mature regional security structures nor a consensus among nations to multilaterally push back against Chinese revisionism.

While Russian hybrid warfare does present a new challenge to NATO, the EU, and their member states, unlike nations in the Asia-Pacific region, they are in a much better position to address it if they work together effectively.

## NATO and EU responses to hybrid warfare

In response to Russian hybrid warfare in 2014, NATO adopted the Readiness Action Plan (RAP) as a means of responding rapidly to new threats as they present themselves along the eastern and southern flanks.

More recently, NATO adopted a Hybrid Warfare Strategy in December 2015 and the European Union adopted its Joint Framework for Addressing Hybrid Threats in April 2016. Both documents speak to working in conjunction with a variety of actors in order to improve resiliency, security, and continuity of governance in the face of hybrid threats. At the same time, both documents call for greater NATO-EU cooperation in addressing hybrid threats and the staffs of both organizations have worked together to agree upon a number of areas where they can focus their cooperative efforts.

Both NATO and the EU are applying some (but not all) of the principles of the Comprehensive Approach as they address the challenges of hybrid warfare. But even these efforts are not likely to prove sufficient in dealing with the broader challenge of hybrid warfare since they do not address the full spectrum of possible pathways used by an aggressor nor do they integrate both vertically and horizontally across nations, organizations, and potentially supporting sister agencies in other nations.

## A Comprehensive Approach in response to a Comprehensive Approach

So far, the Kremlin's short term gains since 2014 have led to crippling EU economic sanctions, a robust counter-messaging effort, and NATO returning to its collective defense roots. But even these efforts can trigger an increase in efforts to erode Alliance cohesion, break EU unity on economic sanctions, and create more unrest among Russian minority populations in Central and Eastern Europe.

So, what would a Comprehensive Approach to addressing Hybrid Warfare look like? In order to know for certain, it would require the actors to come together to work through the stages of conducting a common assessment of the challenges, developing common approaches to address them, and planning for coordinated actions among nations and organizations. Until then, there are some indications of what their results may look like.

Building on the previous work within NATO, the EU, and their members states in addressing Hybrid Warfare, a comprehensive approach could seek to more coherently contain the Russian use of organized crime as an instrument of state power.

A comprehensive approach would address how to prevent them from moving money and buying influence within European nations. It would identify how to use many of the same used techniques to contain and disrupt organized crime since the Kremlin, like organized criminal groups, relies on the use of the legitimate economy to move money to achieve many of its aggressive aims.

The inclusion of real estate, business law, and transparency expertise could help to identify ways to thwart the Russian use of front companies and real estate holdings in major European capitals which launder money and support destabilizing elements. In many cases, transparency can prove to be a helpful offset.

To be prepared for extreme cases, contingency plans could be formulated to ban Russian financial institutions from the SWIFT network, which processes global secure financial transactions.

Good progress has already been made on addressing Russia's ability to use of energy as a weapon but it remains unmoored from a broader comprehensive approach which includes how to convince Russia to abandon aggression and reintegrate into the international community as a trusted partner.

## Recommendations for a Comprehensive Approach to addressing hybrid warfare

Taking into account the increasing recognition of the Comprehensive Approach as an essential process to improving coordination among various actors in solving major security challenges, the following recommendations are offered.

First, a comprehensive approach to address Russian hybrid warfare will require a more extensive assessment phase than when conducting this process for crisis response. In this case, the common assessment also requires a 'red-teaming' effort from a CA perspective. This involves a brutally honest self-assessment (at the national and multilateral levels) of government and societal weaknesses, vulnerabilities, and historical grievances. By seeing our vulnerabilities and weaknesses through our adversaries' eyes, we'll be more able to target our resilience efforts with far fewer blind spots.

Secondly, the effort must truly be a whole of government, whole of system comprehensive approach. This will require a higher level of NATO, EU, financial sector, and national government trust and collaboration with less focus on defending institutional roles and more effort on establishing supported and supporting relationships among nations and international organizations.

Thirdly, it is important to recognize the vital role of law enforcement, private sector (to include banks and financial institutions), cyber, strategic communications and media, and energy sector collaboration but also to integrate their efforts with broader economic, communications, and security measures. These same efforts should also be integrated into global efforts to combat illicit finance and trade.

Finally, while these efforts can produce a coherent full spectrum regional effort to address Russian hybrid warfare, a similar comprehensive approach effort is urgently needed for the Asia-Pacific region.

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