JRC Technical Report

Identifying challenges in Disaster Risk Reduction:

Risk Data Hub for Disaster Risk Management

Workshop

28 – 29 June 2017

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Abstract

The Workshop on **"**Identifying challenges in Disaster Risk Reduction" held in Varese, Italy on 28 -29 of June 2017 aimed to improve the knowledge base on Disaster Risk Assessment (DRA) that could contribute to the potential development of the updated version of EU Guidelines for Risk Assessment and Mapping for Disaster Management**.** The DRMKC Risk Data Hub will become the tool for centralized collection of available knowledge, which will facilitate the identification of gaps. Challenges common to a large number of Disaster Risk Reduction (DRR) initiatives were identified and discussed. Challenging at local, national and international levels for top down strategies and bottom up actions for DRR is to underline the scope, importance and applicability of different methodologies, data usage and actions for different scales.
With this workshop, the DRMKC planned to identify main challenges for DRR focusing the attention on two hazards: floods and drought. To accomplish its objectives, the workshop brought together: experts of flood and drought disaster risk, member states experts with experience in disaster risk assessment at national level and national Web platform developers experienced in disaster risk mapping.

Participants

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1. Motivation and objectives of the workshop

The Disaster Risk Management Knowledge Centre (DRMKC) is a focal point of reference in the European Commission that supports the development of DRM related actions. Some of the core activities of the DRMKC are:

- Contribute to the potential development of an updated version of the EU Guidelines for Risk Assessment and Mapping for Disaster Management[1]
- Develop a Risk Data Hub, an EU wide web-based platform focusing on dissemination and visualisation of data, tools and methodologies (started in 2017).
- Develop an interface for centralised collection of Loss and damages data at National level (pilot project started in 2017)

In the context of the Union Civil Protection Mechanism (UCPM)[2], the European Commission provides the legal basis to regularly produce an overview of natural and man-made risks the EU may face. National Risk Assessments (NRA) produced by EU Member States and participating states in the Union Civil Protection Mechanism are the main source of disaster risk evidence on which this overview is developed.

Furthermore, as part of its commitments for the implementation of the Sendai framework for Disaster Risk Reduction[3], the European Commission aims to enhance disaster risk knowledge across all EU policies.

Directly linked with these developments, the Workshop on **"Identifying challenges in Disaster Risk Reduction"** intends to improve the knowledge base on Disaster Risk Assessment (DRA) that could contribute to the potential development of the updated version of EU Guidelines for Risk Assessment and Mapping for Disaster Management and the DRMKC Risk Data Hub.

According to our experience, three important challenges closely linked are essential for a successful Disaster Risk Reduction:

1.1. A bottom-up methodological approach for disaster risk assessment

Discussions:

- Disaster risk assessment is set on identifying the geographically located causal factors of disasters, including exposure to hazards, vulnerability of people and property, land use and environment. This is important since an inventory based disaster risk assessment linked to individual assets/exposure, can be easily integrated with preparedness, resilience and financing schemes (top-down actions) that are linked at property/asset level.
- Advised methodological approach at local level supports a probabilistic/quantitative risk assessment based on the relation: hazard, exposure, vulnerability/coping capacity. The risk should be considered as a probability of the impact/damage, a plot of a temporal probability against the total consequences (risk curve).
- A local scale, disaster risk assessment requires highly accurate and scope (sector) selected hazard definition. In the case of drought and river floods, the risk drivers are part of different

[1] Commission Staff Working Document, Risk Assessment and Mapping Guidelines for Disaster Management, SEC(2010) 1626 final, 21.12.2010

[2] Decision No 1313/2013/EU of the European Parliament and of the Council of 17 December 2013 on a Union Civil Protection Mechanism, *Official Journal of the European Union,* L (347), 20.12.2013

[3] Action Plan on the Sendai Framework for Disaster Risk Reduction 2015-2030: a disaster risk-informed approach for all EU policies, SWD(2016)205 final/2, 17.6.2016

domains requiring hazard definition based on different concepts (for river floods importance is transferred to location and temporal probability while for drought a more complex relation of a sectorial vulnerability and temporal probability).

- **<u>Foreseen objectives (applied to river flood and drought</u>)**:
- evaluate the disaster risk assessment based on a bottom-up approach, focused on a local, geographically located causal factors;
- select the most suitable hazard for river flood and drought DRA considering the hazard type, scale, data availability;
- evaluate the quantitative and probabilistic approach (risk is the probability of the impact/damage) at local scale;
- evaluate acceptable risk and non-acceptable risk as a relation of Impact and Likelihood;

1.2. The need of development of exposure datasets with national scope and local scale

Discussions:

- Exposure and vulnerability are the main drivers of risk and the only drivers that are manageable. We cannot manage the hazard. Therefore, there is a need to know and measure the exposure to hazard, since "we cannot manage what we cannot measure".
- A great wealth of tools (Hazus, Rasor, Selena, etc.) and methodologies are developed for generating vulnerability or fragility curves, the most complex action in disaster risk assessment. Vulnerability assessment is explicitly linked with the attributes/metrics of exposure (build up space, land use, infrastructure, demography, environment etc.). This information is often available only at local scale part of cadastral plans, critical infrastructure engineering, census, etc., and administrated by different institutions at national level making difficult to be accessed. Therefore, there is a need of optimize the access to exposure datasets with national scope and local scale.

- **<u>Foreseen objectives (applied to river flood and drought):</u>**
- Assess the importance of exposure datasets with local scale;
- characterize the elements at risk (buildings, population, infrastructure, land use etc.) in relation to types of hazard, scale, scope;
- decide among different metrics of exposure for the vulnerability assessment considering the scope, scale and hazard type;
- evaluate the possibility of having exposure datasets with local scale and national scope;

1.3. Disaster Risk mapping

Discussions:

- A successful DRR results from the combination of top-down, strategies, with bottom-up, methodological approaches. The top–down approach refers more to administrative directives, organizations, and operational skills linked with the management of the risk and reflects more the policy component. The bottom-up approach is linked to the analyse of the causal factors of disasters, including exposure to hazards, vulnerability, coping capacity, and reflects more the practice component. In the context of disaster science, policy and practice are often disconnected. This is evident in the dominant top-down DRM strategies utilizing global actions on one hand and the context specific nature of the bottom-up approach based on local action and knowledge. A way to bridge the gap between practice and policy is to develop a spatial data infrastructure of the type of a GIS based risk mapping. It is a way of linking data information and decision support system (DSS) on a common ground that becomes a “battlefield of knowledge and actions”.

- Risk mapping becomes in the context of the bottom-up approach an exercise of aggregation from local to national level of the disaster risk information. What remains after a disaster risk assessment done at local scale is finding the way of aggregating the information to higher geographical scale (national, regional) preserving not only the accuracy of the information but also the scope (sector based, hazard based, likelihood based to assess the acceptability of a risk etc.).

- **Foreseen objectives (applied to river flood and drought):**

- evaluate the national/regional disaster risk mapping as an exercise of aggregating risk information from local level;
- assess the aggregation at higher administration level based on different factors (scope, sector, hazard, likelihood);
- evaluate the impact on Disaster Risk Management actions based on the disaster risk information up scaled at national/regional level;

Overall Objectives

The greater objective of the proposed workshop is to enhance top-down strategies with bottom-up initiatives across different scales for fostering the actions for DRR. Challenging at local, national and international levels for the bottom up and the top down approaches in DRR is to underline the role and importance of different methodologies, data availability and actions for different scales. Following this context the core objectives of the workshop proposes to:

1. Promote a bottom up approach in order to achieve the objectives of DRR.

2. Identify practices associated with risk data information (data, tools, methodologies) that enhance the link between scale and scope.

3. Enhance the use of local data in risk assessment applications with local benefit.

4. Promote an exposure inventory database with national scope and local scale.

5. Support disaster risk mapping as an essential component of risk management.

6. Present good practice through which technologies (GIS web platforms) have proven to be highly effective tools for fostering disaster management.

7. Enable the research expertise for the national risk assessment (NRA)

8. Capitalise on the existing knowledge, networks, tools, methods and data and to support their broad dissemination and technology transfer to optimize resources and to move to a more homogeneous approach.

2. Presentations

The DRMKC planned to discuss main challenges for Disaster Risk Reduction focusing the attention on two considered hazards: floods and drought. To accomplish its objectives the workshop brought together experts on flood and drought disaster risk, member states experts with experience in disaster risk assessment at national level and Web platform developers experienced in disaster risk mapping.

The first day of the workshop started with an introduction of the DRMKC followed by presentations on two of its supporting initiatives for the development of DRM related actions: the potential development of an updated version of the EU Guidelines for Risk Assessment and Mapping for Disaster Management and the development of the Risk Data Hub. Next, experts' presentations on drought risk assessment underlined methodological approaches on risk assessment, exposed datasets and projects on European and national level and presented scientific and technological developments for disaster risk mapping. The second day flood experts' presentations followed a close development of the workshop directing more the discussions on the national approaches and challenges for flood risk assessment in terms of methodologies, data usage and implementation. A more detailed view of the presentations it is presented in the summaries endorsed in following part of the report. Conclusions and remarks of the discussions held after the presentations sessions were collected, structured and presented at the end of this report.

A. Introduction

Disaster Risk Management Centre

Montserrat Marin Ferrer – DRMKC, European Commission, Joint Research Centre

The policy context emphasises the need for a stronger interface between science and policy in DRM at local, national, European and global levels. In this context, the Disaster Risk Management Knowledge Centre (DRMKC) becomes a point of reference in the European Commission that provides a networked approach to the science-policy interface in DRM. The need to improve the use of scientific knowledge is now widely acknowledged and DRMKC propose to: improve the knowledge base support to both Policy Makers and practitioners through science based services and analysis, integrate the technology and scientific knowledge in DRM, support the translation of complex scientific data and analyses into usable information and bring together existing initiatives in which science and innovative practices contribute to the management of disaster risks.

The DRMKC is built on three pillars (**Fig. 1**): *partnership* – fostering EU-level disaster science networks; *knowledge* – pooling of information and granting access to scientific results, and *innovation* – implementing a Support System for Member States providing scientific and technical advice.

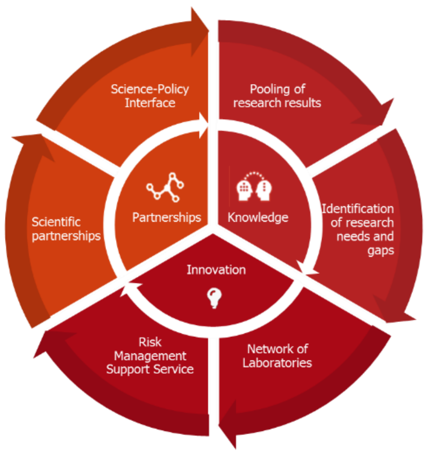


Figure 1. The three main pillars of DRMKC

In practice, DRMKC contributes with:

- Promoting and facilitating the sharing of knowledge, best practices and methodologies in DRM at all levels, lessons learnt, disaster loss accounting and risk assessments. Good example: the Global Flood Partnership, Global Tsunami Informal Monitoring Service (GTIMS), Global Disaster Alert and Coordination System (GDACS) etc. Moreover, it enhances the JRC Collaboration with UNISDR on National Risk Assessment Guidelines, INFORM Index for Risk Management and Loss Data Challenge - collaboration with OECD and UNISDR.

- The production of two flagship publications for sharing information, reducing the knowledge gaps and improving the use and exploitation of research results and technology: 'DRMKC Newsletter'- bimonthly publication recording information on recent activities, future events, key messages from European Commission Services and Member States and 'Science Report in DRM', providing reviews of scientific solutions and their practical use in various area of DRM. In addition, disseminates information through DRMKC website (http://drmkc.jrc.ec.europa.eu/) and structured information regarding on-going DRR and DRM related projects through DRMKC Project Explorer.
- A Support System that facilitates the use of existing expertise to help Member States meet risk management related obligations – DRM Capabilities Assessment, Disaster Loss Databases, Science-policy interfaces, National Risk Assessment. Moreover, DRMKC assists in building globally common standards, through the European Network for Innovation Test Beds (ENITB) and the European Crisis Management Laboratory (ECML).

Overview of National Risk Assessment

Ainara Casajus Valles– DRMKC, European Commission, Joint Research Centre

Detecting and valuing the dimensions of vulnerability, capacity and exposure of individuals and assets is a starting-point to guide and inform disaster risk reduction policies and plans. National Risk Assessment (NRA) is also a valuable source of information for raising awareness and understanding to different stakeholders, informing land-use, designing monitoring systems, defining strategies to transfer risk, etc.

The Union Civil Protection Mechanism (Decision No 1313/2013/EU) calls Member States to develop risk assessments periodically, handling the summary of it to the European Commission in order to promote an effective and coherent approach for disaster risk prevention and preparedness. Based on the documents received, it is concluded that nowadays countries regularly identify events that would negatively affect their economy, population and environment. For its analysis, scenarios are built, generally illustrating an adverse but reasonable worst case. The opinion of experts is largely used through the whole process, together with historical records and databases of different nature. Some points could be improved for future assessments, such as the dynamism nature of risk, the input of several data-information-knowledge sources, and the need to move towards quantitative methods.

The NRA can be useful to deal with some of the DRR Challenges presented in the workshop:
- Throughout the NRA process, the areas that would need further development will easily emerge, such as the gaps in data for the models and the scenarios built, advocating for databases to be designed and/or updated. Likewise, data would need to be collected considering the expected changes in exposure and vulnerability and the relevant impacts of the NRA.
- Although the results of NRA have a national scope, it would be necessary to implement mechanisms with many institutions and groups at different governance levels to collect data, understand community perception and have the expertise in place to carry out the assessment.

Establishing a mechanism that can improve disaster risk information exchange: Risk Data Hub

Tiberiu Antofie – DRMKC, European Commission, Joint Research Centre

One of the objectives of the DRMKC is to advance technologies and capacities in disaster risk and crisis management. The DRMKC RiskData Hub is the resource intended to improve the access and share of curated EU-wide risk data for fostering DRM.
The presentation of RiskData Hub followed the challenges that were communicated in the motivations and objectives of the workshop: a bottom-up methodological approach for disaster risk assessment, risk mapping becoming an exercise of aggregation from local to national level of the disaster risk information, the need of development of exposure datasets with national scope and local scale.

RiskData Hub propose a cross scale access to risk data starting from local to national level **(Fig 2.).** The reason is that, generally, disaster risk assessment is set on identifying the geographically located causal factors of disasters. By quantifying the elements at risk affected (exposure to hazards of: population, assets/properties, infrastructure, land use etc.) RiskData Hub is trying to induce the need of knowing the drivers of risk first. Return periods, scenarios and climate change associated with the extreme events (hazards) will be considered when measuring the exposure. Vulnerability is not mapped in this simple context on the RiskData hub, since vulnerability assessment would explicitly be linked, at local scale, to attributes/metrics of exposure, data that is still needed to be discovered at national level.

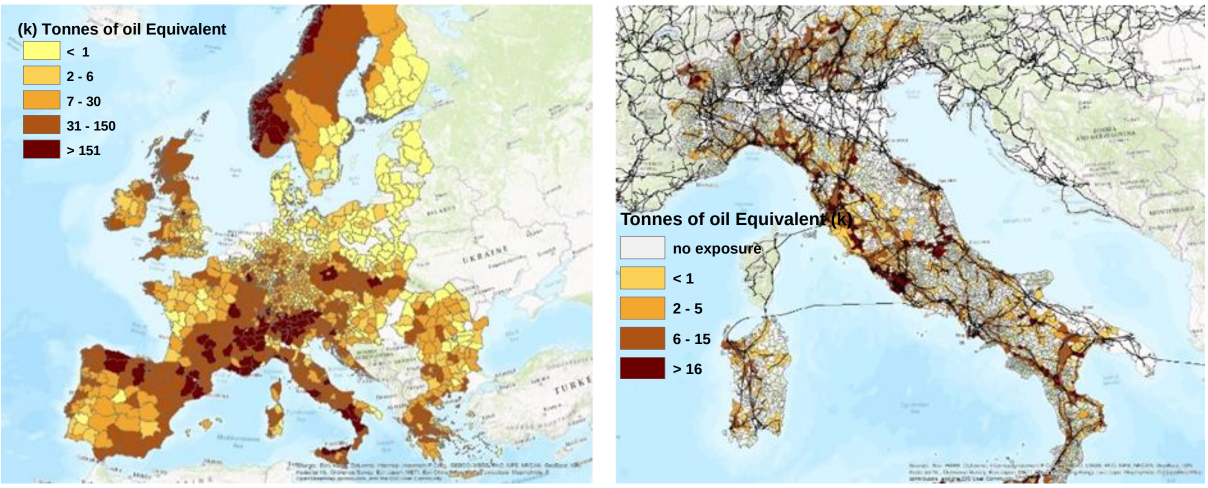


Figure 2. Electricity network measured on landslide susceptible area at subnational level (NUTS 3, LAU level)

Establishing links up to local scale will be relevant for the data quality, accuracy of the vulnerability or risk assessment but also contribute to the reducing of uncertainty. With this approach, RiskData Hub supports a bottom-up probabilistic risk assessment methodological approach. The risk is considered as the probability of the impact/damage, a plot of a temporal probability against the consequences (risk curve). In addition, risk mapping becomes in this context of bottom-up approach an exercise of aggregation from local to national scale of the disaster risk information. Disaster risk assessment done at local scale is aggregated to higher geographical scale (national, regional) preserving not only the accuracy of the information but also the scope (sector based, hazard based, likelihood based to assess the acceptability of a risk etc.).
In order to support the development of a crossed-scale approach linking to detailed local data, RiskData Hub will provide a technical solution for discovering exposure datasets with national scope and local scale. This technical solution will allow member states to collect and manage their datasets. Apart from providing access to geospatial data the RiskData Hub also enable hyperlinks. This approach will be an added value improving the institutional linkages and better connect platforms in areas of common interest.

B. Drought Panel: Experts presentations on Drought Risk Assessment

Drought Exposure, Vulnerability and Risk: JRC Assessment at the Global Scale

Gustavo Naumann - European Commission, Joint Research Centre

A global map of drought risk has been elaborated at the sub-national administrative level. The motivation for this study is the observation that little research and no concerted efforts have been made at the global level to provide a consistent and equitable drought risk management framework for multiple regions, population groups and economic sectors. Drought risk is assessed for the period 2000– 2014 and is based on the product of three independent determinants: hazard, exposure and vulnerability. Drought hazard is derived from a non-parametric analysis of historical precipitation deficits at the 0.58; drought exposure is based on a non-parametric aggregation of gridded indicators of population and livestock densities, crop cover and water stress; and drought vulnerability is computed as the arithmetic composite of high level factors of social, economic and infrastructural indicators, collected at both the national and sub-national levels **(Fig. 3).** The performance evaluation

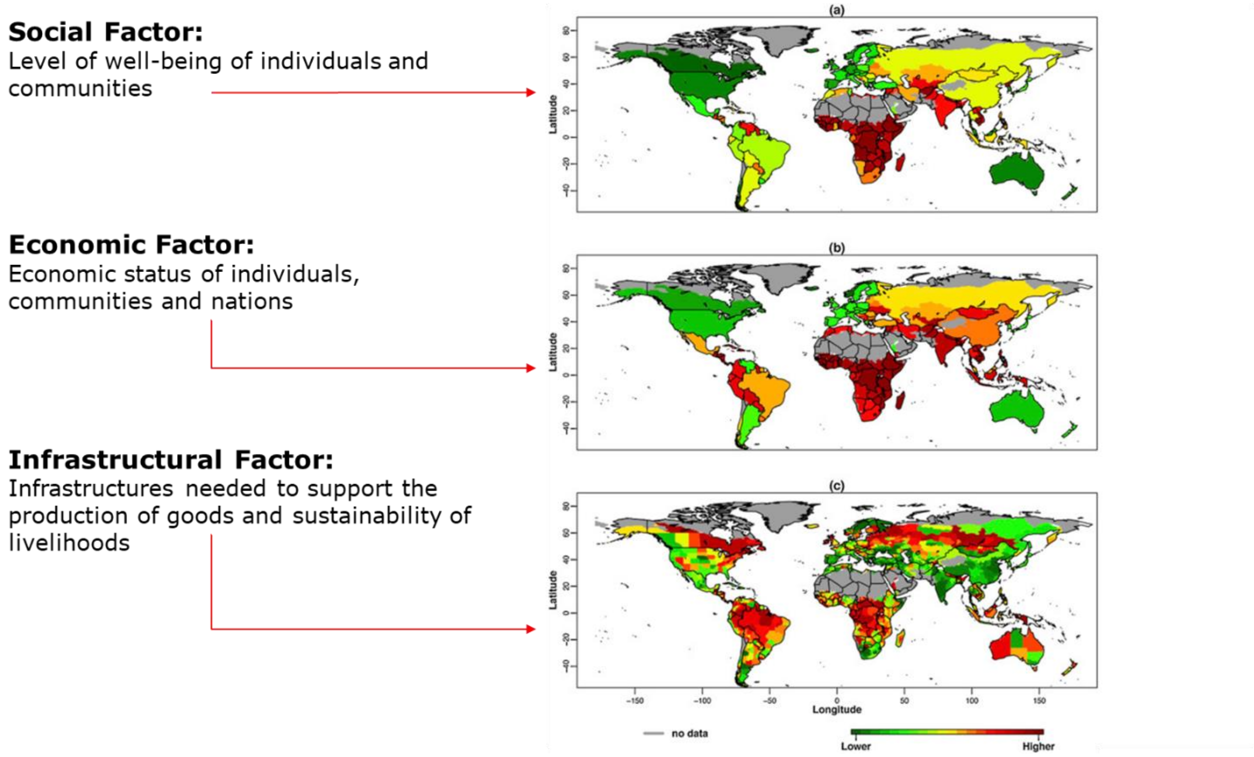


Figure 3. Proxy Indicators of Vulnerability Factors used for Drought assessment at global level (Carrao, et. al., 2016)

of the proposed models underlines their statistical robustness and emphasizes an empirical resemblance between the geographic patterns of potential drought impacts and previous results presented in the literature. Our findings support the idea that drought risk is driven by an exponential growth of regional exposure, while hazard and vulnerability exhibit a weaker relationship with the geographic distribution of risk values. Drought risk is lower for remote regions, such as tundras and tropical forests, and higher for populated areas and regions extensively exploited for crop production and livestock farming, such as South-Central Asia, Southeast of South America, Central Europe and Southeast of the United States. As climate change projections foresee an increase of drought frequency and intensity for these regions, then there is an aggravated risk for global food security and potential for civil conflict in the medium- to long-term. Since most agricultural regions show high infrastructural vulnerability to drought, then regional adaptation to climate change may begin through implementing and fostering the widespread use of irrigation and rainwater harvesting systems. In this context, reduction in drought risk may also benefit from diversifying regional economies on different sectors of activity and reducing the dependence of their GDP on agriculture.

Learning from the past - an online Database of European Drought Characteristics and Impacts

Lena Merete Tallaksen - University of Oslo

The presentation highlighted the development of a European database on reported drought impacts (EDII - http://www.geo.uio.no/edc/droughtdb/index.php). Developed within the EU-FP-7 project DROUGHT-R&SPI the EDII aims to evaluate the availability and use of drought impact information and to provide a new view on drought impacts across Europe. It intends to establish a link between drought indices and the directly observable impacts across a wide range of sectors. In this sense, the EDII becomes a capable source for spatial and temporal information on impacts and their cause, which is essential for drought policy planning at national and pan-European levels. The source of drought impact inventory is variate, differ by region and change over time and includes scientific and governmental sources, private sector reports, theses, scientific articles, newspapers, NGO reports, books and divers online sources. In addition, through a website interface, users can submit drought impact data, which will become a part of the database. The EDII is structured into five primary sections that include the following information on the reported impact: reference, location, timing, description, and secondary impacts/response measure. The drought impact reports in the EDII cover 33 countries, with a geographical imbalance in the distribution of entered reports per country due to availability. In terms of organizing the impact information, the EDII database is structured following a classification scheme of impact categories **(Fig.4)** and subordinate impact types.

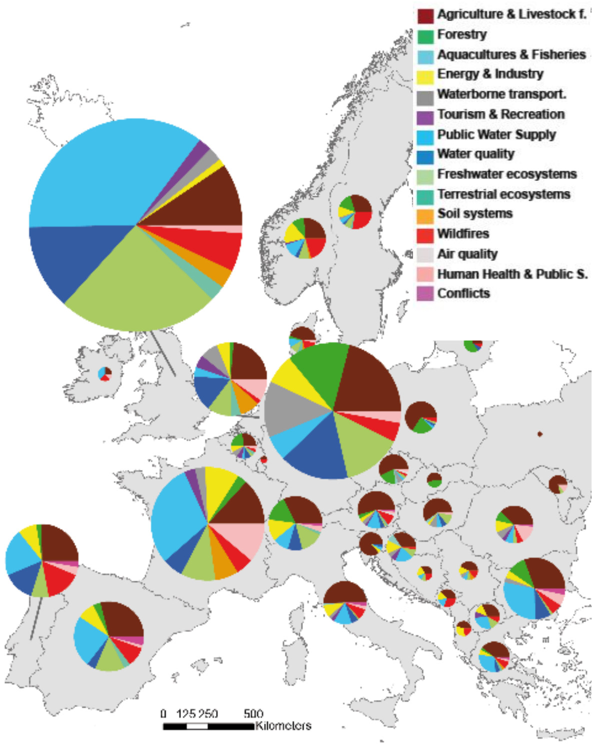


Figure 4. Proportion of impact categories reported by country

Being designed to consolidate drought knowledge, the EDII creates basis for studies relating physical characteristics of the natural hazard of drought events to their various impacts (Stahl, et. al., 2016). It establishes a data source for studies linking the hydrological characteristics of droughts with their effects on society at large. It may also provide the necessary link to evaluate whether drought metrics can predict impacts. For future development it was indicated a further assessment of the representativeness of the database with respect to European drought impacts and their severity. In addition, a continuous updating and uploading of impact data into the database along with a continuous effort to improve the quality of its content it is was recognized.

Drought risk at a pan-European scale

Veit Blauhut – University of Freiburg

Drought risk in describes the probability of socio-economic and environmental systems to suffer negative consequences. In the framework of risk assessment, drought risk can be estimated from the risk analysis or vulnerability assessment perspective, combining hazard information either with (I) a quantification of impacts (damage) as a proxy for vulnerability: the impact approach, or with (II) a combination of vulnerability factors: the factor approach. Impact approaches mainly focus on specific sectors, whereas the majority of factor approaches estimates risk for entire systems. For both approaches, criteria for indices and factor selection applied are rather based on expert knowledge than empirical context. A novel hybrid approach combining hazard information and vulnerability factors to predict the likelihood of impact occurrence in an empirical model framework (Blauhut et al. 2015). For Europe, a standardised and categorised collection of textual drought impact reports from the European Drought Impact Report Inventory (Stahl et al. 2016) (www.geo.uio.no/edc/droughtdb) facilitates sector specific analysis for the entire facet of impacts caused by drought. Vulnerability information stem from a comprehensive pan-European investigation (De Stefano et al. 2015) and pan-European databases; the hazard component is described by a set of operationally monitored drought indices. The multivariable logistic regression framework applied enables to determine the predictive skill of these commonly used hazard indices and vulnerability factors in order to predict drought impacts, and applies a combination of best performing predictors for sector specific risk analysis. Finally, drought risk is mapped for fifteen specific impact sectors at different hazard severities **(Fig. 5).**

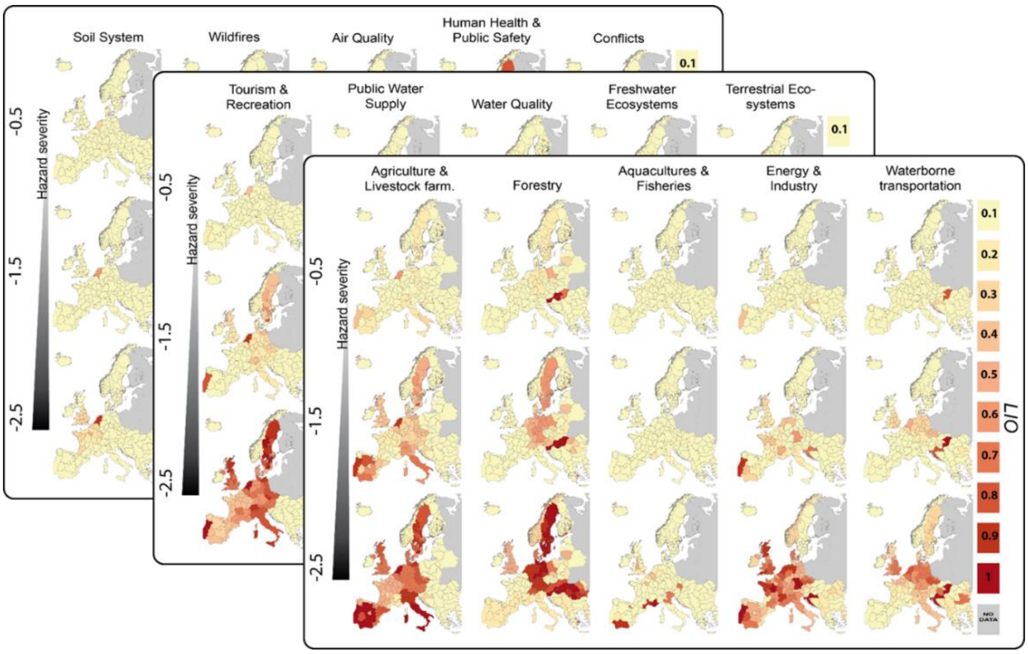


Figure 5. Mapping drought risk, likelihood of impact occurrence (for fifteen specific impact sectors)(Blauhut , V., et al., 2015)

The hybrid

approach is: a simple and transparent method, applicable for a variety of very different impact, hazard and vulnerability information, transferable to all hazards, and independent of its scale of application.

Climate information to support the reduction of natural disasters risk in Hungary

Mónika Lakatos and Zita Bihari - Hungarian Meteorological Service (OMSZ)

The Hungarian Meteorological Service (OMSZ) is responsible for derivation of high resolution, good quality, and representative data. Several past and recent project with participation of OMSZ and National Directorate General for Disaster Management can increase the adaptive capacity of the society to weather and climate extremes and natural disasters in the region.

The Hungarian Meteorological Service feed with 5 km gridded data the Complex Agricultural Risk Management System which is an information system supporting the claim adjustment process in the Hungarian agriculture. The targeted risks drought, frost, storm and heavy shower in this system.

Hungarian Meteorological Service provided climate information to NAGiS system (https://map.mfgi.hu/nater/). The main purpose of establishing NAGiS is to improve the climate basis of the adaptation activities, with special focus on development of the climate monitoring information and projections and providing information on the recent and future climate change over the Carpathian Basin. The KRIGiS: Vulnerability/Impact Studies with a focus on Tourism and Critical Infrastructures project related to NAGiS system. The KRIGiS were implemented with participation of the National Directorate General for Disaster Management in a consortia led by OMSZ.

Building a Geoinformation-Based Disaster Risk Assessment System is under development with participation of OMSZ and National Directorate General for Disaster Management. In addition OMSZ serves the Disaster Management operationally with observations, forecasts and alarm messages. OMSZ participated in preparation of the National Risk Assessment expected by the European Commission with elements of hazard and risk identification and assessment in 2011 and 2014.

The DanubeClim is the follow up project of CarpatClim. The aim of the project is to extend the CarpatClim region to the whole Danube catchment. The first phase of DanubeClim is near finalization. For example, the CarpatClim and the DanubeClim datasets are good basis for performing drought risk assessment in the region.

Platforms for risk data sharing and participative governance, from national to local. **Experience sharing with the French National Observatory for Natural Risks (ONRN)**

Elsa Rostchild – The French National Observatory for Natural Hazards (ONRN)

As a result of lessons learnt from recent disasters in France, major public and private stakeholders have decided to join forces in launching a National Observatory for Natural Hazards (ONRN) in 2012 .

This unique national public-private-civil as well as societal-academic partnership agreement between State authorities, the insurance market trade associations represented by Mission Risques Naturels

(MRN), Caisse Centrale de Réassurance (CCR) the state reinsurer of NatCat insurance system, and involving the Mayors Association, has already linked up with regional observatories to develop "bottom up" projects regarding risk data sharing and dissemination. The observatory leads a network of regional and local observatories for natural risks and coordinate working groups.

The observatory provides a tool for monitoring, evaluation and review of asset exposure, loss records and national and regional risk reduction policies, at different scales, from municipal to national level. It contributes to a shift towards a general culture of disaster risk prevention and mitigation. The ONRN web portal provides access and share key information useful to the activities and decision-making processes of stakeholders involved in risk prevention in the following fields (**Fig. 6):**

•hazards and associated zoning maps: landslides, earthquakes, floods, subsidence - swelling and shrinking of soil rich in clay, storm, hail and snow effects).

•assets at risk, vulnerability and resilience at local level.

•loss records and lessons learnt.

•stakeholders and their projects,

• progress made in the implementation of prevention measures.

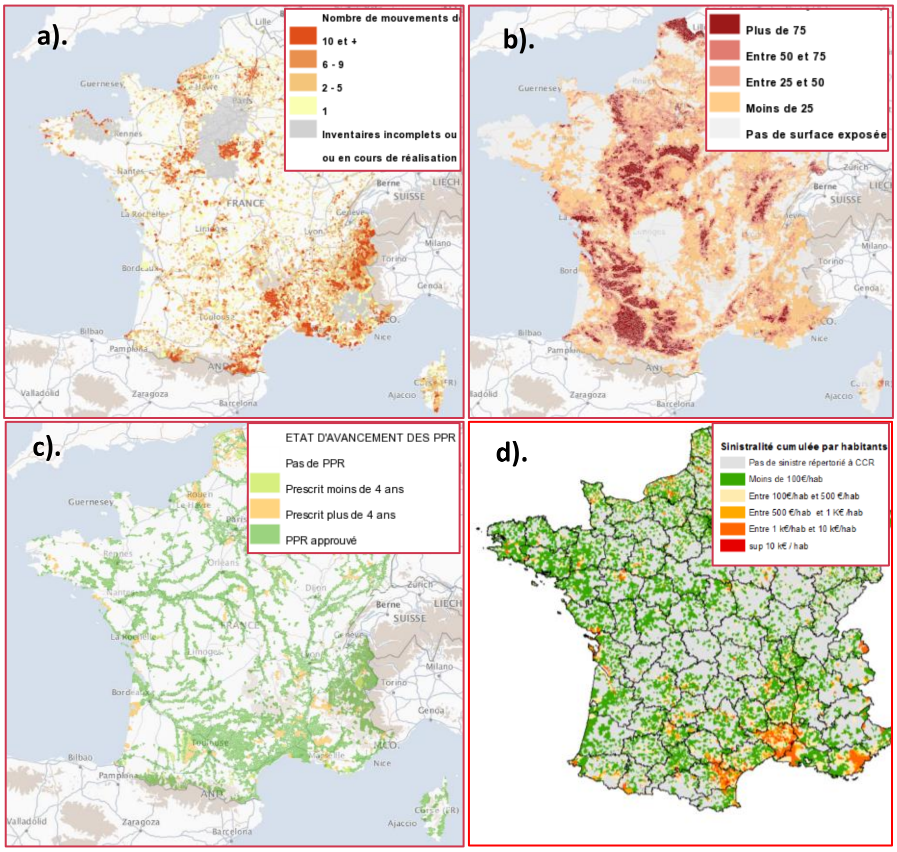


Figure 6. Map view of the ONRN indicators. As example: a). Number of landslides, b). Proportion of municipal surface area with high subsidence in 2014 (%), c).Progress of flood prevention plans, d). Mean cost €/ inhabitant in 2013 due to flood damage.

This platform supports decision making for DRR participative governance and reflects an example of good practice towards integrated disaster risk information management. It can be accessed at: http://www.onrn.fr/site/rubriques/indicateurs/cartographie.html

European and Global Drought Observatories

Alfred De Jager - European Commission, Joint Research Centre

The presentation highlighted the development of two drought information systems: European Drought Observatory (EDO) and Global Drought Observatory (GDO). They provide continuous monitoring and forecasting of the drought condition, timely information on developing drought events and their potential impacts.

The European Drought Observatory (EDO) is developed by the Joint Research Centre (JRC) to monitor, assess and forecast drought events across the entire European continent. At the core of the European Drought Observatory (EDO) are a web portal and map server presenting up-to-date drought relevant information to the public and to decision makers in policy and water resources management. As droughts can affect the entire water cycle (e.g., precipitation, soil moisture, stream flow and groundwater) and have direct impacts on the vegetation cover, all these components need careful monitoring. Therefore, a suite of indicators is calculated from different data sources in order to capture various aspects of a drought event and to forecast its probable evolution. Available drought products include a monthly updated Standardized Precipitation Index (SPI), daily updated modelled soil moisture anomalies, and remote sensing observations on the state of the vegetation cover (i.e. anomaly of the fraction of Absorbed Photosynthetically Active Radiation (fAPAR), Standardized SnowPack Index (SSPI), Normalized Difference Water Index (NDWI)) and Combined Drought Inidcator (CDI).
The CDI proposed is based on three main indices: Standardized Precipitation Index (SPI-1 and SPI-3), soil moisture anomaly and fAPAR anomaly. The indicator is based on five levels of impact **(Fig. 7):**

- "Watch" when a relevant precipitation shortage is observed,
- "Warning" when this precipitation shortage translates into a soil moisture anomaly,
- "Alert" when these two conditions are accompanied by a negative anomaly in the vegetation condition,
- "Partial recovery" when the meteorological conditions are recovered to normal but not the vegetation conditions,
- "Full recovery" when meteorological and vegetation normal conditions are recovered after a drought episode.

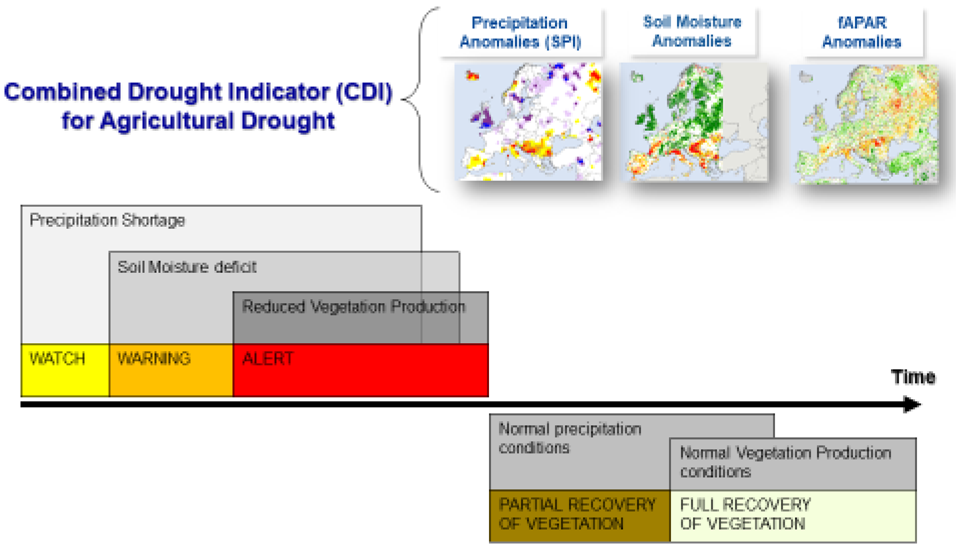


Figure 7. CDI classification scheme based on three drought impact levels and two vegetation recovery stages (Sepulcre-Canto, et. al., 2012)

The Global Drought Observatory (GDO) is an information system developed by Joint Research Centre (JRC) for the European Commission's humanitarian services, providing up-to-date information on droughts world-wide and their potential impacts. Drought monitoring is achieved by a combination of meteorological and biophysical indicators, while the societal vulnerability to droughts is assessed through the targeted analysis of a series of social, economic and infrastructural indicators. The combination of the information on the occurrence and severity of a drought, on the assets at risk and on the societal vulnerability in the drought affected areas results in a likelihood of impact, which is expressed by a Likelihood of Drought Impact (LDI) indicator. The location, extent and magnitude of the LDI is then further analysed against the number of people and land use/land cover types affected in order to provide the decision bodies with information on the potential humanitarian and economic bearings in the affected countries or regions. All information is presented through web-mapping interfaces based on OGC standards and customized reports that can be drawn by the user.

C. Flood Panel: Experts presentations on Flood Risk Assessment

Identifying Challenges in Disaster Risk Reduction - Flood Risk

Francesco Dottori - European Commission, Joint Research Centre

In this presentation, it was discussed some of the open challenges in flood risk assessment, such as the need of better addressing flood vulnerability, working on loss data collection and improving access to data and methods.

In terms of hazard modelling as challenge it was mentioned the heterogeneity of the methods often different and confined by data availability. Also multiple sources of hazard that may or may not be considered (e.g. pluvial flooding taken into account only by 14 Member states in their risk plans, interaction of multiple processes such as riverine and pluvial flooding which often is not considered) and the interaction of floods and other hazards were presented as open challenges.
In terms of data, the availability of two datasets namely exposure data and loss data were presented as being poorly exploited or being in an early phase of usage.

In the second part, were presented the methods and tools developed at JRC for flood risk assessment, which include operational systems for flood forecasting, flood hazard maps and experimental systems for inundation forecasting and rapid risk assessment **(Fig. 8).**

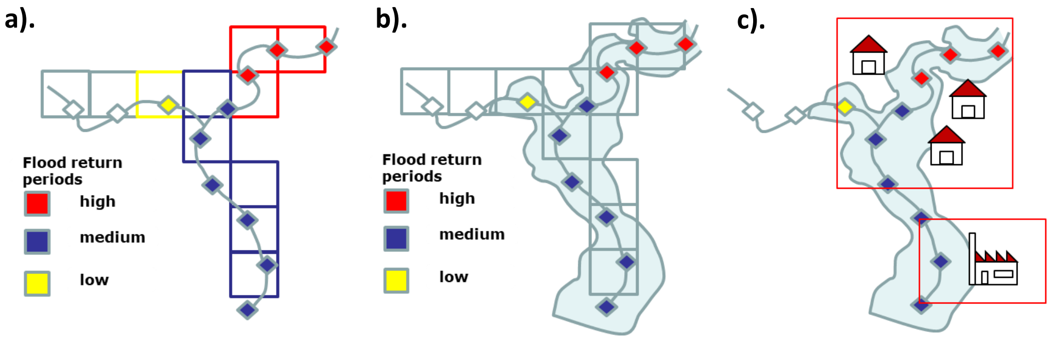


Figure 8. Rapid risk assessment procedure; a).flood forecast, b.) rapid flood mapping, c). impact assessment (Dottori,F., et al.,, 2017)

European Flood Awareness System (EFAS) offers operational flood prediction for the major European rivers and early warning information to partners such as National/Regional Hydrological Services or Emergency Response Coordination Centre (ERCC) operating within the European Commission's Humanitarian Aid and Civil Protection. The European flood hazard map database provides consistent and comparable flood hazard information across Europe such as the flood hazard maps at 100m resolution, for return periods from 10 to 500 years (available at http://data.jrc.cec.eu.int/collection/FLOODS). In term of experimental systems for inundation forecasting and rapid risk assessment linking EFAS and Copernicus EMS satellite mapping intends to improve accuracy and timeliness of flood risk maps.

Risk issue in the Hungarian National Water Strategy and the DriDanube DTP project

Szalai Sándor - Hungary Szent Istvan University

The presentation was an overview of two initiatives in the Danube region regarding on one hand the implementation of the Danube Flood Risk Management Plan (DFRMP) and on the other hand the recently started project on Drought Risk in the region – DriDanube.

In 2010, the International Commission for the Protection of the Danube River (ICPDR) agreed to develop an international Danube Flood Risk Management Plan (DFRMP) in synergy with the EU Water Framework Directive and the Danube River Basin Management Plan (DRBMP). The ICPDR agreed that two scenarios are relevant for the flood hazard map at the level of the international river basin district – flood hazard areas with medium and with low probabilities. The medium probability floods are almost unanimously based on a 100-year recurrence period while the recurrence period of floods with low probability varies mostly from 300 to 1000 years. Overall, the low probability hazard area covers 51,146 km2 in the basin. At the end of 2014, the DFRMP became available for public consultation on the ICPDR website and adopted in December 2015. The DFRMP includes a number of flood risk maps, showing the population numbers affected by floods, the share of inundated areas by class of economic activity and the potential that the EU Integrated Pollution Prevention and Control Directive and Seveso installations (containing polluting substances) or the protected areas in the basin will be affected by floods.

DriDanube - Drought Risk in the Danube Region project (http://www.interreg-danube.eu/dridanube) aims to increase the capacity of the region to adapt to climatic variability, to manage drought related risks by enhancing resilience to drought with recently developed tools and data sets (the objective has been identified as answering to deficiencies both in drought monitoring process and in drought management systems). The project is set to develop: a new drought monitoring service prepared for operational use, an unified drought risk protocol based on the Civil Protection Mechanism and an improved drought emergency response in the Danube region. The project will target primarily partners and stakeholders from Danube Basin such us: National Hydrometeorological Services, emergency response authorities, non-governmental organizations, industries, water and farmers' communities.

A questionnaire has been circulated for the overview of the risk problematics in the Danube region.

Geospatial data used in Romania for development of risk maps reported under the Flood Directive

Viorel Chendes - National Institute of Hydrology and Water Management

The presentation focused on the overview of the implementation of the Flood Directive 2007/60/EC in Romania, underling the methodological aspects of hazard and risk mapping, and the integrated system containing databases, digital maps and GIS specialized software.

Methodologies used to prepare flood hazard maps. Flood hazard map were prepared for three probabilities of exceeding the maximum flow and contain the following elements: (i) flooding limit, which is the extension of water, (ii) water depth or the water level. The basic data on flood hazard is estimated with hydraulic (2D) and hydrological modelling. Water depths for required flood scenarios with return period 10, 100 and 1000 years are calculated.
The data used include information contained in topographic maps, scale 1: 25,000, aerial photos, integrated high accuracy DEM (generally coupled LIDAR and bathymetry), hydrological and climatic data, geodetic and hydraulic studies.

Methodologies used to prepare flood risk maps. The flood risk mapping is based on flood hazard maps and data analysis of the exposed elements and their vulnerability. The vulnerability assessment was made taking into account the water depth-damage function. The ranges of values of water depth that define vulnerability of floodplain assets are water depth below 0.5 m, between 0.5 m and 1.5 m and less than 1.5 m. The flood risk map is produced for the exceeding probability of 10 %, 1 % and 0.1 %. The risk assessment is based on risk matrix using four risk classes as a function of the exceeding probability for maximum water depth and exposure classes. The risk map presents the flood extent, water depth, risk classes, potential damages (hot spots) and degree of potential exposure of settlements, economic activities, infrastructure and cultural heritage locations (museums, monuments) for all 3 scenarios.
The data used for risk assessment includes the flood hazard map and variate exposure datasets (Fig. 9) that were combined for a more complete dataset, such as:

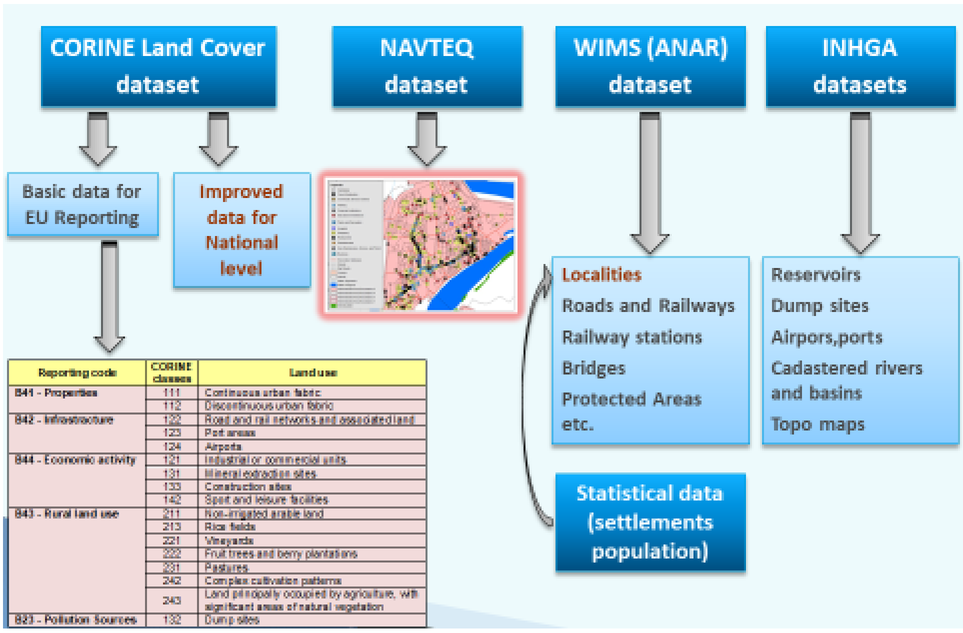


Figure 9. Exposure datasets used for flood risk maps

- CORINE 2006 Land cover database (reprocessed);
- NAVTEQ datasets mostly covering the cultural heritage locations, financial institutions, hospitals, educational institutions;
- ANAR Datasets, the infrastructure considered for damage assessment were roads, railways, bridges and buildings.

- National Institute of Hydrology and Water Management (INHGA) data for airports and rivers and basins inventory.

The national flood hazard maps are available at: http://gis2.rowater.ro:8989/flood/ .

Flood risk management issue in Hungary

Belovai Támas - General Directorate of Water Management

The presentation described the level of implementation of the Flood Directive 2007/60/EC and the future adaptations of the Hungarian flood prevention strategy, considering the ongoing socio-economic demands at national level.

4. The Flood Risk management planning started in 2008 and included in 3 main steps:

.1. Methodology 2008 – 2010

In this method, it was determined the content and formal requirements of flood risk and hazard maps (methodology of the datasets, hydraulic modelling process).

.2. Preliminary risk assessment, data acquisition, Hazard and risk maps 2011 – 2014

In Hungary the preliminary flood risk assessment has been done based on the readily available information within the Hungarian water management. In Hungary, three flood groups are created for an examination of inundation hazards:

• Floods of river sections (*riverine floods):* floodplains *protected* by dykes In Hungary, about 4,200 km of flood protection dykes have been built. Their establishment and protective ability are on different levels, so the hazard of flooding in the areas they protect varies as well. The hazard of inundation in these areas is fundamentally affected (apart from the hydrological load) by the protective ability of the dykes, and the by the defence potential (the human and material resources of the defence organization).

• Floods of river and stream sections not protected by dykes (*flash floods*). Flash floods areas are on the small streams in mountainous and hilly areas. Here, due to the typically narrow valleys, big slope and raid floods 1D hydraulic simulation is usually sufficient. The water velocity defines the risk calculation, next to the inundation depth.

• Inland inundations (*excess water*). In this case, the inundation of the area does not originate from the river, but directly from rainfall and high groundwater level. Consequently, the simulation of the process is based on the modelling of the soil water balance.

.3. Mapping, planning – 2014 - 2015 assumed the implementation of hazard and risk mapping and strategic risk management planning

•Flood hazard maps, showing the extent and expected water depths/levels of an area flooded in three scenarios, a low probability scenario or extreme events, in a medium probability scenario (at least with a return period of 100 years) and if appropriate a high probability scenario.

•Flood risk maps, are prepared for the areas flooded under these scenarios showing potential population, cultural economic activities and the environment at potential risk from flooding, and other information such as sources of pollution.

4. The future plans to reduce the flood risks:

.1. Flood riverbed management plans

The aims of the flood riverbed management plans are to reducing flood levels, keeping or repairing capacity of riverbed and ensuring the flood protection safety.

The flood riverbed management plans are made for 67 river sections, dividing the flood zones in primary, secondary, temporary, and dead zones in the flow. Main focus is on improvement of the conveyance capacity of the flood bed.

.2. The first revision of the Flood risk and hazard maps it is a running project that has three main phases (ÁKK2020)

- Establishing evaluation (2016-2018) mainly focused on:
- methodological adjustment considering the EU trends and guidelines;
- complete and update the needed database (updates in DTM, analysis of Geometric information, surveys on the terrain and riverbed, subsoil data, collecting flood events and impact);
- an overview the neighbouring countries applied methodologies, line up the transboundary rivers basins, delineation of cross borders flood plains, overview of international databases;
- line up the flood risk and hazard mapping to different flood management strategies;
- review of the water damage protection plans that contain the new designed water level;

- Updating preliminary flood risk assessment and calculating hazard maps (2018-2019). This phase introduced new criteria for flood risk assessment and hazard mapping:
- considered the endangered populated area;
- remodelled the flood hazard considering the flood wave, depth, speed and return period;
- improve smaller streams (pluvial floods) from 1 D hydrodynamic to 2 D hydrodynamic modelling.
- update the hydrodynamic model for the excess water causing inland inundation.

- Flood risk assessment, preparation of flood risk maps and making flood risk management (2019-2022). This phase sets to:
- develop a national strategy for flood risk assessment that is built on local plans, basin plan towards a National plan;
- develop a Cost and Benefits Analyses (CBA) for risk management implementation.

Functionalities of Monitor IMGW-PIB. Data Presentation and Visualization System

Radoslav Doktor, Danuta Limanówka - Institute of Meteorology and Water Management

The presentation underlined the functionality, characteristics and utility of an information system, Monitor IMGW-PIB (Institute of Meteorology and Water Management – National Research Institute). It is developed and it can be used as a scientific and technological support for DRM related actions. Monitor IMGW-PIB is focused on three monitoring components: hydrological, meteorological and reservoir. The main functionalities of the system are presentation and visualization of data, warnings and forecast products. The users of this system are the IMGW's experts and a wide range of key institutions involved in crisis situation management, nation-wide (Government Security Centre, Armed forces, Fire and Rescue Services, National and Regional Water Management Boards etc.). The data is free and available upon registration.

For h*ydrological* monitoring the system presents real time data of water level both from telemetric sensors and observations. Based on the water levels and actual rating, curves discharges are calculated for all the gauges. Water levels and discharges data together with forecasts are presented on the hydrological chart. All of them can be also drawn on the river's cross section chart (Fig. 10) predicting potential state of the water level. Real time data with historical data, alerts and warnings states can be compared on the same charts taking into consideration local conditions such as cross section, river banks etc.

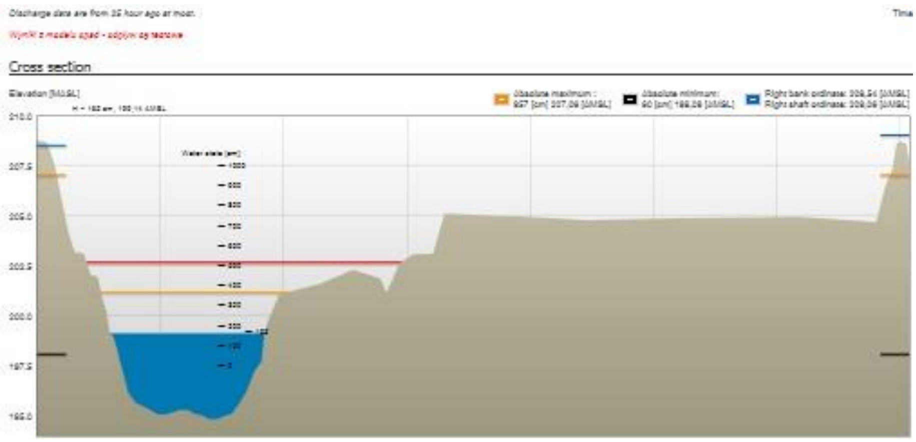


Figure 10. River's cross section chart predicting potential state of water level

For the *meteorological* monitoring, the system presents real time data of hourly and daily sum of the precipitation, air temperature, relative humidity and wind speed and direction. Once recorded and identified as high or possible danger precipitation warning signals are released.

For the *reservoirs,* Monitor presents real time data of inflow and outflow volume and reservoir water level state. All of the data and information are presented on the charts with the thresholds shown for the flood danger levels.

Monitor provides dynamic resizable map viewer that covers entire territory of Poland. The map represents three groups of objects regarding to observation and measuring hydrological, meteorological and reservoir gauges. Monitor includes tools presenting precipitation over last three hours based on the IMGW's meteorological radar network (Fig. 11).

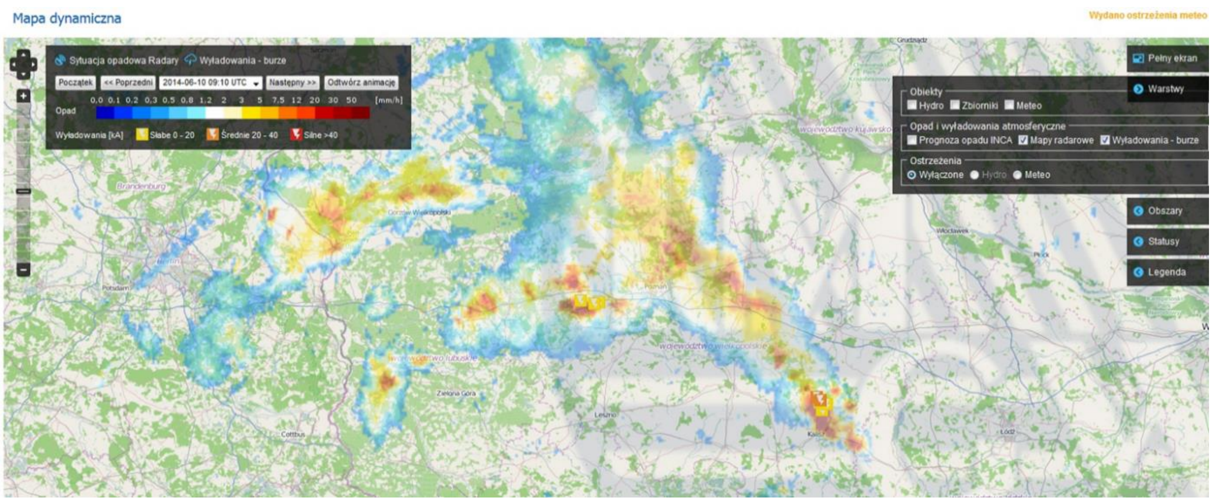


Figure 11. Data visualization based on IMGW's meteorological radar network

The system includes product-presenting precipitation forecast in catchments for next 1-3-6-12-24-48 hours based on numerical meteorological models ALDIN & COSMO.

Information about the forecasted or observed risks and meteorological and hydrological phenomena are communicated to the interested public and published on two official websites: www.imgw.pl and www.pogodynka.pl .

Underlying the role and importance of different methodologies, data availability and actions for different scales and scopes

Roxana Liliana Ciurean - University of Vienna

General considerations potentially contributing to the workshop objectives:

- There is a clear distinction in framing, use and definition of concepts like vulnerability, impact, and exposure in the flood and drought risk reduction communities (disaster risk vs. climate adaptation schools). Identifying and making plain the differences and how they impact the decision-making process (e.g. the actors considered) in each community could enhance a better understanding and cooperation between them (see PLACARD Project, https://www.weadapt.org/knowledge-base/transforming-development-and-disaster-risk/placard).

- A bottom-up DRM methodological approach represents a significant step forward in addressing the most critical drivers of risk (i.e. exposure and vulnerability) because it enables a change of focus from risk mitigation to risk prevention.

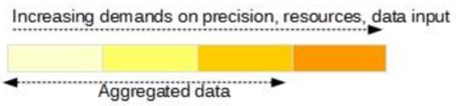
- Multi-hazard risk assessment and the evaluation of future risks in a global (incl. climate) change context represent some of the most important challenges/opportunities in advancing current DRM practices in Europe. In order to achieve these goals, there is a great need to ensure the exchange of technologies (incl. tools), experience, and knowledge between member states with different levels of DRR implementation strategies and risk cultures.

Identifying the best practices on flood risk assessment (with focus on assets, vulnerability and loss data) methodologies linking different spatial scales *(*only current practices focused on economic flood damage assessment were identified during the open discussion)

- The differences between flood and drought damage/vulnerability assessment methodological approaches, as well as the link between methodology and scope of the assessment (indicated by the level where the decision-making process takes place and reflected also in the spatial/temporal scale of analysis) were illustrated and discussed (Fig. 12)

- There was a strong incentive in understanding the role Uncertainty Analysis (UA) plays in the decision-making process as part of the Disaster Risk Management framework, as well as the practical use of uncertainty information. Studies have shown that in order to reduce the uncertainty in vulnerability assessment estimates (e.g. due to the estimation of exposed assets, uncertainty in damage models, probability of hazard events and their intensity), and therefore increase their credibility, more resources have to be invested in validation of the results and models. This, however, is conditioned by the accessibility, availability and reliability of the input data.

MANAGEMENT LEVEL (OBJECTIVE)	SPATIAL SCALE	DATA		DAMAGE/ VULNERABILITY MODELS	Selected references
		Assets (ID, value, classification)	Loss		
EC, transnational river basin authorities (e.g. ICPDR)	Supra-national	Tangible; intangible	Direct	Country specific depth-damage functions, vulnerability indices	Alfieri et al. 2015; JRC
Governmental authorities	National	Tangible; intangible	Direct; indirect	Damage/vulnerability matrix; damage functions, vulnerability indices	Hall et al., 2003, RWS-DWW, 2005
National river basin -, regional authorities	Regional	Tangible; intangible	Direct; indirect (e.g. business disruption)	Damage functions (empirical, synthetic)	De Moel and Aerts, 2011
Municipal authorities	Local (incl. single assets)	Tangible (depreciated values); intangible	Direct; indirect (e.g. emergency services)	Damage functions (empirical, synthetic), probabilistic -, multi-parameter models	Kreibich et al. 2010, Merz et al., 2013, Penning-Rowsell et al., 2013



(Based on: Messner at al., 2007, Merz et al. 2010, de Meol et al. 2015)

Figure 12. Identifying current practices on flood economic damage assessment (focused on scale, loss data, and models)

References:

de Moel et al. (2015) Flood risk assessments at different spatial scales, Mitig Adapt Strateg Glob Change (2015) 20:865–890

Merz et al. (2010) Assessment of economic flood damage, Nat. Hazards Earth Syst. Sci., 10, 1697–1724

Messner at al. (2007) Evaluating flood damages: guidance and recommendations on principles and methods, FLOODSite Project Deliverable 9.1

DRMKC report. Science for disaster risk management 2017: knowing better and losing less

Karmen Poljansek - DRMKC, European Commission, Joint Research Centre

The Disaster Risk Management Knowledge Centre has produced this flagship science report as a contribution to the Science and Technology Roadmap of the Sendai Framework for Disaster Risk Reduction.

The report "Science for disaster risk management 2017: knowing better and losing less" is the result of the multi-sectorial and multi-disciplinary networking process and it supports the integration of science into informed decision making through translating evidence for disaster risk management and strengthening the science-policy interface.

The report aims to bridge science and policy as well as operation communities. The intended audience consists of practitioners and policy makers in addition to experts from different scientific disciplines The writing phase was carried out by Author teams consisting in total of 8 Coordinating Lead Authors, 3 Facilitators, 34 Lead Authors and 140 Contributing Authors (Fig 13).

Figure 13. The network of contributors (Poljanšek, K.,et al., 2016)

The drafts were circulated for formal review to 123 scientific experts, policymakers and practitioners. The preparation of the report succeeded in pulling together a network of 273 contributors from 26 mostly European countries and 172 organizations. It has been endorsed by 11 European Commission Services and it was officially released at the Global Platform for Disaster Risk Reduction in May 2017.

The scope of the report is divided conceptually into three distinct parts: understanding disaster risk, communicating disaster risk and managing disaster risk, forming the "bridge concept" of the report. The "Understanding disaster risk" part is covering risk assessment methodologies and examples in general, provides a comprehensive overview of hazard related risk issues. The "Communicating disaster risk" part tackles many issues on communication in different phases of DRM among different actors and "Managing disaster risk" addresses the governance issues of the full disaster risk cycle. The first and last chapters wrap the scope of the report into a whole. The "Current status of disaster risk management and policy framework" aims to explain why recent global and European initiatives are beginning to seek help to strengthen society's resilience by using science and technology. The final part "Future challenges of disaster risk management" aims to inform decision makers and practitioners of existing science that should find its way into legislative form and practice.

The report is available online: http://drmkc.jrc.ec.europa.eu/knowledge/Challenges-Sharing .

3. Discussions and key outcome

The Workshop on "Identifying challenges in Disaster Risk Reduction" proposed to improve the knowledge base on Disaster Risk Assessment (DRA) and contribute to the potential development of the updated version of EU Guidelines for Risk Assessment and Mapping for Disaster Management and the DRMKC Risk Data Hub. These aspects will be presented as follow. Moreover, collaboration ideas expressed among participants in the workshop have been adapted in three follow up actions, which are detailed at the end of the report.

3.1. DRMKC RiskData Hub - is set to become a web-based platform of exchange and sharing of geospatial data, focusing on dissemination and visualisation of data, tools and methodologies. In this sense, part of the aims followed by the workshop on "Identifying Challenges in DRR"" could be resumed as:

- Discovery datasets and related web platforms and web applications that can be enabled through RiskData Hub;

- Discovery of robust, scientifically founded methodologies with the intention of establishing a common and accepted scientific approach on flood and drought disaster risk assessment.

Web Platforms and datasets:

- The ONRN web portal (http://www.onrn.fr/site/rubriques/indicateurs/cartographie.html provides access and share key information useful to the activities and decision-making processes of stakeholders involved in risk prevention. The observatory provides a tool for monitoring, evaluation and review of asset exposure, loss records and national and regional risk reduction policies, at different scales, from municipal to national level. It contributes to a shift towards a general culture of disaster risk prevention and mitigation. The data is free for downloading.
- Monitor IMGW-PIB it is a web application that can be used as a scientific and technological support for DRM related actions (published on the websites: www.imgw.pl and www.pogodynka.pl). Monitor IMGW-PIB is focused on three monitoring components: hydrological, meteorological and reservoir. The main functionalities of the system are presentation and visualization of data, warnings and forecast products. The data is free and available upon registration.
- NAGiS system (https://map.mfgi.hu/nater/) is a multipurpose geo-information system. The main purpose of establishing NAGiS is to improve the climate basis of the adaptation activities, with special focus on development of the climate monitoring information and projections and providing information on the recent and future climate change over the Carpathian Basin.
- European Drought Impact Report Inventory (EDII) (http://www.geo.uio.no/edc/droughtdb/index.php) aims to evaluate the availability and use of drought impact information and to provide a new view on drought impacts across Europe. It intends to establish a link between drought indices and the directly observable impacts across a wide range of sectors. In this sense, the EDII becomes a capable source for spatial and temporal information on impacts and their cause, which is essential for drought policy planning at national and pan-European levels.

Projects:

- DriDanube - Drought Risk in the Danube Region project (http://www.interreg-danube.eu/dridanube) aims to increase the capacity of the region to adapt to climatic variability, to manage drought related risks by enhancing resilience to drought with recently developed tools and data sets. The project is set to develop: a new drought monitoring service prepared for operational use, an unified drought risk protocol based on the Civil Protection Mechanism and an improved drought emergency response in the Danube region.

<u>Methodological aspects</u>

- Within the DROUGHT-R&SPI project, it was developed an approach for drought risk assessment combining hazard information and vulnerability factors to predict the likelihood of impact occurrence (LIO) in an empirical model framework (*Blauhut et al. 2015*). The method is applied at Pan-European scale and it establish a link between drought indices (in this case SPEI) and the directly observable impacts across a wide range of sectors. The multivariable logistic regression framework applied enables to determine the predictive skill of these commonly used hazard indices and vulnerability factors in order to predict drought impacts. Availability and accessibility of impact information appears in this aspect essential, such as it may provide the necessary link to evaluate whether drought metrics can predict impacts. For further information, please see:

- Blauhut V., Gudmundsson, L., and Stahl, K.: Towards pan- European drought risk maps: quantifying the link between drought indices and reported drought impacts, Environ. Res. Lett., 10, 014008, doi:10.1088/1748-9326/10/1/014008, 2015a.

- Within the French National Observatory for Natural Hazards (ONRN) a simple model is used to examine the damage drought can induce to buildings and infrastructure due to soil subsidence (soil subsidence is a process by which certain soils shrink and swell in response to dry and wet conditions). The model is capable of reproducing yearly drought-induced building damages suggesting a strong meteorological influence. In addition, due to relation increased damage - increase of temperature the method can be accounted for climate change. For further information, please see:

- Corti, T., Muccione, V., Köllner-Heck, P., Bresch, D., and Seneviratne, S. I.: Simulating past droughts and associated building damages in France, Hydrol. Earth Syst. Sci., 13, 1739-1747, https://doi.org/10.5194/hess-13-1739-2009, 2009.
- Corti, T., Wüest, M., Bresch, D., and Seneviratne, S. I.: Drought-induced building damages from simulations at regional scale, Nat. Hazards Earth Syst. Sci., 11, 3335-3342, https://doi.org/10.5194/nhess-11-3335-2011, 2011.

- Within European Drought Observatory, a methodological approach has been developed for drought risk assessment for national and subnational scales. The method is based on the product of three independent determinants: hazard, exposure and vulnerability. Drought hazard is derived from a non-parametric analysis of historical precipitation deficits; drought exposure is based on a non-parametric aggregation of gridded indicators of population and livestock densities, crop cover and water stress; and drought vulnerability is computed as the arithmetic composite of high level factors of social, economic and infrastructural indicators, collected at both the national and sub-national levels. For further information, please see:

- Hugo, C., Gustavo, N., Paulo, B.,: Mapping global patterns of drought risk: An empirical framework based on sub-national estimates of hazard, exposure and vulnerability, Global Environmental Change, Volume 39, 2016, Pages 108-124, ISSN 0959-3780, http://dx.doi.org/10.1016/j.gloenvcha.2016.04.012.

3.2. Risk Assessment and Mapping for Disaster Management

The workshop on "Challenges in DRR" was also organised to discover approaches for disaster risk assessment that might be useful for a possible updated version of EU Guidelines for Risk Assessment and Mapping for Disaster Management targeting in this case only two hazards: flood and drought.

Being a barely comprehensive effort due to the complexity of the research field, the outcome overview is only focused on presenting conceptual observations on disaster risk assessment, considering components such as: use, applicability, data availability, importance and methods for different administrative scales and considered hazards (flood and drought). It is an approach, which proposes to shift the focus from risk mitigation to risk prevention. It is an incomplete and constrained overview on the methods and approaches but it aims to provide a functional basis for disaster risk assessment. In addition, the outcomes overview follows the challenges identified at the beginning of the workshop.

Key messages:

Next, we will address the key messages in terms of assessment methodologies for exposure, vulnerability, hazards and disaster risk - the main components considered for disaster risk assessment.

<u>Disaster Risk assessment components</u>

- In the context of disaster risk assessment an element or system is at risk if they are exposed (situated) in the range of a phenomenon (hazard). Exposure becomes in this sense hazard related. The vulnerability is directly linked with the degree of exposure and intensity and magnitude of the hazard (damage function), derived from attributes or conditions that increase the susceptibility to damage, impact. In this aspect, vulnerability is linked with the same spatial dimension that the exposure is referred to. This concept places the location in the centre of the risk assessment model, becoming a feature of the hazard in the case of exposure and as a characteristic of the degree of exposure in the case of vulnerability. It applies perfectly for flood risk assessment but not for drought.
- In the case of drought it is acknowledged the fact that within the given high risk zone there are other characteristics that will have a significant impact on whether or not exposed elements or system are likely to experience harm. In this context it becomes important to evaluate the link between drought metrics (physical characteristics of the natural hazard) of an event to various characteristics of exposure which will assess the most vulnerable elements or systems that are becoming most likely to be harmed. This relation intends to place vulnerability in the centre of risk assessment model. It helps predicting and locating the impacts within the risk zones and establish that impacts are symptoms of vulnerability.
- In practice, the most difficult part in risk assessment is to find a mathematical definition that can predict impact from the hazardous events and more specifically metrics of the hazard. In this sense, an estimation of the relation hazard-impact can be made from the vulnerability assessment perspective. Two approaches can be identified: combining hazard metrics with a quantification of impacts (damage) as a proxy for vulnerability or combining hazard metrics with characteristics of exposure as a damage function. For the first approach, a good example is the method developed in DROUGHT-R&SPI project that establishes a link between drought indices (e.g. SPEI) and the directly observable impacts across a wide range of sectors. The second approach is used mostly for flood risk assessment and is using the assessment of physical vulnerability based on physical characteristics of exposure. Nevertheless, the damage function method is also useful for drought risk assessment too, an example can be the simulated building damages curves from drought-induced soil subsidence approach (ONRN).
- Another practical consideration would be to formalise a definition of the hazard. Already well expressed for floods, in the case of droughts most accepted definition is “a deficit of water relative to normal conditions”. Deficits are measured/modeled in absolute terms, summed up over a space-time dimension in a mathematical value that tries to captures the “real-world”. In this sense, drought impacts multiple sectors across propagated space and time scales. This is consistent with the

conceptual view of drought propagation (Van Loon, 2013) that starts from its origin as a precipitation deficit to a deficit in soil moisture continue with hydrological deficits (in groundwater and streamflow, and related water resources) and finally to a socioeconomic impact associated with the three previous mentioned phases. Thus, starting from the fundamentals of the local water balance (deficit at a location, at a time, parametrized by duration and spatial extended), it is possible to satisfy the objective of providing a robust mathematical definition of drought which can be linked with the impact-signal that could be carried out across scale, time and sectors (scope).

A bottom-up methodological approach for disaster risk assessment

- The advised methodological approach supports a probabilistic/quantitative risk assessment based on the relation: hazard, exposure, vulnerability/coping capacity. The risk should be considered as a probability of the impact/damage, a plot of a temporal probability against the total consequences (risk curve).
- Disaster risk assessment is set on identifying the geographically located causal factors of disasters, including exposure to hazards, vulnerability of people and property, land use and environment. This is important since an inventory based disaster risk assessment linked to individual assets/exposure, can be easily integrated with preparedness, resilience and financing schemes (top-down actions) that are linked at property/asset level.
- A crossed-scale view in disaster risk assessment is important considering administrative units as aggregation stages for risk information. The management of the risk reflects more the policy component and they are linked with administrative directives, organizations and operational skills coordinated at level of administrative entities.
- Even if is not clearly stated a cross-discipline approach in the perspective of Multi-Hazard Risk Assessment is anticipated. This implies an alignment of methodological approaches and data used for disaster risk assessment across different hazards.
- Different scales call for different methods when it comes to assessing flood and drought risks. In addition, assessments at different scales have different uses. As it is expected, the consensus is that no single index is sufficient to characterise the peril.
- A local scale, disaster risk assessment requires highly accurate and scope (sector) selected hazard definition. In the case of drought and river floods, the risk drivers are part of different domains requiring hazard definition based on different concepts (for river floods importance is transferred to location and temporal probability while for drought a more complex relation of a sectorial vulnerability and temporal probability).

The need of development of exposure and loss (impact) datasets with national scope and local scale

- Exposure and vulnerability are the main drivers of risk that need to be measured or quantified. Conceptual frameworks shows the importance of reducing the risk by reducing vulnerability and mitigating hazard even before a risk can manifest itself. Nevertheless, vulnerability is directly linked with the degree or the characteristics (metrics) of exposure. Therefore, there is a need to know and measure the exposure to hazard.
- Availability and accessibility of loss and damage (impact) information provide the necessary link to evaluate whether the hazard metrics can predict impacts. Being designed to consolidate disaster risk knowledge, the impact datasets creates the basis for studies relating physical characteristics of the natural hazard events to their various impacts. The identification of the characteristics of reported impacts challenges the methodologies and accuracy of the data sets used for disaster risk assessment.

- Generating vulnerability and fragility curves is most important in disaster risk assessment as it assesses whether hazard metrics can predict damages. Vulnerability assessment is explicitly linked with the attributes/metrics of exposure (build up space, land use, infrastructure, demography, environment etc.). This information is often available only at local scale part of cadastral plans, critical infrastructure engineering, census, etc., and administrated by different institutions at national level making difficult to be accessed. Therefore, there is a need of centralized exposure datasets with national scope and local scale.

Mapping disaster risk management

- A successful DRR results from the combination of top-down, strategies, with bottom-up, methodological approaches. The top–down approach refers more to administrative directives, organizations, and operational skills linked with the management of the risk and reflects more the policy component. The bottom-up approach is linked to the analyse of the causal factors of disasters, including exposure to hazards, vulnerability, coping capacity, and reflects more the practice component. In the context of disaster science, policy and practice are often disconnected. This is evident in the dominant top-down DRM strategies utilizing global actions on one hand and the context specific nature of the bottom-up approach based on local action and knowledge. A way to bridge the gap between practice and policy is to develop a spatial data infrastructure - risk mapping. It is a way of linking data information and decision support system (DSS) on a common ground that becomes a "battlefield of knowledge and actions".
- Risk mapping becomes a way of communicating quantifiable consequences with probabilities of occurrence (calculated from the recurrence of the hazard) assessed at the level of elements and up scaled at level of sectors/systems and represented at spatial dimensions that are administratively relevant (city/communes, province, regions country level).
- After a disaster risk assessment done at local scale the information is transferred at different scale as an exercise of aggregating the information to higher geographical scale (national, regional) preserving not only the accuracy of the information but also the scope (sector based, hazard based, likelihood based to assess the acceptability of a risk etc.).

3.3. Follow-up actions

The workshop became also a source for discovering networks, partnerships and activities that will increase the existing knowledge and contribute to understanding of disaster risk in the frame of DRM related actions. Three follow-up actions have been planned by DRMKC in collaboration with participants at the workshop:

- Activation of the DRMKC Support Service for the sustainable continuity of the activity of the European Drought Reference (EDR) database and the European Drought Impact Report Inventory (EDII). Both are part of the EU funded DROUGHT R&SPI Project and at present are hosted by Freiburg University in Germany. A main opportunity of this initiative would be to exploit on EDII database that can be developed as a pan European database on losses and damages related to drought and it could contribute to the national collection of information and data promoted by Sendai Framework on Disaster Risk Reduction. This information would be very beneficial to the communities dealing with the preparation of the National Risk Assessments under the EU Civil Protection Mechanism.
- Upon the discussions with the participants at the workshop, the need of a training on risk assessment for droughts has been stated. Following this request, the DRMKC has advanced the possibility to have a training implemented during 2018 using the DRMKC Support Service. In this case, the preferred option for the implementation of this Support Service would be to task one organization

with sound knowledge on Drought Risk Assessment to develop the training. The European Commission would in this case acquire the rights to further disseminate the training material to the rest of the DRM family.

- During the workshop, the DRMKC has found the opportunity to address the challenges and gaps of the Knowledge Management process and the role of the Knowledge Centres in general. A well-received collaboration has been proposed offering the opportunity to stronger underline and indicate the capabilities and skills of the Knowledge centre. The collaboration proposal is foreseen to be implemented through the EC's Expert Management Portal.

4. References

Blauhut V., Gudmundsson, L., and Stahl, K.: Towards pan- European drought risk maps: quantifying the link between drought indices and reported drought impacts, Environ. Res. Lett., 10, 014008, doi:10.1088/1748-9326/10/1/014008, 2015.

Corti, T., Muccione, V., Köllner-Heck, P., Bresch, D., and Seneviratne, S. I.: Simulating past droughts and associated building damages in France, Hydrol. Earth Syst. Sci., 13, 1739-1747, https://doi.org/10.5194/hess-13-1739-2009, 2009.

Corti, T., Wüest, M., Bresch, D., and Seneviratne, S. I.: Drought-induced building damages from simulations at regional scale, Nat. Hazards Earth Syst. Sci., 11, 3335-3342, https://doi.org/10.5194/nhess-11-3335-2011, 2011.

de Moel et al. (2015) Flood risk assessments at different spatial scales, Mitig Adapt Strateg Glob Change (2015) 20:865–890.

De Stefano, L., González-Tánago, I., Ballesteros, M., Urquijo, J., Blauhut, V., James, H., and Stahl, K.: Methodological approach considering different factors influencing vulnerability – panEuropean scale, Drought R & SPI, Technical Report no. 26, http: //www.eu-drought.org/technicalreports, last access: 22 July 2017.

Dottori, F., Kalas, M., Salamon, P., Bianchi, A., Alfieri, L., and Feyen, L.,: An operational procedure for rapid flood risk assessment in Europe, Nat. Hazards Earth Syst. Sci., 17, 1111-1126, https://doi.org/10.5194/nhess-17-1111-2017, 2017.

Carrão, H., Naumann, G., Barbosa, P., : Mapping global patterns of drought risk: An empirical framework based on sub-national estimates of hazard, exposure and vulnerability, Global Environmental Change, Volume 39, 2016, Pages 108-124, ISSN 0959-3780, http://dx.doi.org/10.1016/j.gloenvcha.2016.04.012.

Merz et al.: Assessment of economic flood damage, Nat. Hazards Earth Syst. Sci., 10, 1697–1724,2010.

Messner at al.:Evaluating flood damages: guidance and recommendations on principles and methods, FLOODSite Project Deliverable 9.1, 2007.

Poljanšek, K., Marín Ferrer, M., De Groeve, T., Clark, I., Faivre, N., Peter, D., Quevauviller, P., K., Boersma, K.E., Krausmann, E., Murray, V., Papadopoulos, G.A., Salamon, P., Simmons, D.C., Wilkinson, E., Casajus Valles, A., Doherty, B., Galliano, D., 2017. Science for disaster risk management 2017: knowing better and losing less. Executive Summary. EUR 28034 EN, Publications Office of the European Union, Luxembourg, ISBN 978-92-79-69673-2, doi:10.2760/451402, JRC102482.

Sepulcre-Canto, G., Horion, S., Singleton, A., Carrao, H., and Vogt, J.: Development of a Combined Drought Indicator to detect agricultural drought in Europe, Nat. Hazards Earth Syst. Sci., 12, 3519-3531, https://doi.org/10.5194/nhess-12-3519-2012, 2012.

Stahl, K., Kohn, I., Blauhut, V., Urquijo, J., De Stefano, L., Acácio, V., Dias, S., Stagge, J. H., Tallaksen, L. M., Kampragou, E., Van Loon, A. F., Barker, L. J., Melsen, L. A., Bifulco, C., Musolino, D., de Carli, A., Massarutto, A., Assimacopoulos, D., and Van Lanen, H. A. J.: Impacts of European drought events: insights from an international database of text-based reports, Nat. Hazards Earth Syst. Sci., 16, 801-819, https://doi.org/10.5194/nhess-16-801-2016, 2016.

Van Loon F., : On the propagation of drought. How climate and catchment characteristics influence hydrological drought development and recovery. PhD Thesis, Wageningen University, Wageningen, the Netherlands, 2013, Available at http://edepot.wur.nl/249786 (Accessed July 22, 2017).

Agenda

Day #1 Wednesday 28th June 2017

10:00 -10:15 Registration

10:15 – 10:45 Introduction, meeting objectives and panels of discussion:

Panel 1: Drought Risk Assessment

Panel 2: Flood Risk Assessment

10:45 - 11:00 *Short introduction* **-** *DRMKC* ***by M. Marin Ferrer***

11:00 – 11:30 *Overview of National Risk Assessment* ***by A. Casajus Valles***

11:30 – 12:00 *Establishing a mechanism that can improve disaster risk information exchange: RiskData Hub* ***by T. Antofie***

12:00 - 13: 45 Lunch

Panel 1: Experts presentations on Drought Risk Assessment

14:00 – 14:30 *Drought Exposure, Vulnerability and Risk: JRC Assessment at the Global Scale by* ***G. Naumann***

14:30 - 15:00 *Learning from the past - an online Database of European Drought Characteristics and Impacts by* **L. M. Tallaksen**

15:00 – 15:30 *Drought risk on a pan-European scale by* ***V. Blauhut***

15:30 – 16:00 *Climate information to support the reduction of natural disasters risk in Hungary by* ***M Lakatos, Z. Bihari***

16:00 – 16:15 Coffee Break

16:15 - 16:45 *Introducing ONRN the French national DRR platform by* ***E. Rothschild***

16:45 – 17:15 European and Global Drought Observatories *by* ***A. de Jager (EDO)***

17:15 -17:45 Round table to discuss the potential of promoting research results that are relevant for Disaster Risk Reduction:

- *Identifying the best practices on drought risk assessment (focus on elements exposed, hazards, vulnerability and loss data): methodologies and tools linking different scales (regional, national and local)*
- *Discover a mechanism, which provide a better information flow from regional to national and local level;*

- *Exchanging experiences on structuring of drought risk data, information and knowledge relevant for Disaster Risk Reduction;*
- *Enabling the research expertise in the national risk assessment (NRA);*

17:45 End of the Panel 1

Day # 2 Thursday 29th June 2017

Panel 2: Experts presentations on Flood Risk Assessment

10:00 – 10:30 *Identifying Challenges in Disaster Risk Reduction - Flood Risk by* ***F. Dottori***

11:00 – 11:30 *Geospatial data used in Romania for development of risk maps reported under the Flood Directive* **by V. Chendes**

11:30 – 12:00 *Risk issue in the Hungarian National Water Strategy and the DriDanube DTP project* **by S. Szalai**

12:00 -12:30 *Flood risk management issue in Hungary* by **B. Támas**

12:00 – 13:45 Lunch

14:**00 -** 14:30 *Functionalities of Monitor IMGW-PIB. Data Presentation and Visualization System* by **R. Doktor, D. Limanówka**

14:30 – 15:30 Round table to discuss the potential of promoting research results that are relevant for Disaster Risk Reduction:

Contribution: *Underlying the role and importance of different methodologies, data availability and actions for different scales and scopes by* **R. L. Ciurean**

- *Identifying the best practices on flood risk assessment (focus on elements exposed, hazards, vulnerability and loss data): methodologies and tools linking different scales (regional, national and local)*
- *Discover a mechanism, which provide a better information flow from regional to national and local level;*
- *Exchanging experiences on structuring of flood risk data, information and knowledge relevant for Disaster Risk Reduction;*
- *Enabling the research expertise for the national risk assessment (NRA)*
-

15:30 -16:00 Wrap up. DRMKC report. *Science for disaster risk management 2017: knowing better and losing less,* by **K. Poljansek**

16:00 End of Panel 2

16:10 End of the workshop

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