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Science Policy Interfaces in Disaster Risk Management in the EU

Mapping the support provided by science in the EU Civil Protection Mechanism

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Abstract

Mapping the support provided by science in countries included in the EU Civil Protection Mechanism

There is space for improved scientific support within Member States and the European Commission in disaster risk policy-making, early warning systems and disaster response. This reports constitutes the second phase in a study of JRC on the topic. The "smart practices" presented are examples of Science Policy Interfaces in practice that could be transferred to other countries considering institutional and socio-economic context. The report is based on collection and analysis of publicly available material. The study will be followed up with a third phase, including interviews with Member States. The conclusions allow to formulate a set of recommendations, most of which will be addressed by further research at the JRC as part of the Disaster Risk Management Knowledge Centre.

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Executive summary

Policy context

The role of science in disaster risk management has been recognized in EU legislation and internationally at the Global Sendai Framework for Disaster Risk Reduction. Evidence for policies and science-based advice during emergencies are called for, but are complex to create and use in practice. A previous pilot project concluded that there is scope for a partnership among EU Member States and the European Commission to share scientific knowledge and advice. In line with that, the current research studies how States acquire science-based advice and if existing structures facilitate the space for science-based advice in disaster risk management. The current study covers all the countries included in the EU Civil Protection Mechanism in three domains of disaster risk management: policy making, early warning systems and disaster response.

Key conclusions

Science has a strong presence and role in monitoring events and, in most cases, warning population as well as in drafting plans and regulations. In policy networks and especially in disaster response the space for scientists and authorities to interact is limited but scientific knowledge is an added value in dealing with new scenarios and to gain information of the hazards and its impacts.

In Europe, the research applied to disaster risk management is conducted by research organizations, such as research groups and academic institutions, but mainly in partnership with governmental organizations or within this institutions. These practices can facilitate the necessary space for trust and resources but may hinder independence. Likewise, as many players may be involved, the use of scientific results and support may be limited in practice and the possibility to overcome the problems of integrating science in disaster risk management is narrow. At the same time, it is observed that the context, both institutional and socio-economic, has an effect in integrating science in DRM.

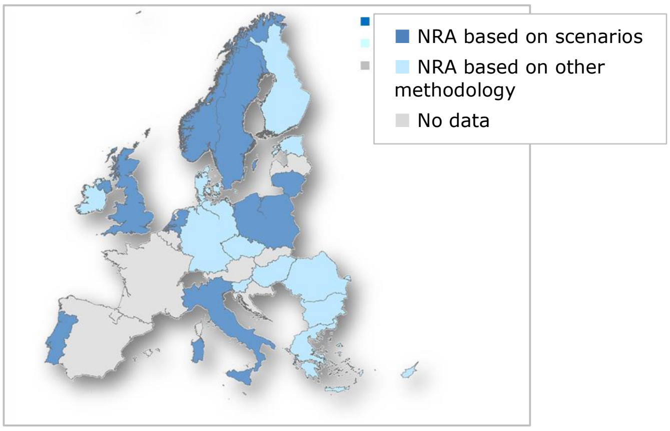
There is a gap between the types of expertise used in practice; governmental agencies responsible of disaster risk mainly use experts in natural sciences or applied sciences like engineering and health.

In spite of the limitations, national systems have proved to evolve, and European initiatives have leveraged for a positive effect on Member States. Changes in practices and structures for partnership would facilitate interfaces between science and policy. In that sense, as shown through the "smart practices", knowledge is better integrated in decision-making by ensuring relevant, credible and legitimate actors and enough space for actors to communicate, translate information and mediate.

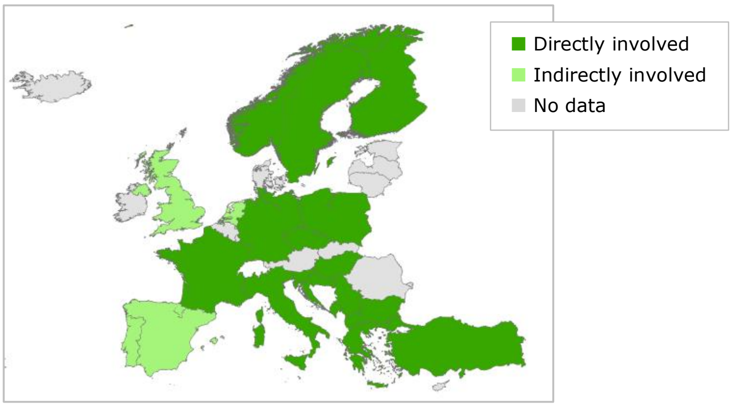
Main findings

Science supports decision-makers in disaster risk management although the space for interaction and the recognition of science is variable depending on the domain of analysis.

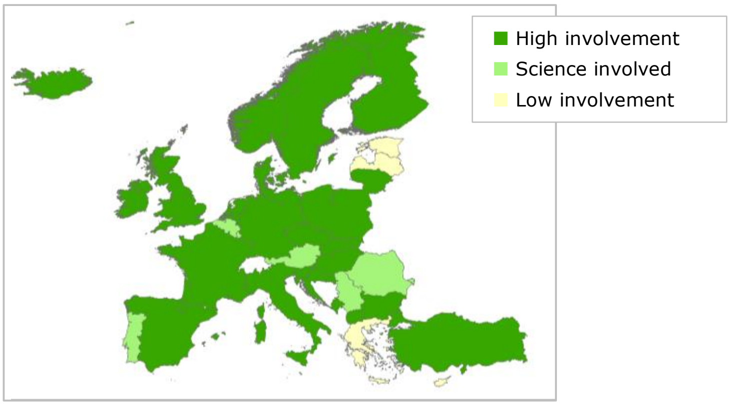
Among the countries which provided their National Risk Assessment, science is represented in the use of scenario building as methodology.



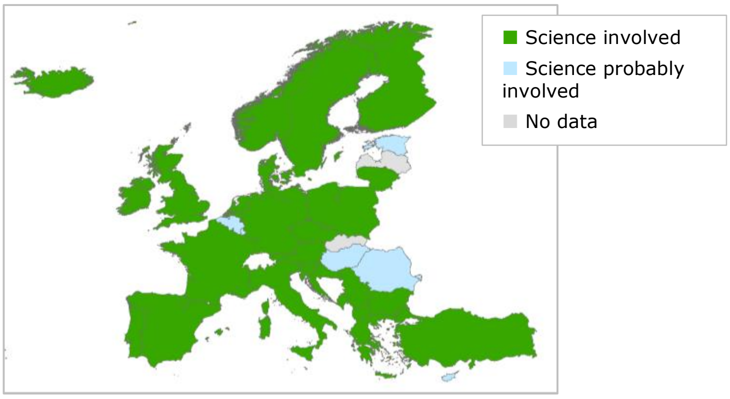
Among the countries which have established a National DRR Platform, research organizations are commonly directly engaged.



Science support is important for monitoring events, based on the bodies in charge of monitoring weather events, floods, earthquakes, radiation and forest fires. Most of the groups in charge are within the government and conduct research for their own development



For disaster response, authorities have established partnerships and regulations to have scientific support. Usually, some of these groups conducts research or has large experience in working with research organizations.



Related and future JRC work

The study lists a set of recommendations for future research. Some of the issues pointed out will be addressed in a third phase of the SPI study at the JRC, others are consistent with the short and mid-term objectives of the Disaster Risk Management Knowledge Centre, and some are long term issues that may be studies in future research projects.

Quick guide

In order to bridge decision-makers and scientists, disaster risk needs to be treated in an overlapping space of scientific research and political decision-making. From the desk research conducted mapping SPI, it is concluded that these interfaces exist in policy making, disaster response, and especially in monitoring events.

In the present study, it is considered that scientists can be located in advisory committees, permanent or ad-hoc advisory structures, academies, professional societies and research organizations but also work independently. These structures can be placed more or less closely to the government, although they can have a governmental mandate to work in.

1. Introduction

Incorporating new science in disaster risk management practices and policy is challenging, not least in Europe where a lot of scientific results are produced under the European and national research programmes. The role of science in disaster risk management has been recognized in EU legislation (the 2013 Union Civil Protection Mechanism) and the global Sendai Framework for Disaster Risk Reduction. Evidence for policies and science-based advice during emergencies are called for, but are complex to create and use in practice.

Knowledge is fragmented among different scientific and technical communities, which are often not coordinated with officials at the different institutional levels where disaster risk is dealt with. The variety of scientific disciplines studying the many aspects of hazards, exposure, vulnerability, resilience and coping capacity to prevent, prepare for or response to disasters results in a large number of specialized scientific centres. Similarly, disaster risk is cross-cutting across ministries, not only involving emergency management, but also land use planning, finances, economy, environment, climate, security, etc. Most countries have concentrated the mandate for disaster risk management at regional or even local governments, resulting in a complex science-policy interface.

In the Scientific Seminar on Natural Disasters "Bridging science-based early warning and early action decision making" organized by the JRC and the UK Met Office in 2012 it was recommended to explore the potential of a European partnership to address the key challenges in disaster management through providing a platform for integrated and coherent multi-disciplinary scientific advice on a European scale. Since then, the European Commission has set up the Disaster Risk Management Knowledge Centre (DRMKC), launched in 2015. The DRMKC has among its objectives the study and improvement of the disaster risk management science-policy interface in the Commission and EU Member States.

The pilot project "Surveying the landscape of science/policy interfaces for disaster management policy making and operations", executed in 2014 with the participation of **United Kingdom**, **Sweden, Finland and Hungary**, concluded that there is scope for a partnership among EU Member States and the European Commission to put in common with others best practices for using science into policy making and to share scientific knowledge and advice among Member States with the European Commission. This pilot project recommended to extend the research to a larger number of Member States. Based on this, the present study aims to identify the interfaces of science and decision makers in the EU and to present practical examples of these which represent "smart practices".

2. Objectives and Scope

There is a need to discover how States acquire science-based advice in practice and if existing structures facilitate the space for science-based advice in disaster risk management.

The project covers all the countries included in the EU Civil Protection Mechanism, which currently includes all 28 EU Member States in addition to Iceland, Montenegro, Norway, Serbia and the Former Yugoslav Republic of Macedonia. The study takes into account the definition of "hazard" used by the Sendai Framework for Disaster Risk Reduction 2015-2030[1], so the study covers events with a natural origin and the ones induced by human activities. Based on that, biological hazards and technological hazards are included in the current research, but not terrorism.

As part of disaster risk management, the domains analysed are (1) policy-making, (2) early warning systems and (3) disaster response. Particularly, the project identifies the presence of actors providing scientific knowledge to (1) the National DRR Platform, as part of policy-making processes; (2) monitoring events for early warning systems for (a) weather events, (b) floods, (c) earthquakes, (d) radiation/nuclear accidents and (e) forest fires; and finally, (3) in advising in disaster response. As part of the use of science in the domain of policy making, the methodology applied in the different National Risk Assessments is also analysed.

Including the National DRR Platform, the study recognizes not only the project level but also the boundary work done at policy networks. These networks are sets of formal institutional and informal linkages between governmental and other actors structured around shared beliefs and interests regarding public policy making and implementation (Moran et al, 2006), so they can easily constitute an interface for authorities and scientists.

In practice there are a great variety of groups providing scientific input to policy processes and operation activities. The roles and functions of science depend on the system they are embedded in so it differs significantly among states, time and domains. In the present study, it is considered that scientists can be located in science policy advisory committees or councils, permanent or ad-hoc advisory structures, academies, professional societies and research organizations but also work independently, out of the mentioned groups. Moreover, these structures can be placed more or less closely to the government, although they can have a governmental mandate to work in (OECD, 2015). Finally, science and technology in disaster risk management deal with the risk factors of hazard and vulnerability, so science concerns natural but also social sciences.

[1] United Nations. Sendai Framework for Disaster Risk Reduction 2015-2030

3. Methodology

Science and technology have proven that they can contribute to reduce or prevent the impact from disasters, as Member States recognized during the negotiations for the Post-2015 Framework for Disaster Risk Reduction (Aitsi-Selmi et al., 2015). Nonetheless, despite the large amount of research on disaster management, hazard research seems to be not accessible or relevant enough for decision makers (Weichselgartner and Obersteiner, 2002). Actually, the demarcation between societal values, economic constrains, legal frameworks, political decisions and scientific evidence is not always clear. Moreover, frames of reference used by the different actors engaged in policy making or during emergency operations may be notably distinct.

In order to bridge decision-makers and scientists, disaster risk needs to be treated in a science-policy context, in the overlapping space of scientific research and political decision-making and public action (Lant and Senneville, 2010). In fact, the traditional idea that scientific knowledge is transferred linearly to practitioners has proven to be mistaken, proving that knowledge has to be created collaboratively to increase its practicability (Weichselgartner and Kasperson, 2010).

Science-policy interfaces are social processes where scientists and decision-makers can jointly construct knowledge through exchange and co-evolution (IPBES, 2009). The research of the individuals, institutions and mechanisms that facilitate the interaction across the science-policy interface led to the concept of boundary organizations. Based on Guston (2001), boundary organizations provide the opportunity to create and use boundary objects[2], involve the participation of actors from both sides of the boundary and exist at the frontier of the two relatively different social worlds of politics and science, but they have distinct lines of accountability to each.

There is no unique format for science-policy interface (SPI) but knowledge is better integrated in decision-making by (1) ensuring relevant, credible and legitimate knowledge and actors and (2) enough space for actors to communicate, translate information and mediate (Cash et al., 2003). Combining this principles with the features for effective SPIs (Young et al., 2013), it is possible to build an ideal science-policy interface framework (Figure 1) which enable us to analyse and compare cases of study.

SPIs is based on three pillars:

1. Communication, understood as a two-way active and inclusive dialogue between science and decision makers.
2. Translation, described as the procedures to make information accessible, on time and comprehensive.
3. Mediation, which includes processes of anticipation, trust building, learning, conflict management and quality assessment.

At the same time, the interaction must enjoy of required independence to work, have the corresponding relevant expertise involved and enough resources (in terms of human resources, funds, time and networks).

Information is gathered through desk research. The main sources are governmental websites, meteorological websites, government reports (such as the National report on the implementation of the Hyogo Framework for Action[3] but also dissemination reports

[2] Boundary objects are objects that adapt to local needs and the constrains of the several parties employing them and facilitate communication between the multiple social worlds (Star and Griesemer, 1989)

[3] http://www.preventionweb.net/english/hyogo/progress/reports/

or guides regarding disaster management) and reports from previous projects related to crisis management, such as the ANVIL[4] Project.

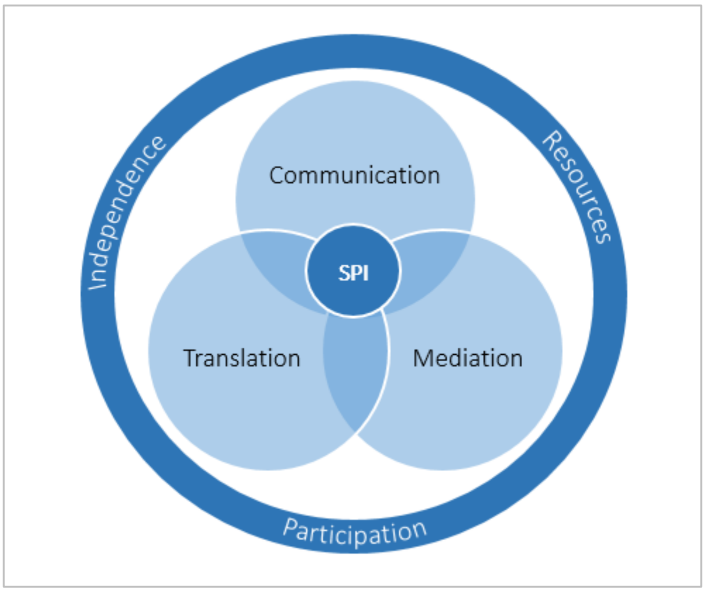


Figure 1. Science-policy interface (SPI) framework, based on Cash et al. (2003) and Young et al. (2003)

Eight countries take part of a more exhaustive analysis: Norway, Portugal, Iceland, Netherlands, France, Austria, Spain and Italy. For these, the role of science is scanned at the three domains described and at all the levels of governance existing in the country. This deep analysis enables us to map actors and organizations but also policies, mechanisms and practices which represent "smart practices". Considering the requirements for successful SPI (Figure 1), smart practices are interesting ideas in linking the worlds of scientists and decision makers in disaster management which could be (partially) replicated in other countries or levels.

It is noteworthy mentioning that not all boundary work can be recorded; boundary work may happen several times ad-hoc and informally.

[4] http://anvil-project.net/. ANVIL was an EU co-funded security research project in FP7. The main goals of ANVIL have been to try to reveal what works and what doesn't work for national and regional civil security systems across Europe, to provide advice to policy makers about this, and to identify emerging research needs for future EU research programmes.

4. Results

4.1 Policy-making: National Risk Assessment

In 2013, some countries handled their National Risk Assessment. They engaged public authorities, scientific bodies and consultancies and choose a methodology. Figure 2 represents the use of scenarios in building the document. It is considered that this method is a better approach to carry out the assessment as (1) it can easily be applied to determine likelihood and impact, (2) incorporate uncertainties related to the events and it (3) facilitates the involvement of different actors.

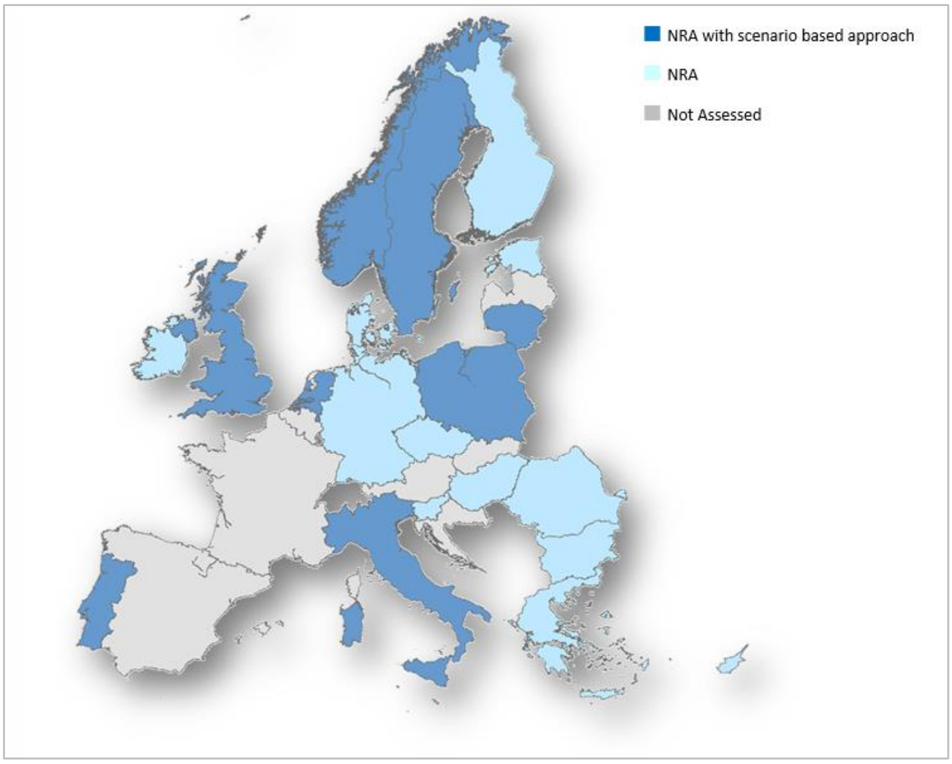


Figure 2. Use of scenarios in the National Risk Assessments.

From the countries which presented their National Risk Assessment, around half of them based the document on scenario building.

Italy: Seismic Scenarios for National Risk Assessment

Context

After the approval of an Ordinance in 2003 (PCM 3274/2003), the National Civil Protection Department (DPC) requested a seismic hazard map for earthquakes. The map was based on updated information and a new model. The Seismic Hazard Map (MPS04) defines the seismic zones of the country based on the maximum acceleration in hard ground with a probability of 10% in 50 years. The work covered the national territory with the exception of Sardinia and some minor islands, for which specific studies were required. The seismic hazard assessment was reviewed by national and international experts. The map was approved by the National Committee for Predicting and Preventing Major Risks (*Commissione Nazionale per la Previsione e Prevenzione dei Grandi Rischi)* of the Department of Civil Protection and it became the reference map with a national ordinance in 2006 (PCM 3519/2006).

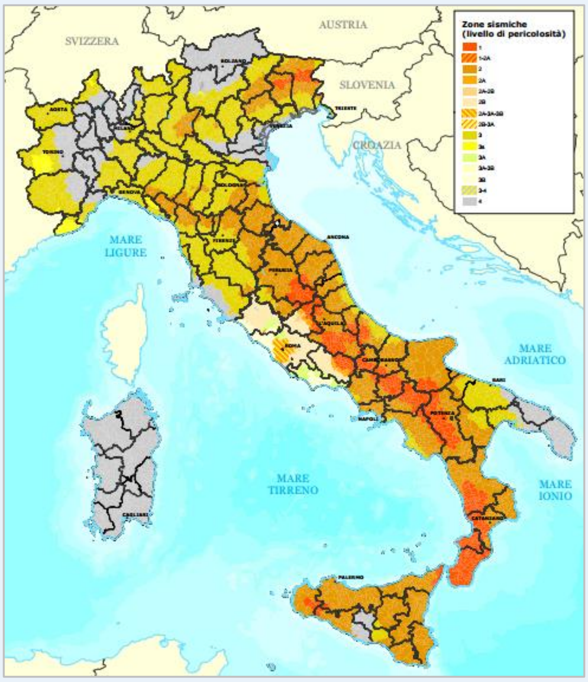


Figure 3. Seismic classification 2015 (Source: Civil Protection Department, 2015)

Actors

The Department has a group dealing with Seismic and volcanic risk (Office III). This group establishes the criteria and methodologies to assess and design mitigation activities regarding seismic risk, develops tools for predicting the impact of an earthquake in Italy and plans for the operative and rehabilitation phases.

These tasks are carried out with the support of centres of excellence for this type of risk: the National Institute of Geophysics and Volcanology (INGV), the Network of University Laboratories of Seismic Engineering (ReLUIS) and the European Centre for Training and Research in Earthquake Engineering (Eucentre).

The National Institute of Geophysics and Volcanology (INGV) is the research body entrusted with the supervision of the seismicity in the whole country and activity of Italian volcanoes through a network. The institute also estimates seismic hazard at regional and national level based on high standard methods published universally recognized and shared. INGV works closely with the Ministries of Education, Environment, Foreign Affairs and Defence and especially with the Department of Civil Protection and other authorities at national and local scale responsible for disaster risk management.

Crowley, H., Colombi, M. Borzi, B., Faravelli, M., Onida, M., Lopez, M., Polli, D., Meroni, F., Pinho, R. (2009) A comparison of seismic risk mapas for Italy, Bulletin of Earthquake Engineering, 7(1), 149-180

Classificazione sismica (10 December 2015) [in Italian]. Retrieved from: http://www.protezionecivile.gov.it/jcms/it/classificazione.wp

Pericolosità sísmica (December 2012) [in Italian]. Retrieved from: http://www.mi.ingv.it/pericolosita-sismica/

L'Instituto (8 November 2015) [in Italian]. Retrieved from: http:// http://istituto.ingv.it/l-ingv/Istituto/view?set_language=it

Netherlands: Quality and expertise in the process of assessing the risks

Context

The holistic approach considered by the National Safety and Security Strategy aims to preserve the territorial, physical, economic and ecological safety and the social and political stability of the country. The first step to achieve this is a National Risk Assessment (NRA), which is carried out yearly. The government used to do the national risk assessment but, in order to avoid political and policy bias and to use the most up to date knowledge, a network of knowledge institutions, intelligence services, planning agencies, scientists and think tanks has been developed to conduct this task.

The NRA, which consists of a risk analysis and a risk assessment is followed by a capabilities analysis. This way, the assessment serves to prioritise risks to prepare for and, the following analysis uses the scenarios analysed in the NRA to find out the gaps in capacities.

Actors

Since 2011, the National Risk Assessment is carried out by experts from the appointed Network of Analysts for National Security (ANV). The group has a permanent core of six organizations, called the NRA Task Group, plus an extended network of knowledge institutions, civil services, private companies, research agencies, and consultancy firms, whose input is used for the assessment when necessary.

The permanent core consists of:

- The National Institute for Public Health and the Environment (RIVM). This research institute is an independent agency of the Ministry of Health, Welfare and Sport. It carries out research and supports policy making to, for example, the Ministry of health, Welfare and Sport, the Ministry of Infrastructure and the Environment or the Ministry of Economic Affairs, Agriculture and Innovation.
- The General Intelligence and Security Service (AIVD), which are the secret services of the Netherlands.
- The Netherlands Organisation for Applied Scientific Research (Clingendael Institute), a Dutch think tank and a diplomatic academy specialized in international relations.
- The Research and Documentation Centre (WODC), under the Ministry of Justice. It is a research centre on security, criminal, civil and administrative justice and migration issues. Part of the research conducted by the WODC is in accordance with the research programme of the Ministry of Justice.
- The International Institute of Social Studies at the Erasmus University Rotterdam.

The experts involved are numerous and from different backgrounds. For example, in the National Risk Assessment 6 (2014), we can find the University of Amsterdam, the Verwey-Jonker Institute (which conducts scientific research on social issues) and different consulting firms.

The National Steering Committee for National Safety and Security (SNV), composed by the director-general of all national ministries acts throughout the whole Strategy Process. The consultation is being prepared in the Interdepartmental working Group on National Security (IWNV), in charge of setting the agenda. During the NRA, the SNV select the themes to be analysed, participates in scenario building and approves the products done by ANV.

Within the ANV there is a Secretariat, which coordinate the actors and production process. It acts as the focal contact point, manages the finances and maintains contact with all the networked organizations.

There is also a Methodology Working Group, which is not part of the ANV. It supports this group regarding methodological questions and improvements.

Products and services

The main task of ANV is to develop scenarios and deliver the NRA but also advises SNV in the selection of themes at the beginning of the cycle.

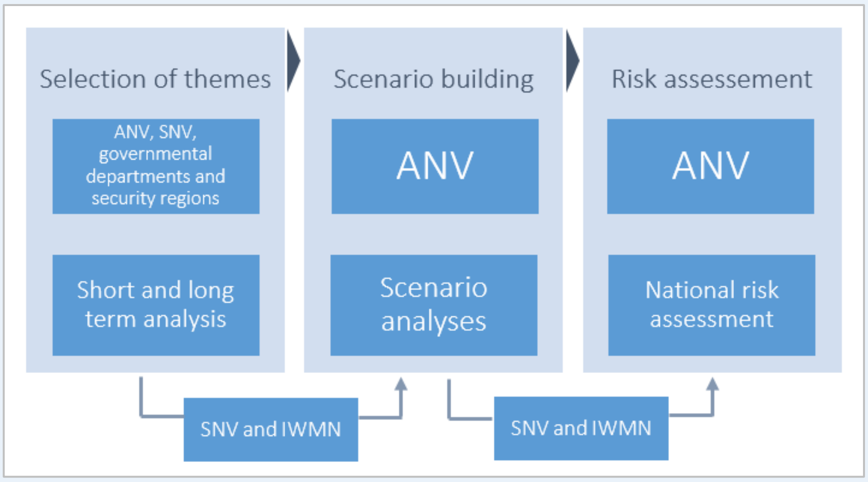


Figure 4. Workflow of the NRA, based on the National Safety and Security Strategy

As said, the NRA is divided in two parts: threats analysis and risk assessment. First, threats are identified and developed. Hazards are grouped in themes, and based on their potential danger or impact in the country, a number of scenarios with impact at national level are selected to be developed. Depending on the nature of the scenario and the features of it, different specialists are involved. The scenario may be developed by the working group or externally. Representatives of the governmental departments have a seat and usually chair the working group. The scenario is built taking in mind the 10 impact criteria and needs to offer sufficient leads to carry out the risk assessment and enough concrete for the capabilities assessment.

Next, each scenario is assessed in terms of likelihood to occur in the next 5 years and its impact on the five vital interests established by the National Strategy. Finally, all scenarios are brought together in a two-dimensional risk diagram based on their likelihood and impact.

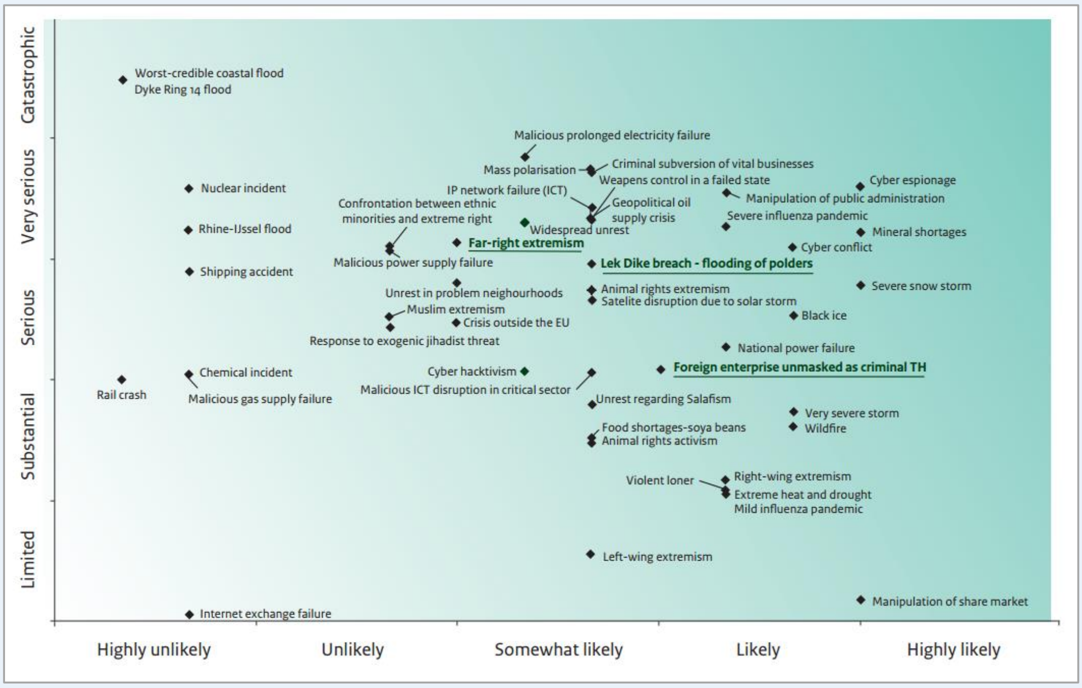


Figure 5. Risk Diagram from the National Risk Assessment 6 (Source: National Institute for Public Health and the Environment, 2014)

The results of the National Risk Assessment are the based for the next stage: capability analysis.

For the NRA there is a Quality Plan which establishes the working methods, organizational structure, tasks and responsibilities of ANV. This document also contains details regarding planning cycle, the production process, the arrangements for handling knowledge and confidential information, the communication, the transfer to the panels for capability analysis, and quality and expertise assurance.

Ministry of the Interior and Kingdom Relations (the Netherlands) (2009). Working with Scenarios, Risk Assessment and Capabilities in the national Safety and Security Strategy of the Netherlands. The Hague: Ministry of the Interior and Kingdom Relations.
Ministry of Security and Justice (the Netherlands) (2013). Working with scenarios, risk assessment and capabilities in the National Safety and Security Strategy of the Netherlands. The Hague: Ministry of Security and Justice
National Institute for Public Health and the Environment (2013). *National Risk Assessment 2011*
National Institute for Public Health and the Environment (2014). *National Risk Assessment 6*

4.2 Policy-making: National DRR Platform

Policy making processes and outcomes are partly shaped by the relation of interests and power of governmental actors and other stakeholders. UNISDR encourages the development of National DRR Platforms as arenas to exchange knowledge and coordinate actions.

National DRR Platforms differ from country to country, in composition and activities. The participation of science is deduced by its engagement in the platform, based on the information given by the country to the UNISDR[5]. It can be direct, if RO are permanent players, or through working groups which give advice to the authorities involved.

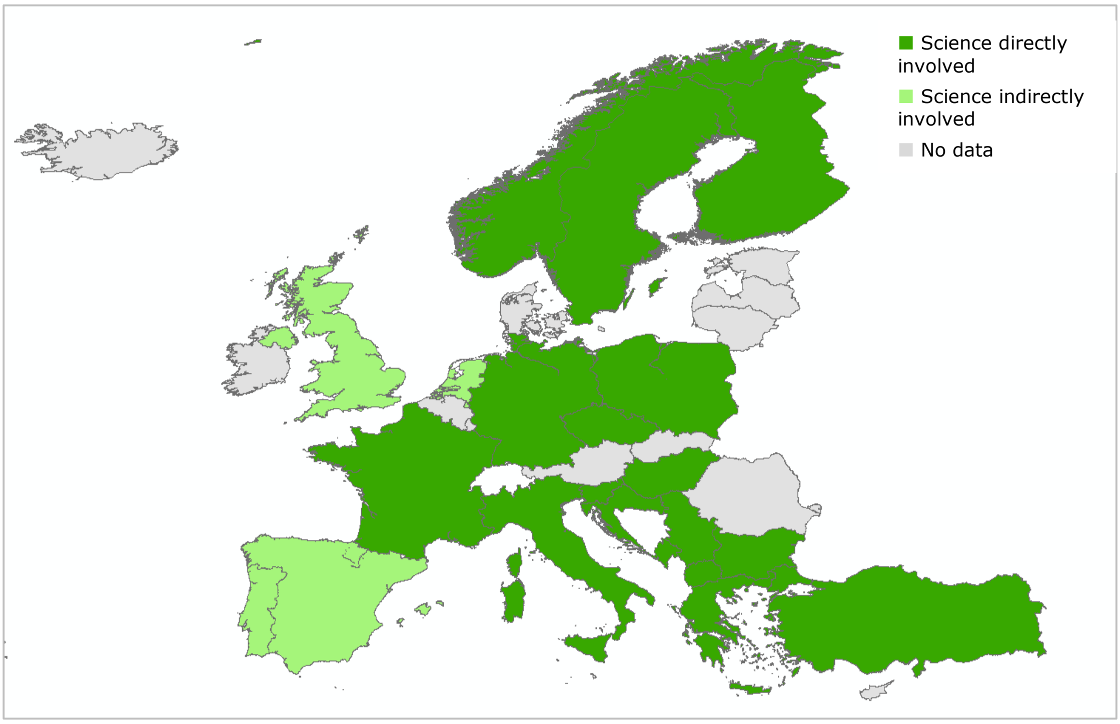


Figure 6. Presence of Science in the National DRR Platform

[5] http://www.unisdr.org/partners/countries

France: Science integrated in the national policy network for DRR

Context

The National DRR Platform followed the French Government Committee for International Decade for Natural Disaster Reduction - IDNDR (1990-2000). The case of France shows how the platform can become an arena for information sharing, knowledge exchange and technology transfer, both nationally and internationally.

Actors

The platform is led by the Ministry for Ecology, Sustainable Development and Energy (MEDDE) with the support of the Association for the prevention of natural catastrophes (AFPCN) under the aegis the Policy Board for the Prevention of Major Natural hazards (COPRNM). AFPCN brings together individuals and entities involved in the management of natural hazards:

- Institutional agencies, such as Water Agencies, the French Geological Survey (DRGM), Scientific and Technical Centre for Building (CSTB), the River Basins Administrations (EPTB), The National Institute for Industrial Environment and Risks (INERIS), the National Research Institute of Science and Technology for Environment and Agriculture, Météo France, etc.
- Professional organizations, such as National Federation of the Public Urban Planning Agencies (FNAU) and the federation of insurance companies named *Mission Risques Naturels* (MRN).
- The private sector, like the Central Reinsurance Fund (CCR), the private insurance company FM Global and Predict services.
- Associations, which represent local and national officials, local authorities and affected-by-floods communities.

In 2004, a Scientific Council was launched. It has more than 30 members, with a background in natural and social sciences. The council acts as an advisor, as a trainer and participates in research.

Products and services

The association has clear goals: it aspires to contribute to improve public policy, promoting more effective lines of action and coherent practices in the field. Actually, AFPCN works in the whole chain of risks: from scientific knowledge and prevention to civil protection-led crisis management, rescue and reconstruction. It provides advice and recommendations to the French government on legislation and policies and guidance to local groups and associations. At the same time, it can voice civil society concerns to government.

The Scientific Council plans a set of activities every year with a specific budget and works closely with the Parliament, academies, scientific public institutions, universities and companies.

For example, in 2014, the Council participated in a study of disasters and fundamental rights, in partnership with the University Paris Diderot, and in a research related to uncertainty and decision-making with INERIS and the Institute for Risk Management (IMdR).

United Nations International Strategy for Disaster Reduction (2007). *Guidelines. National Platforms for Disaster Risk Reduction*. Retrieved from: http://www.unisdr.org/files/601_engguidelinesnpdrr.pdf
Vie de l'association (2015, October 19) [in French]. Retrieved form: http://afpcn.org/animation-et-reseau-dacteurs/vie-de-lassociation/
Vie du conseil scientifique (2015, October 19) [in French]. Retrieved form: http://afpcn.org/recherche-et-expertise/vie-du-conseil-scientifique/

EU countries participate in different international platforms based on geographical situation or specific hazards.

Nordic countries: The Emergency Prevention, Preparedness and Response (EPPR) Working Group

Context

The Arctic Council is the leading intergovernmental forum promoting cooperation, coordination and interaction among the Arctic states, Arctic Indigenous communities and other Arctic inhabitants on common issues, particularly regarding sustainable development and environmental protection. The work of the Council is primarily carried out in six Working Groups. The Emergency Prevention, Preparedness and Response (EPPR) is one of these. It was established in 1996 to contribute to the protection of the Arctic environment from the threat or impact from an accidental release of pollutants or radionuclides. In addition, EPPR considers questions related to the consequences of natural disasters.

Actors

The Artic Council has eight member states (Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden and EEUU) and representatives from organizations of these countries, such as the Saami Council. The Arctic Council assessments and recommendations are the result of analysis and efforts undertaken by the Working Groups, and its decision are taken by consensus.

Every country and organization has one representative per delegation per working group, three representatives per delegation sit on the Artic Council and active participation in the Ministerial Meeting.

Services and Products

The EPPR Working Group holds annual meetings to discuss projects, proposals, and guidance from the Ministers and Senior Arctic Officials. In addition, the group uses the meetings as a venue for sharing best practices on the infrastructure and procedures needed to prevent, prepare, and respond to emergencies in the Arctic.

The points to discuss are set by Senior Artic Officials, who meet every six months. The results and assessments of the Working group are sent to these, for its consideration. These officials are the ones bringing the results to the Artic Council.

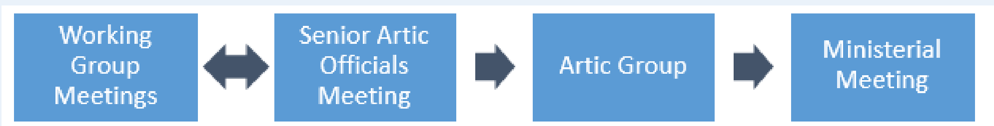


Figure 7. Flow of decisions in between the different groups of the Artic Council

EPPR has a Strategic Plan and a Communication Plan and refines its mandate biennially through Ministerial Declarations. All initiatives from EPPR, as any other Working Group from the Council, are sponsored by one or more Arctic States. Some projects also receive support from other entities.

The group has being involved in different projects like the Update of the Environmental Risk Matrix for oil pollution, the improvement of Technical Analysis Capabilities for Radiological Emergency Response and several pilot projects. A Working Plan defines the projects and the participation of every country.

The Artic Council: a backgrounder (9 November 2015). Retrieved from: http://www.arctic-council.org/index.php/en/about-us
Committees (9 November 2015). Retrieved from: http://modelarcticcouncil.org/how-it-works/committees/
EPPR Work Plan 2011 – 2013 (9 November 2015). Retrieved from: http://arctic-council.org/eppr/wp-content/uploads/2010/04/2011-2013-Workplan.pdf

Science is included in working groups for the draft of regulations and plans.

Spain: Civil Protection Commissions

Context

Research that Ministries and other administrative bodies can carry out for activities related to the platform and decision making is a common form of scientific support.

The civil protection structure of Spain is organised in three levels: national, regional and municipal. Every level has an advisory committee which, among others, provides policy advice to the political authority.

Actors

The system contemplates a inter-ministerial committee at national level to draft technical regulations and criteria regarding disaster risk management, coordinate actions of the actors involved in the field of civil protection and to certify contingency plans of national scope. The group is chaired by the Ministry of Interior and is composed by representatives of the Ministries of Economy, Education, Agriculture, Health and the Environment; the Nuclear Safety Council, which does and promotes research regarding nuclear safety and radiology; and representatives of every region.

Although the permanent participants are mainly officials, the Commission can create technical commissions or invite relevant experts, ensuring the necessary knowledge for decision making.

The General Directorate of Civil Defence and Emergencies (DGPCE) serves as the technical Secretariat, implementing the agreements and coordinating the working groups created.

Equally, every region has a Commission (*Comisión de Protección Civil de la Comunidad Autónoma*). It is composed by representatives of the national and regional government and local corporations.

Every Commission is regulated by regional decree so the composition may vary from one region to another. In the case of Catalonia, for example, representatives of the organizations in charge of meteorology, geology, water and environmental quality are permanently seated. Some regions contemplate the possibility of creating working groups for technical support and its composition is generally open, covering institutional agencies, experts or other entities relevant to the topic in debate. In some regions, the scientists and experts can be present during the meeting to give advice but they have no vote.

Services and Products

The products and services are established once the working group is created. The team remains active until the fulfilment of their mission. This way, at the end of 2014 the National Commission decided to create a working group to study the feasibility of incorporating new early warning systems for dam break. This working group was proposed by the DGPCE based on the request of the Regional Civil Protection Authority of Valencia and based on a report written by the Polytechnic University of Valencia.

Spain. REAL DECRETO 967/2002, de 20 de septiembre, por el que se regula la composición y régimen de funcionamiento de la Comisión Nacional de Protección Civil. *Boletín Oficial del Estado,* 2 de octubre de 2002, num 236, pp 34894-34986. Available at: http://www.boe.es/boe/dias/2002/10/02/pdfs/A34894-34896.pdf

Spain. Ley 2/1985, de 21 de enero, sobre Protección Civil. *Boletín Oficial del Estado,* 25 de enero de 1985, num 22, pp 2092-2095. Available at: http://www.boe.es/buscar/doc.php?id=BOE-A-1985-1696

Funciones. Consejo de Seguridad Nuclear (7 November 2015) [in Spanish]. Retrieved from: https://www.csn.es/funciones-del-csn

La Comisión Nacional de Protección Civil actualiza planes territoriales especiales para Aragón y País Vasco (December 2014) [in Spanish]. Europa Press. Retrieved from: http://www.europapress.es/epsocial/politica-

4.3 Early Warning Systems

Science is clearly recognized in monitoring events and triggering the alert. Figure 8 summarizes the organizations which are engaged in monitoring events and have an active role in research. The actor in charge may be (1) governmental or semi-governmental who usually conducts and promotes research for the fulfilments of its tasks or it is (2) a research centre or institute, for which research is a pivotal activity, who operates and maintains the network to monitor a specific event. More or less directly there is capacity to develop and integrate new insights in the task of monitoring.

The final index presented in Figure 8 is a sum of the science support given in monitoring weather events, floods, earthquakes, radiation and forest fires. The organizations that are the 'science providers' are listed in Annex 1.

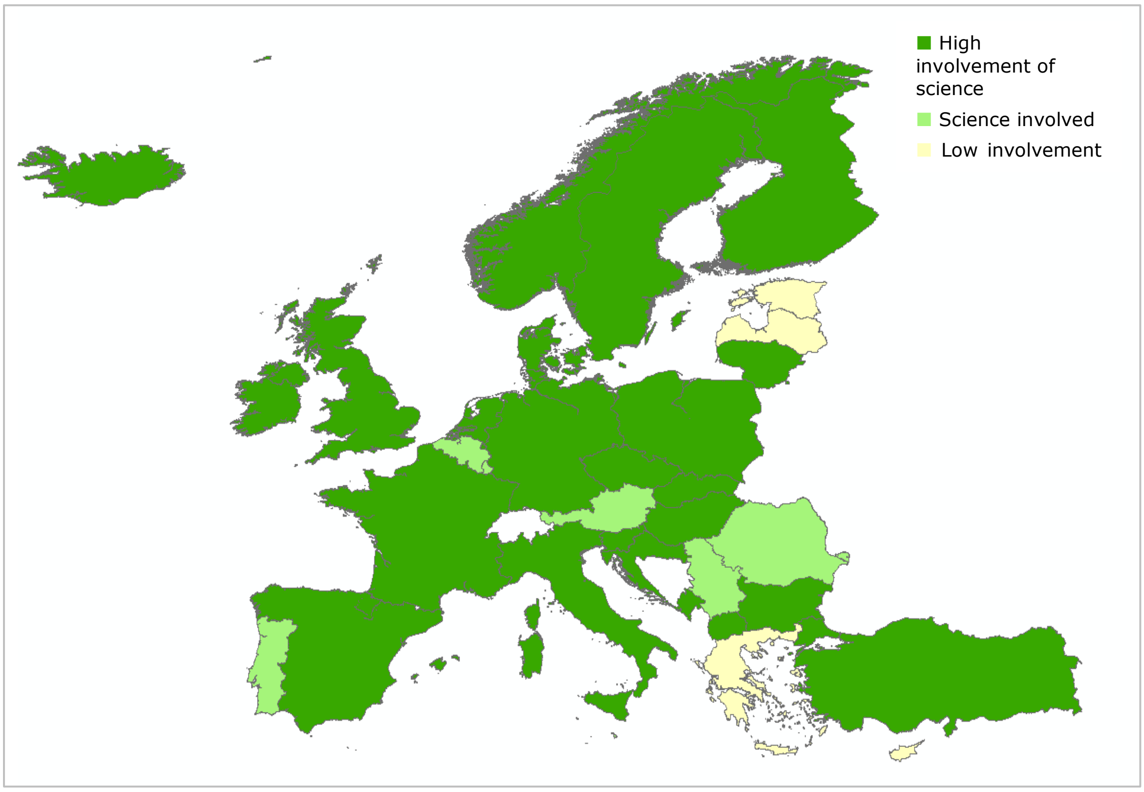


Figure 8. Scientific support in monitoring hazardous events in the EU Civil Protection Mechanism.

The meteorological services have a vital role in weather forecasts and actively warn the population. In almost all countries, regulations are in place establishing the tasks of these organizations in order to protect life, property and infrastructures. Thus, there are laws and decrees that establish the tasks of these organizations together with partnerships and Memorandums of Understanding to work with other agencies and services involved in disaster risk management.

These bodies, which in many cases were created long time ago as research institutes, have a long tradition in working with decision makers. In fact, nowadays most of the bodies in Europe have a Ministry or the government as their parent organization. Some of these organizations, such as the presented case of Météo France, have developed mechanisms to incorporate users' needs and preferences. Research is an important activity; meteorological agencies conduct research in order to develop better tools and increase knowledge within the organization.

The meteorological services in Europe provide useful information for the marine and aviation sectors but also tailor services to different sectors. This way, as the Royal Netherlands Meteorological Institute (KNMI) points out, the meteorological organizations favour the development of activities, enhancing the overall resilience of the country.

For flood forecasts, research groups are engaged in monitoring although not always in warning the population. For example, in the case of Netherlands, Spain, UK or Romania, different players, with more or less relation to research, are involved in monitoring water levels, including weather data input, forecasting the flood and alerting the authorities and the population. In some cases, such as Lithuania and Sweden the hydrological and meteorological services are merged in the same organization. In any case, the input of meteorological information is indispensable. The Flood Directive has leveraged improvements in this field in different countries but still the cooperation of hydrological services with other services is limited as many players are involved in water management.

In the case of earthquakes, the scientific support is evident. The actor in charge of monitoring is usually embedded in a research organization, like a University or Academy.

Countries have a comprehensive network to monitor radiation in the environment. In some occasions the responsibility depends on different agencies depending on the object to be monitored: air, water, food, etc. For example, in Cyprus, a unique service (RICS), measures levels of artificial and natural radioactivity in the air, soil, water, food and consumer goods. This agency doesn't conduct nor seem to participate in research. The situation of Bulgaria is different. Many players participate in the monitoring network, and among those, the Bulgarian National Hydrometeorological Service (BNHMS) and the National Centre for Radiobiology and Radiation Protection (NCRRP) carry out research. There exists a third situation, such as the Swedish Radiation Safety Authority in Sweden. This authority centralizes nuclear and radiation issues but it funds research for its daily tasks and for scientific grounds.

In the case of radiation, warning the population is generally centralized in a governmental organization. This body normally also has the mandate to collaborate in response and policy making.

Forest fire risk indexes were found for several countries, directly or indirectly carried out by the Meteorological Services. So, generally there is space for scientific input for this service.

It is noteworthy mentioning the platforms for early warning that exist at European level such as Meteoalarm, the European Radiological Data Exchange Platform (EURDEP), the European Flood Awareness System (EFAS) and the European Forest Fire information System (EFFIS).

France: Civil Security Commission at the High Council of Meteorology

Context

The High Council of Meteorology is a national organization for cooperation between Météo France, the service of meteorology, and users, both private and public. It was launched in 1991 to evaluate the services provided and to formulate actions and recommendations for the development of new insights regarding weather forecast and monitoring of events.

The Superior council of Meteorology has different specialized committees, more or less structured, for the study of different sectors, such as agriculture, environment or civil protection.

The Civil Security Commission is in charge of discussing the application of meteorology to improve the protection of people and property, the conditions to warn in case of hazardous weather events, the actions to reduce the impact of severe weather and the influence of weather in major risks (of natural and technological origin). Likewise, the Commission also serves as a space to evaluate the satisfaction of the user with the services of Météo France in the field of disaster risk management.

The Commission of Civil Security may be composed by representatives of:

- Météo France,
- SCHAPI, the central service for hydrometeorology and flood forecasting, under the Ministry of Ecology and Sustainable Development (MEDDE).
- CMVOA, the Operational Centre at Ministerial level for monitoring and warning.
- The General Directorate of Civil Security and crisis management, under the Ministry of Interior.
- Departmental division of operations and crisis management from different regions.
- IFFO-RME, the French Institute for Trainers in Major Risks and Environmental Protection.

Degrace,J. (2010). *The Vigilance system in France, (continental and overseas)* [PowerPoint slides]. Retrieved from: https://www.wmo.int/pages/prog/drr/events/MHEWSCostaRica/Docs/Session%202/France/Vigilance_france_FWI_CR_mars2010.pdf

Conseil Supeieur de la Meteorologies. Securite civile (2015, October 22) [in French]. Retrieved from: http://www.meteofrance.fr/nous-connaitre/conseil-superieur-de-la-meteorologie/securite-civile

Spain: *Integrated Coastal Alert system (iCoast)*

Context

The Mediterranean coastline experiences episodes of extreme storminess with extensive damage and losses. The management of this type of event is particularly difficult due to the fact that the coastline is highly populated and contains many uses and defences. In the last 20 years, extreme storms have been responsible for at least 50 causalities in the Spanish Mediterranean coast and more than 30 million euros in damages to coastal defences, harbours and other infrastructures.

The project started in 2013 and will finish in 2015, funded by DG ECHO, with the intervention of seven organizations from three countries to study this phenomena.

Actors

iCoast is coordinated by CIIRC and centred in the region of Catalonia (Spain).The actors involved are listed below.

From Spain:

- CIIRC, the International Centre for Coastal Resources Research, is a consortium created in 1993 and formed by the Regional Government of Catalonia, the Polytechnic University of Catalonia (UPC) and the International Federation of Institutes for Advanced Studies (IFIAS).
- SIMO, a private company specialized in wave and sea current prediction.
- SMC, Meteorological Service of Catalonia, is an institutional agency under the Department of Territory and Sustainability of the Regional government of Catalonia. It is the organization giving support and information to the regional government regarding meteorology and climatology.
- CECAT, Emergency Centre of Catalonia. It is the main centre for coordination and information for disaster response at regional level. It is within the Civil Protection Directorate at the Regional Department of Interior.
- IGC, the Geological and Cartographic Institute of Catalonia, an institutional agency competent in geodesy and cartography in the region of Catalonia.

From Italy:

- ITHACA, Information Technology for Humanitarian Assistance, Cooperation and Action. It is a non-profit association for applied research in disaster response using remote sensing techniques.

From Ireland:

- CMR, Coastal and Marine Research Centre. This research centre located within the University College Cork carries out applied and basic research in, among others, coastal processes, marine geomatics and applied remote sensing and GIS.

Products and services

The project aims to address coastal risks caused by extreme waves and high sea water levels. Based on a study of coastal hazards and risks at the western Mediterranean coast and an analysis of prevention policies, the early warning system iCoast will be created. The prototype will be used to forecast storm events in the coast but it will also help decision makers to intervene.

iCoast (8 November 2015). Retrieved from: http://www.icoast.eu/
Gracia, V (2014). *iCoast, Kick off meeting* [PowerPoint slides]. Retrieved from: http://ec.europa.eu/echo/funding-evaluations/financing-civil-protection-europe/selected-projects/integrated-coastal-alert_en

Netherlands: *Storm surge warning system*

Context

The Warning Service, *Stormvloedwaarschuwingsdienst* (SVSD), was established in 1916 and has been constantly improving its tools and methodologies to provide the best service. In 1953, the service was able to forecast the storm surge in the North Sea but many authorities did not take the warning seriously. Consequently around 135000 hectares of land were inundated and 1835 people died.

After this event, the Dutch Government built a network of dikes, locks and dams to protect the country from floods, labelled as the Delta Plan, and improved the warning system.

In 1954 the service moved to the Ministry of Infrastructure and the Environment (*Rijkswaterstaat - RWS*)

Actors

The service is issued by the *Rijkswaterstaat* and the Royal Meteorological Institute (KNMI) and is part of the Water Management Centre (WMCN). The first one is in charge of water level observations and the KNMI, that works 7/24, gives the meteorological input. The SVSD has the last responsibility for forecasts in case of a storm surge along the coast and in the lower part of the Rijn and Meuse estuary and warns the related authorities. The users of forecast information are the SVSD, the Rijkswaterstaat North Sea Directorate - DNZ, the Rijkswaterstaat Zeeland Directorate - DZL, the Water boards and the KNMI.

The *Rijkswaterstaat* is the executive agency of the Ministry of Infrastructure and the Environment. It is responsible for the design, construction, management and maintenance of the main infrastructures in the country, which includes the waterway network and water systems.

Since 2009, The Water Management Centre (WMCN) provides daily information to the users of water in the Netherlands regarding water levels, flood risk and water quality. Both the national and regional departments of the *Rijkswaterstaat* work together in this network centre. The monitoring data regarding water is provided to the Water Management Centre where it is interpreted with weather forecasts from the KNMI, Deltares models and regional reports. This way the Centre writes the reports to the users and authorities.

The WMCN has national coordination committees: LCM, for environmental incidents, LCW, related to drought or temperature and LCO in case of flooding at national level. There are also crisis advisory groups (in case of floods and droughts, in case of lakes, regarding defences and for storm surge warning).

The Water Boards are regional government bodies in charge of water barriers, waterways, water levels, water quality and sewage within a region. The country is divided in 23 regional water authorities with long tradition is water management, protection and quality.

The KNMI is the national institute for weather, climate and seismology. It provides forecasts and information regarding these topics and also performs research. The institute is an agency of the Ministry of Infrastructure and the Environment and their duties are set in the KNMI Act.

Products and services

The forecast for proper closure of the movable storm surge barrier is required at least 6 hours ahead. Since 1980 the forecasts are based on a numerical hydrodynamic model which uses forecast from a meteorological model. In the last years, a number of significant improvements to the model have been implemented and tested.

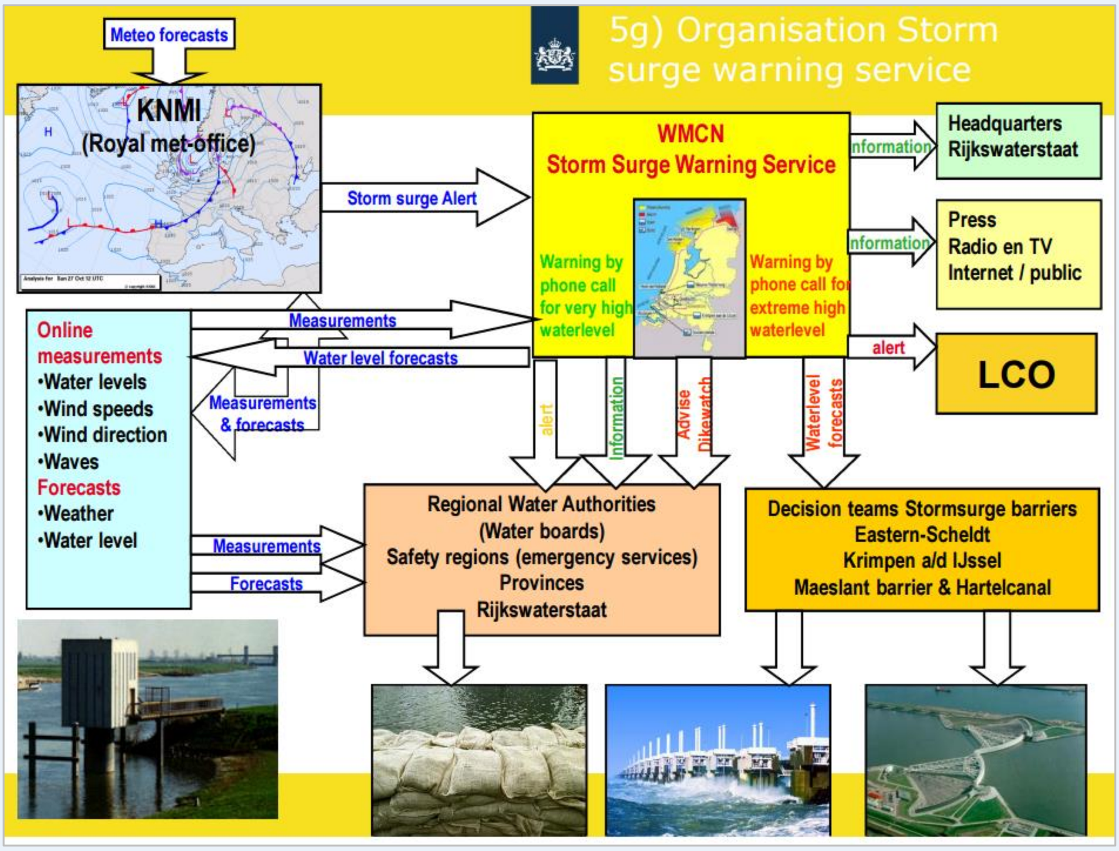


Figure 9. Actions and actors engaged in the SVSD (Kroos, 2012)

The impact of a storm surge is determined by the combination of the astronomical tide and the meteorological effect. The water levels are given by the Centres in Noordzee and Zeeland and the meteorological data, by KNMI.

The probability of reaching the warning level in different time lapses determines different levels of emergency. Depending on the level, different actors are warned (Figure 10). For example, if the probability of reaching the warning level within 8 days is higher than 25%, then KNMI contacts the Water Management Centre.

Level	Action	Exceedance [year^{-1}]	ID
Information	KNMI informs WMCN	10	IP
Pre-warning	WMCN issues limited warnings	5	VP
Warning	WMCN office opened, issues warnings	2	WP
Regional Alarm	WMCN advises local authorities, LCO active	0.2	RAP
National Alarm	DG-RWS leading	$5 \cdot 10^{-2} - 10^{-2}$	LAP
Critical	NCC leading	$5 \cdot 10^{-3} - 10^{-3}$	KRIT
Design		$5 \cdot 10^{-4} - 10^{-4}$	MHW

WMCN	Netherlands' Water Management Centre
LCO	National Flooding Committee
DG-RWS	Director General of Rijkswaterstaat
NCC	National Crisis Centre

Figure 10. Summary of the authorities to warn depending on the level of emergency for storm surge (de Vries, 2013)

The SVSD gives warning and alarms 12 hour before the high tide and corrects this every 3 hours. The warnings are sent by telephone, sms and internet. The water boards are in charge of watching the dikes and repairing them, while the safety regions carry out tasks related to relief and evacuation.

The LCO receives the information by the storm surge warning service and the forecasts of expected damage by the regional water authorities to report to the top levels of the government about the country-wide status for the dikes and the forecasted damage on dikes and dunes. This way, the government can decide which measures to take. In case the forecast exceed Critical levels on more than 20%, the situation is commanded by the higher levels of the Director General of Rijkswaterstaat and the National Crisis Centre, where cabinet ministers are involved in decision making.

De Vries, H. (2013, October 27). Dealing with extreme storm surges in the Netherlands. Paper presented at the 13th International Workshop on Wave Hindcasting and Forecasting & 4th Coastal Hazards Symposium: Banff, Canada. Retrieved from: http://cdn.knmi.nl/system/data_center_publications/files/000/051/985/original/Paper-Hans_20de_20Vries.pdf?1432900053
Dutch Water Authorities (15 November 2015). Retrieved from: http://www.dutchwaterauthorities.com/
Kroos, J. (2012). *Water Management Centre for the Netherlands WMCN. Storm surge warning service.* [PowerPoint slides]. Retrieved from: https://oss.deltares.nl/c/document_library/get_file?uuid=e3a572d7-7997-4450-bcea-4e9abd9bfb24&groupId=145641
Organisation (15 November 2015). Retrieved from: https://www.government.nl/ministries/ministry-of-infrastructure-and-the-environment/contents/organisation
Rijkswaterstaat – Ministry of Infrastructure and the Environment (2011). Water Management Centre the Netherlands. Focal point for water. Rijkswaterstaat.
Slomp, R. and Kolen, B. (2013). *Rijkswaterstaat. Flood Forecasts and evacuation strategies in the Netherlands* [PowerPoint slides]. Retrieved from: http://lafrance.nlambassade.org/binaries/content/assets/postenweb/f/frankrijk/nederlandse-ambassade-in-parijs/import/16h45b-slomp-kolen-klein.pdf
Verlaan, M., Zijderveld, A., de Vries, H. and Kroos, J. (2005). Operational storm surge forecasting in the Netherlands: developments in the last decade. *Phil. Trans. R. Soc. A* 363, pp 1441–1453

Europe: *European Forest Fire Information System EFFIS*

Context

In the `90s, European countries were already exchanging information of forest risk during the fire campaign. The main product shared were fire risk maps but these were computed with different methods so its applicability remained low. In 1998, the EC set a research group at the JRC in charge of developing and implementing methods to evaluate and map forest fire danger and its consequences at European scale. To advice the development of the methodology created, DG Environment established the Commission´s Expert Group on Forest Fires of the Members States. The work of these groups led to the creation of EFFIS. In 2000 the modules European Forest Fire Risk and Forest Fire Damage Assessment System of the European Forest Fire Integrated System (EFFIS) were operative for the first time. Nowadays, EFFIS provides all the base information regarding forest fires at European level and its surrounding territories.

Actors

Currently, the EFFIS network is constituted by 39 countries, including 25 EU Member States (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, the Netherlands and the United Kingdom), 10 European non-EU countries (Albania, Bosnia & Herzegovina, former Yugoslavian Republic of Macedonia, Kosovo, Montenegro, Norway, Russia, Serbia, Switzerland and Turkey), and 4 MENA countries (Algeria, Lebanon, Morocco and Tunisia).

Services and Products

EFFIS provides assessments during pre-fire and post-fire phases at European level, supporting fire prevention, preparedness, firefighting and post-fire operations. It complements national fire information systems of the participating countries. The final users, the Civil Protection and Forest Services in the countries monitored by the system, are involved in all EFFIS activities through DG Environment.

The system uses the Canadian Forest Fire Weather Index (FWI) to assess the level of fire danger through the continent. There are six categories, from very low to extreme, showing the risk of forest fires. Maps can be consulted online and are sent to users daily.

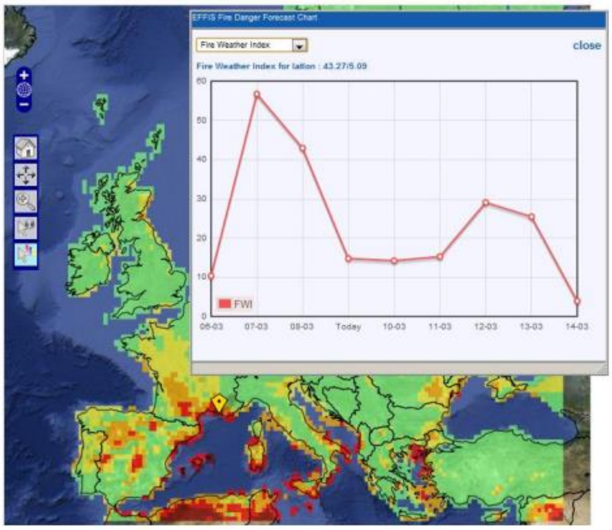


Figure 11. FWI values forecasted for 6 days by EFFIS system (EFFIS, 2012)

EFFIS (7 November 2015). Retrieved from: http://forest.jrc.ec.europa.eu/effis/EU
Forest Fires in Europe, Middle East and North Africa 2014 (2015). Retrieved from: http://forest.jrc.ec.europa.eu/media/cms_page_media/9/Forest%20fires%20in%20Europe%2C%20Middle%20east%20and%20North%20Africa%202014_final_pdf.pdf
San-Miguel-Ayanz, J. , Schulte, E., Schmuck, G. and Camia, A. (2013). The European Forest Fire Information System in the context of environmental policies of the European Union. Forest Policy and Economics, 29, pp 19-25.

4.3 Disaster Response

After mapping the actors providing advice to the operational groups in disaster response, it is concluded that mainly governmental agencies and services perform this task in Europe. This way, meteorological services are commonly giving scientific support. In fact, for some hazards, such as meteorological events or nuclear accidents, countries have clearly established the actor(s) for advice during response. For some other hazards, the support is not always obvious.

If the group providing support conducts research or usually funds research for their operational tasks, it is considered that science is involved. In the latter case scientific support is less evident, but the group would probably have built a network with research organizations.

In some occasions, contingency plans and operational groups recognize the need of specialists and experts to make decisions. In this case it is considered that science is probably involved (Figure 12). The organizations that are the 'science providers' are listed in Annex 1.

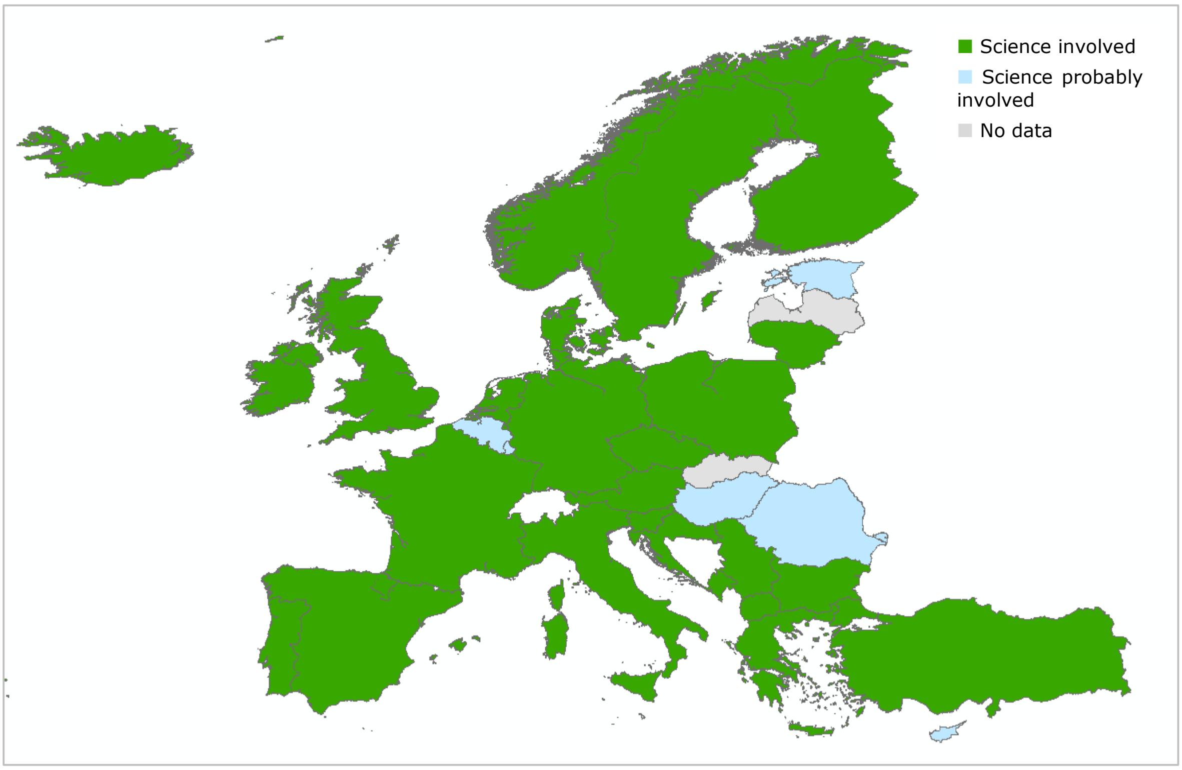


Figure 12. Scientific support in response operations in the EU Civil Protection Mechanism.

Norway: Investigating coordination in disaster risk response

Context

In 2007, a tank from the Vest Tank Company (Gulen Municipality, south western of Norway) exploded causing fire in a nearby tank which contained oily waste. The fire devastated part of the industry. Although nobody was seriously injured by the explosion and its aftermath, the population leaving near the plant experienced nauseas and vomits. In addition, the content of the tanks were unknown at a first stage, which resulted in a need for public information.

Actors

The task of investigating the coordination of the different stakeholders involved in the event was given to the Directorate for Civil Protection (DSB). The different authorities and institutes that participated in the response, and in the report, were:

- Gulen Municipality, which acted as the first authority to respond. The emergency response personnel from Gulen Fire Service participated in the acute phase of the emergency.
- Hordaland Police District, who organised the rescue effort.
- The County Governor of Sogn and Fjordane. By law, the Country Governor has to coordinate and supervise emergency planning in the county. Particularly, he/she has the obligation of advising the municipalities of the area.
- The Norwegian Coastal Administration, the agency responsible to prepare and act in case of acute pollution.
- The Norwegian Institute for Public Health. This research agency was contacted during the acute phase and the days after by the company, the County Governor and the Municipality. The Institute even visited the area some days after the accident and participated in the public meeting with the population to inform them about the health consequences of the incident.
- The Norwegian Food Safety Authority, the agency responsible for safe food and drinking water in the country. It was engaged in the aftermath of the accident analysing the surroundings of the company.
- The Norwegian Pollution Control Authority (SFT), an agency under the Ministry of the Environment and responsible for climate and pollution issues. As the agency is also responsible of the effects of chemicals in the environment. The day after the accident SFT inspected the area.
- The Directorate for Civil Protection and Emergency Planning (DSB), who is the coordinating authority in case of Seveso accidents, was in touch with the different authorities and agencies at all levels.

At the same time, another investigation was undertaken by GexCon AS for the local Police authorities of the district centred in the explosion.

Products and services

The report drafted by the listed actors and coordinated by DSB, which has no role in commanding response, describes the incidents and the actions carried out by each of the participants. The evaluation of the incidents serves to highlight gaps and opportunities for learning. In the presented case, the main points to address concerned the local capacity to respond, the interaction and communication of the different actors and levels and these with the public, and the regulations concerning industries. This evaluation, together with the other investigations focusing on safety and security issues, are public.

Directorate for Civil Protection and Emergency Planning (DSB) (2007). *The Vest Tank Accident. Experience gained from the Authorities' collective handling of the Vest Tank accident in Gulen Municipality*. Retrieved from: http://www.dsb.no/Global/Publikasjoner/2007/Tema/Vest_Tank_english.pdf

Skjold, T. van Wingerden, K., Abiven, R. and Larsen, O. (2008). *Accident investigation following the Vest Tank explosion at Sløvåg.* Retrieved from: http://www.dsb.no/Global/Farlige%20stoffer/Dokumenter/Report_accident_vest_tank.pdf

Spain: Group for Evaluation and follow up in the field for accidents with hazardous goods

Context

In Spain, regions, and municipalities, must plan and implement actions and resources to respond to an emergency. This way, every region has a contingency plan regarding the Transport of Dangerous Goods.

To deal with the accident, regional authorities and groups intervening have the technical input and advice of committees that are constituted and from regional and national institutional agencies, regarding meteorology, natural resources or toxicology. When possible, the company in charge of the transport is involved to give advice and facilitate resources.

Actors

In the region of Catalonia, the Regional Ministry of Interior directs the response. There is an Advisor Council that analyse the situation and support the Ministry in taking decisions and mobilising resources. These, together with the media cabinet, are located in the Emergency Command Centre. In the accident site, different groups deal with the emergency. Among them, there is a group for Evaluating and Following-up the Risk. The group is composed by different agencies depending on the type of hazardous substance and the environmental vector (water, soil, air) affected. This way, if the soil is polluted, the Waste Agency (ARC) leads the group but if the aquatic environment is affected, the Water Agency (ACA) takes that role. If radiological waste or substances are involved, the group would be composed by SCAR, and CSN, the Nuclear Safety Council. In the field, the municipal service of the environment and the companies in charge of the transport and the hazardous substance are also engaged.

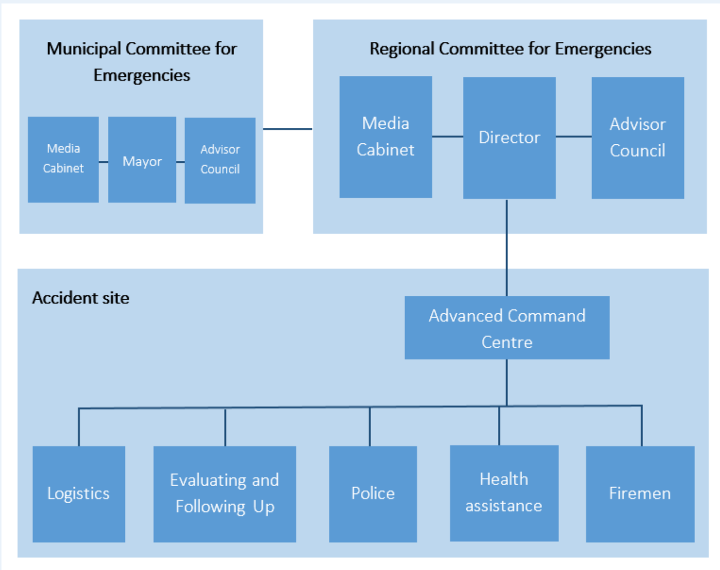


Figure 13. Groups engaged in an accident with hazardous goods based on TRANSCAT (2015)

Products and services

The group has to evaluate and follow-up the consequences and scope of the accident over the population, the surrounding properties and the environment. They also do field work assessing the surrounding and informing the command group about the situation and its evolution.

TRANSCAT. Pla Especial d'Emergencies per Accidents en el transport de mercaderies perilloses per carretera I ferrocarril a Catalunya (2015). Departament de Proteccio Civil, Departament d'Interior de la Generalitat de Catalunya. Retrieved from: http://interior.gencat.cat/web/.content/home/arees_dactuacio/proteccio_civil/plans_de_proteccio_civil/plans_de_proteccio_civil_a_catalunya/documents/Document_Pla_TRANSCAT.pdf

***Netherlands:* Pool of communication crisis experts**

Context

The supra-regional crisis communications expert team (*Bovenregionaal team crisiscommunicatie* - BTC) launched in 2014, is a top team of communication professionals that work in municipalities and safety regions. This initiative has been implemented by the Ministry of Security and Justice and the Security Council after the recommendations for better coordinated communication during emergencies in the investigation of a fire in a chemical plan in Moerdijk.

Actors

The professionals are from different security regions and they have substantive expertise on specific types of disasters. The team consists of strategic advisers for the Management Team and the Regional Operational Team (ROT), heads of mission in crisis organizations and analysts. Due to that, these professionals possess substantive expertise and knowledge of the crisis process.

Products and services

These experts can be requested 24/7 to work under the authority which has asked for assistance, both at municipal or regional level. They can be requested as an expert in a specific issue or to supplement their crisis team. The support is expected to be onsite after the first eight hours. Besides, the expert team can be requested in the "cold phase" of crises for advice in risk assessment and scenario-building.

With the creation of this expert team, the Netherlands boost quality in crisis response, securing that support is independent from GRIP, the coordinated regional incident management procedure, and that it does not depend on ad-hoc and informal networks. Pool members are trained and can learn from meetings and regular deployments.

Bovenregionaal team crisiscommunicatie van start (2013, December 12) [in Dutch]. Retrieved from: *https://www.nctv.nl/actueel/nieuws/bovenregionaal-team-crisiscommunicatie-van-start.aspx*
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5. Conclusions

First of all, it can be concluded that based on the existing interfaces found at policy-making, early warning system and response, science supports disaster risk management at national level in the countries engaged in the EU Civil Protection Mechanism. Nonetheless, its recognition is variable depending on the domain of analysis.

In the case of the National DRR Platform, science is represented in the arena in almost all the countries that established this arena. Scientific input is represented by research organizations and academic institutions. However, in the National Risk Assessment, one of the pillars for disaster risk policy making, scientific support is variable.

Science has a strong presence and role in monitoring events and, in most cases, warning population. In this domain, meteorological bodies provide scientific input based on regulations and partnerships. Their participation is also considered in response. The clear and profitable engagement of these bodies in early warning system and response, and even in policy making, can be understood based on their large experience dealing with authorities, their interest in development and research to improve their tools and outcomes and the established mechanisms to work together with them. Another group that usually provides scientific input in the three domains analysed are the organizations involved in radiation and nuclear accidents. Their mandate and functions in the disaster risk management cycle are clear.

In Europe, scientific research that applies to disaster risk management is conducted by RO, such as research institutes and academic institutions, but mainly in partnership with governmental organizations or within these institutions. Most of the agencies and services related to environmental and security issues fund and participate in research projects, with national and European partners. This practice has advantages and disadvantages: it promotes a space for trust between scientists and decision makers and funding for research but can hinder the scientific independence required. Likewise, as many players may be involved, the use of scientific results and support, especially for disaster response, may be limited in practice. Moreover, if the interaction between the scientific body and the user is inadequate, the possibility to overcome the problems of integrating science in disaster risk management is very narrow.

There is a gap between the types of expertise used in practice as governmental agencies responsible of disaster risk mainly uses research related to natural sciences. Engineering and geophysical sciences are well recognized to study and monitor natural events but other expertise and aspects of disaster risk management, like vulnerability, are usually pushed by political agendas.

For some countries it is not possible to conclude if there is scientific support in all the domains of analysis. In fact, scientific support is ad-hoc and informal in many situations and not recognized publically. As desk research may be limited to describe this reality, further research is needed to understand the real support of science in EWS and response.

From the research carried out more in detail in Norway, Portugal, Iceland, Netherlands, France, Austria, Spain and Italy, it is possible to provide a better picture of the disaster risk management systems and to come upon with some of the factors that facilitate or prevent SPI in these countries.

In the eight countries assessed there are strong institutes and agencies with expertise in different hazards. There is a close link between these organizations and Ministries or directly the government in terms of funding and recognition for early warning systems and operational response at national level. When the relevant level of crisis management is the municipality, the countries have developed a mechanism for support and a clear chain of command to secure resources (among them, it is considered scientific support). This supporting role is better developed for response than for policy making.

Scientific support is very important for policy making. Scenarios and plans are built based on studies, and many times, research institutes or agencies which conduct research have an active role in drafting documents. Equally, countries have Advisory Groups, such as examples of France and Italy. Nonetheless, and as observed for the general study, scientists may have a role to support, and agencies dealing with DRM have the capacity to incorporate science but the impact of it may be reduced by not engaging them in strategy planning or monitoring and by not chairing them in some platforms. In fact, disaster risk management is discussed in different arenas at all levels of governance.

The detected expertise is mainly related to natural and applied sciences (such as engineering and health), although the profits of using the different types of science (social, economics and humanities). In fact, social science can provide the necessary perspective to warn and inform population and different sectors of society more efficiently. Humanities are needed to engage citizens in new frameworks for action. It is necessary to promote the integration of different types of expertise in solving the problems. More importantly, it is not just analysing the situation and designing solutions with an interdisciplinary view, but to work in between disciplines to deal with the problems of DRM.

It is clear by the documents and activities carried out that the eight countries have invested time and money in dealing with disaster risk. Much is known about the geo-physical characteristics of hazards and progress has been made in the last years regarding the impact of risks, but reducing risks is not so common. This concept, which is of vital importance for decision makers, has a high degree of uncertainty. For the latter, the citizens must be recognized as active actors in disaster management, and the interaction of these with scientists should be facilitated. In relation to the *problematiques* originated to uncertainty, accountability issues emerge as a barrier for scientists and decision makers to work. In the analysed countries, risk ownership is not always obvious.

Disaster management is still response driven in many countries. Countries generally have a contingency plan in place which connect the EWS system with the response and the actions to carry in both phases. Nonetheless, less attention is payed to connecting prevention/mitigation with response. This can be partly explained by the traditional sectorial management of risk, where prevention is mainly carried out by the Ministry of the Environment, or a depending agency, and response, by the Ministry of Interior. Civil protection agencies have a limited role in prevention and mitigation although they could intervene as a *knowledge broker* in most cases.

Besides, some countries still give little importance to evaluation. After an emergency in Iceland or in the Netherlands, for example, different organizations are engaged to investigate the actions taken and its effectiveness. The results of this assessment are useful to fill the detected gaps. In fact, some members, have long tradition in working through multi-sectorial teams and can better accommodate different stakeholders discussing and reaching consensus. These aspects prove that the engagement of science is more or less limited depending on the predominant governance culture, so to say, to the social and economic values of the population.

Among the countries well analysed, also, it is possible to distinguish a particular institution working within the limits of river basins. These groups in charge of water management were generally institutionalized decades ago and enjoy of a high degree of independence, like in the Netherlands and Spain. These bodies have payed special attention to flood management but more consideration should be given to the risk of drought, taking into account climate change.

In spite of the limitations mentioned, national systems have proved to evolve, particularly in the last decade. For example, the concept of multi-risk has gained attention in the last years, especially in Early Warning Systems. Many agencies have developed in this path and nowadays they provide a multi-risk bulletin for weather events. Here, the work of advocacy, networking and knowledge sharing of the World Meteorological Organization (WMO) has proved to be productive. In the same line, European initiatives regarding risk have a positive effect on Member States. The guidance and exchange of knowledge which is carried out when drafting a Directive and after for its implementation in the country, together with the impulse in the agenda of many countries, has an overall positive effect. For example, the Floods directive pushed risk mapping and flood forecasting and the Seveso Directive boosted communication procedures between the industries and the agency in charge of disaster prevention. Finally, there are different windows of opportunity for better integrate scientific knowledge. With small changes of structure and putting in place some procedures, scientific knowledge will be more available to decision makers.

6. Recommendations

Considering that there is space and mechanisms in place for scientific support within Member States and Member States with European Commission, some recommendations can be listed for further research. Some of these issues will be addressed in a third phase of the SPI study at the Joint Research Centre, others are consistent with the short and mid-term objectives of the Disaster Risk Management Knowledge Centre, and some are long term issues that may be studies in future research projects.

1. The present study mapped the actors proving science to disaster risk management in three domains. To have a better picture of policy making, it is necessary to also map the actors which are involved in (a) land use planning, (b) national policy arenas or platforms not related to the UNISDR initiative, (c) risk mapping and (d) prevention and mitigation policies. This study could be multi-hazard in order to find synergies and disparities among different agencies and hazards.

2. In line with the point above, it is necessary to study the policy networks and the spaces of interaction between different sectors for disaster risk management. Considering that most of the research is done by agencies and institutes that may not have a direct mandate in disaster risk management, these arenas are the opportunity for different groups to interact and to exchange interest and needs. This way, for example, the environmental agencies conducting or funding research would know which lines of research to prioritise or to open. Equally, the establishment of comprehensive strategies for disaster risk reduction at national level would be necessary to promote synergies and share resources. The work done and lessons learned regarding climate change can be profitable for disaster risk management.

3. As mentioned in the conclusions, desk research needs to be complemented with another analysis to define the SPI existing in practice. This way, it would be possible not only to find more actors providing science support to every domain but also to describe the services and products provided by the players involved in the compiled practices. For that reason, it is highly recommended to start with the countries where the current research didn't give definite results, such as Cyprus, Estonia, Latvia, Greece and Slovenia.

4. In line with point 2, and to understand the real relationship between scientists and decision makers, key actors from different countries need to be interviewed. The interviews can be based on the SPI framework (Figure 1). A template of interview, for scientists and decision makers, is included in Annex 2.

5. Disaster Risk Systems have many components interacting in a country. Horizontally, different sectors and organizations, governmental or not, participate in policy making and disaster operations. At the same time, countries have different layers of governance interacting with different missions and challenges. For the future studies, it is recommendable to focus on the level which is relevant for (a) policy-making, (b) early warning systems and (c) disaster response.

6. Meteorological services have experience in structuring their work with decision makers and users. This can be used as a pool for knowledge for other organizations in charge of monitoring and alerting authorities and population.

7. Science policy interfaces can be prevented by factors coming from other spheres, out of the project context. To successfully transfer the smart practices collected to a new system, the institutional and sociocultural context should be similar. Ideally, projects that aim to materialize a mechanism or practice to reinforce SPI, should also consider actions at above spheres (Figure 14). The quality of the different components will facilitate research to become actionable.

Finally, SPI can exist but not be effective. Thus, SPI would need to be assessed. At project level, communication, mediation and translation should be monitored over time. Also, independence, expertise and participation. Among the expected outputs, learning and trust should be carefully examined. These actions should be treated as part of an ongoing experiment, as a source of knowledge for future projects.

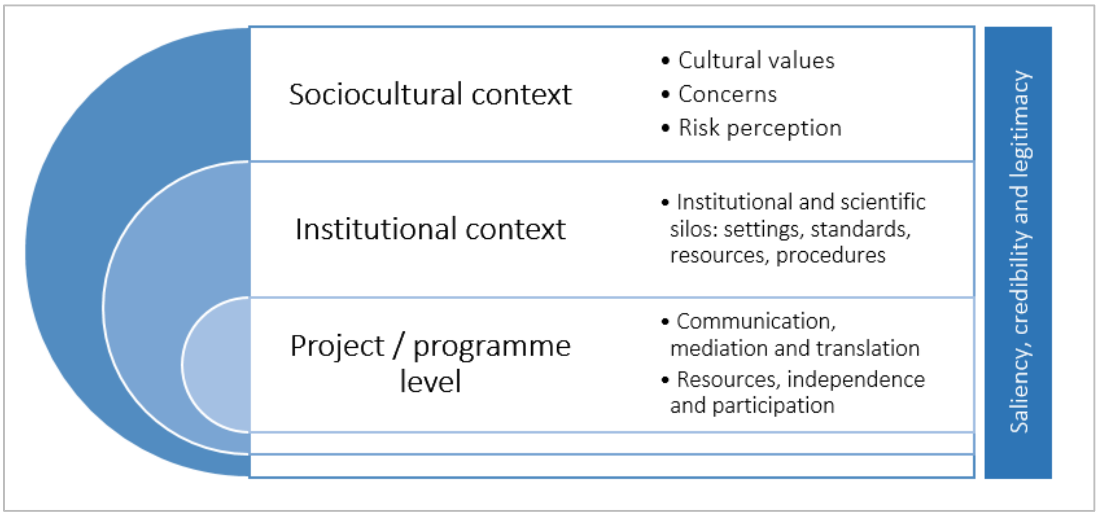

Figure 14. Framework of action to improve SPI.

8. Future work in the topic needs to cover activities for decision makers and scientists, together and separately, as different institutional circumstances limit their interaction at early stages of policy making. Equally, science can benefit implementation and evaluation of all domains although these actions are generally limited to authorities. Actually, considering that decision making is cyclical and ongoing, scientific input should occur at all stages (Vogel et al, 2007).
9. At European level there are initiatives working with SPIs. The study of these could be beneficial considering the supportive role that the European Commission want to perform.
10. Indirectly, but related to the topic of this study, a complementary line of action which would provide outcomes in the long term would be promoting networking among RO and groups and especially at the private sector. Moreover, (1) a legal research regarding risk ownership and (2) a good research of SPIs communicating with the population could be carried by the Disaster Risk Management Knowledge Centre.
11. It would be interesting to examine the activities and results obtained by the TEA Working Group in Finland, created to facilitate cooperation and knowledge exchange between ministries.

Annex 1

Organizations in charge of monitoring events for Early Warning Systems

Country	Weather events	Floods	Seism	Radioactivity	Forest fires
Austria	Central Institution for Meteorology and Geodynamics (ZAMG)		Central Institution for Meteorology and Geodynamics (ZAMG)		Central Institution for Meteorology and Geodynamics (ZAMG)
Belgium	Royal Meteorological Institute of Belgium (IRM)	Regionalized hydrological services[6]	Royal Observatory of Belgium (ROM)		
Bulgaria	Bulgarian National Hydrometeorological Service (BNHMS)	Bulgarian National Hydrometeorological Service (BNHMS)	Geophysical Institute of the Bulgarian Academy of Scince	Bulgarian National Hydrometeorological Service (BNHMS) National Centre for Radiobiology and Radiation Protection (NCRRP)	Bulgarian National Hydrometeorological Service (BNHMS)
Croatia	Meteorological and Hydrological Service (DHMZ)	Meteorological and Hydrological Service (DHMZ)	Department of Geophysics, University of Zagreb	State Office for Radiological and Nuclear Safety (SORNS)	Meteorological and Hydrological Service (DHMZ)
Cyprus			Geological Survey Department		
Czech Republic	Czech Hydrometeorological Institute (CHMI)	Czech Hydrometeorological Institute (CHMI)	Institute of Geophysics (Academy of Sciences of the Czech Republic), IPE MUNI Brno, and IGN/TU Ostrava,	National Radiation Protection Institute (SURO)	Czech Hydrometeorological Institute (CHMI)
Denmark	Danish Meteorological Institute (DMI)		Geological Survey of Denmark and Greenland (GEUS)	National Institute for Radiation Protection*	
Estonia			Geological Survey of Estonia		
Finland	Finnish Meteorological Institute (FMI)	Finnish Environment Institute (SYKE)	Institute of Seismology (University of Helsinki)	Radiation and Nuclear Safety Authority (STUK)	Finnish Meteorological Institute (FMI)
France	Meteo France	French National Hydrometeorological and Flood Forecasting Centre (SCHAPI) together with Meteo France	French National Seismic Monitoring Network (RéNaSS), with stations from Universities, the RAP (Réseau accélérométrique permanent, the BCSF (composed by the Ministry of Research and the CNRS-INSU), and the Laboratory for Detection and Geophysics (CEA-LDG)	Institut de Radioprotection et de surete nucleaire (IRSN)	Meteo France
Germany	German National Meteorological Service (DWD)	German National Meteorological Service (DWD)	BGR seismological central observatory	Federal Office for Radiation Protection (BfS)	German National Meteorological Service (DWD)

6 Depending on the region

Greece			Institute of Geodynamics of the National Observatory of Athens (NOA-IC)	Greek Atomic Energy Commission (EEAE)	
Hungary	Hungarian Meteorological Service (OMSz)	Hungarian Hydrological Forecasting Service HHFS	Kövesligethy Radó Seismological Observatory	Hungarian Hydrological Forecasting Service HHFS National Research Institute for Radiobiology and Radiohygiene (NRIRR)	
Ireland	Met Eireann	Met Eireann	Irish National Seismic Network (INSN)	Radiological Protection Institute of Ireland (RPII)	Met Eireann
Italy	Servizio Meteorologico, Ministerio Defensa	Central Functional Centre and Rivier Basins	National Institute of Geophysics and Vulcanoloy (INGV)	Institute for Environmental Protection and Research (ISPRA)	National Civil Protection (DPC)
Latvia				Institute of Food Safety, Animal Health and Environment (BIOR)	
Lithuania	Lithuanian Hydrometeorological Service (LHMS)	Lithuanian Hydrometeorological Service (LHMS)		Environmental Protection Agency (AAA)	Lithuanian Hydrometeorological Service (LHMS)
Luxembourg		Administration de la Gestion de l'Eau	Centre de reserche scientifique du MNHN		
Malta			Seismic Monitoring Research Group, University of Malta	Malta Environment & Planning Authority (MEPA)	
Netherlands	Royal Netherlands Meteorological Institute (KNMI)	Royal Netherlands Meteorological Institute (KNMI)	Royal Netherlands Meteorological Institute (KNMI)	National Institute for Public Health and the Environment (RIVM) Institute of Food Satety (RIKILT)	
Poland	Institute of Meteorology and Water Management (IMGW)	Institute of Meteorology and Water Management (IMGW)	Institute of Geophysics, Polish Academy of Sciences	Central Laboratory for Radiological Protection (CLOR) Institute of Meteorology and Water Management (IMGW)	Institute of Meteorology and Water Management (IMGW)
Portugal	Portuguese Sea and Atmosphere Institute (IPMA)		Portuguese Sea and Atmosphere Institute (IPMA)		Portuguese Sea and Atmosphere Institute (IPMA)
Romania	Administratia Nationala de Meteorologie (NMA)	National Institute of Meteorology and Hydrology (NIMH)	National Institute for Earth Physics (INFP)		
Slovakia	Slovak Hydrometeorological Institute (SHMÚ)	Slovak Hydrometeorological Institute (SHMÚ)	Slovak Hydrometeorological Institute (SHMÚ)	Slovak Hydrometeorological Institute (SHMÚ)	

Slovenia	Environmental Agency (ARSO)	Environmental Agency (ARSO)	Environmental Agency (ARSO)	Slovenian Nuclear Safety Administration	Environmental Agency (ARSO)
Spain	State Meteorological Agency (AEMET)		Instituto Geografico Nacional (IGN)	Nuclear Safety council (CSN)	State Meteorological Agency (AEMET)
Sweden	Swedish Meteorological and Hydrological Institute (SMHI)	Swedish Meteorological and Hydrological Institute (SMHI)	Department of Earth Science, University of Uppsala	Swedish Radiation Safety Authority	Swedish Meteorological and Hydrological Institute (SMHI)
UK	UK Met Office	Envionmental Agency (EA), Natural Resources Wales (NRW) and Scottish Environment Protection Agency (SEPA)	British Geological Survey	Environment Agency, Public Health England, the Scottish Environment Protection Agency (SEPA)	UK Met Office
Iceland	Icelandic MET Office (IMO)	Icelandic MET Office (IMO)	Icelandic MET Office (IMO)	Icelandic Radiation Protection Safety Authority	
Montenegro	Institute of Hydrometeorology and Seismology of Montenegro (IHMS)	Institute of Hydrometeorology and Seismology of Montenegro (IHMS)	Institute of Hydrometeorology and Seismology of Montenegro (IHMS)	Centre for Ecotoxicological Research (CETR)	Institute of Hydrometeorology and Seismology of Montenegro (IHMS)
Norway	The Norwegian Meteorological Institute	Norwegian Water Resources and Energy directorate (NVE)	Department of Earth Science University of Bergen NORSAR	Norwegian Radiation Protection Authority (NRPA)	The Norwegian Meteorological Institute
Serbia	Republic Hydrometeorological Service of Serbia (RHMS)	Republic Hydrometeorological Service of Serbia (RHMS)			Republic Hydrometeorological Service of Serbia (RHMS)
Macedonia	Hydrometorological Service of Macedonia (HMS)	Hydrometorological Service of Macedonia (HMS)	Macedonia Sismological Observatory	Institute for Public Health	Hydrometorological Service of Macedonia (HMS)
Turkey	Turkish State Meteorological Service (TSMS)		National Earthquake Monitoring Center (Bogazici University)	Turkish Atomic Energy Authority (RAEK)	Turkish State Meteorological Service (TSMS)

Organizations in charge of giving support in disaster response

Country	Research organization
Austria	Central Institution for Meteorology and Geodynamics (ZAMG)
Belgium	Experts can assist the Coordination Committee (CC)
Bulgaria	Bulgarian National Hydrometeorological Service (BNHMS)
Croatia	Meteorological and Hydrological Service (DHMZ) Department of Geophysics, University of Zagreb State Office for Radiological and Nuclear Safety (SORNS)
Cyprus	
Czech Republic	Czech Hydrometeorological Institute (CHMI)
Denmark	Danish Meteorological Institute (DMI) National Institute of Radiation Protection
Estonia	

Finland	Radiation and Nuclear Safety Authority (STUK) Finnish Environment Institute (SYKE) Finnish Meteorological Institute (FMI)
France	Meteo France French National Hydrometeorological and Flood Forecasting Centre (SCHAPI) Centre of Documentation, Research and Experimentation on Accidental Water Pollution (CEDRE) French Research Institute for Exploitation of the Sea (IFREMER) Centre d'Etudes Techniques Maritimes et Fluviales (CETMEF) Institut de Radioprotection et de surete nucleaire (IRSN)
Germany	German National Meteorological Service (DWD)
Greece	Institute of Geodynamics Greek Atomic Energey Commission (EEAE)
Hungary	Experts in operations
Ireland	Met Eireann Environmental Agency (NEPA) Universities
Italy	Centres of Competence (Universities, research institutes)
Latvia	
Lithuania	Lithuanian Hydrometeorological Service (LHMS)
Luxembourg	Experts, other services and even the private sector may be included in or supporting the Crisis Team commanding the emergency.
Malta	
Netherlands	Royal Netherlands Meteorological Institute (KNMI) Institute of Food Safety (RIKILT)
Poland	Institute of Meteorology and Water Management (IMGW)
Portugal	Portuguese Sea and Atmosphere Institute (IPMA) Laboratorio Nacional de Engenharia civil (LNEC) Laboratorio Nacional de Energia e Geologia (LNEG) Instituto Nacional de Investigacao Agraria e Veterinaria (INIAV) Instituto Nacional de Saude (INSA)
Romania	Experts in the National Committee for Emergency Situations
Slovakia	
Slovenia	Slovenian Nuclear Safety Administration
Spain	State Meteorological Agency (AEMET) Nuclear Safety council (CSN)
Sweden	Swedish Radiation Safety Authority
UK	UK Met Office Public Health England
Iceland	University Earth Sciences Institute Icelandic Met Office
Montenegro	Institute of Hydrometeorology and Seismology of Montenegro (IHMS)
Norway	Norwegian Water Resources and Energy directorate (NVE) Norwegian Radiation Protection Authority (NRPA)
Serbia	Republic Hydro meteorological Service of Serbia (RHMS)
Macedonia	Hydro-metorological Service of Macedonia (HMS)
Turkey	Turkish State Meteorological Service (TSMS)

Annex 2

Interviews template for decision makers

Science has proven to be necessary to reduce and prevent the impact of disasters but is often not well integrated in political decisions. In order to bridge decision-makers and scientists, disaster risk need to be treated in an overlapping space between scientific research and political decision, in science policy interfaces.

Science-policy interfaces are social processes where scientists and decision-makers can jointly construct knowledge. In this spaces actors can communicate and mediate while using relevant, credible and legitimate knowledge.

The current project 'Science-Policy Interfaces in Science in Disaster Risk Management in the EU' aims to understand where, when and how science is used in disaster risk management at the European territory. The study covers three domains: policy making, early warning systems and disaster response. Based on desk research, the role of science in several countries has been diagnosed and in order to better understand the relation between authorities and scientist, representative smart practices have been collected. These can be used as a practical example to discuss and analyze the features of the interaction, such as resources, space for communication, trust, learning, etc.

The results of the study will be important inputs for the recently launched Disaster Risk Management Knowledge Centre (DRMKC), the new European Commission initiative on better knowledge and competence management for sounder EU policy making. The DRMKC implements a networked approach to translate complex scientific data and analyses into usable information, to provide science-based advice for DRM policies, as well as timely and reliable scientific-based analyses for emergency preparedness and response coordinated activities.

Policy-making

Policy making for risk prevention and mitigation is an important part of disaster risk management. In the study, policy making is understood as the formulation of ideas or plans used by the government in order to make decisions and it can be summarized into three: strategy planning, design and implementation of policies (prevention, mitigation and preparedness/contingency plans), and the review of these policies. Taking into account the multidisciplinary nature of disaster risk and the effect of international movements, the study also examines the work at higher level, at policy network. These networks are sets of formal institutional and informal linkages between governments and other actors around a shared interest regarding public policy making and implementation.

QUESTIONS

1. **Use of science: Do you use scientific support in policy making?**

In which stage is science/expertise generally used: to draft policies, to implement policies, to monitor them?

Which should be the role of science in policy-making?

2. **Actors: Who provides scientist advice?**

Are there research groups/institutes/agencies which commonly work with you (your institution) providing scientific input to policy-making? Which are these?

Do you use different expertise, from natural and social science, to support you?

3. **Research Funds: Is your institution involved in research for policy making?**

Does your institution fund research? If so, which type of research do you fund normally, operational or academic research?

If not, is it possible for you to influence where research funds are allocated?

Are there scientists with the required expertise available to work with your institution?

Is the institution involved in bilateral agreements or partnerships with other institutions internationally for policy making?

4. **Mechanism for integration: How is the scientific data or advice integrated in the policy-making process?**

Is it a structured process (for example, through agreements and partnerships) or experts are required for specific tasks? Is this structure convenient or could be improved?

Do you have the sufficient resources (time and money) to properly integrate the scientific information into decision making?

Are the roles and procedures clearly defined and explained to the scientists?

5. **Uncertainty: Do scientists communicate you the existing uncertainty of their advice and studies?**

6. **Accountability: Who has to respond for the decisions, policies, plans and other regulations made regarding risk prevention and mitigation?**

What actors are accountable in policy making?

Are scientists accountable? What are they accountable for?

Is accountability defined by law?

7. **Difficulties: Which are the problems that your institution commonly faces when working with scientists?**

Is the information given by experts understandable? Is information presented in an easy way?

Are the products given by experts (like a map, a scenario, a risk assessment) on time and relevant?

Is the input of science evaluated in order to know its relevance?

8. **Workflow: Does your institution support regional and local level to integrate science?**

Do you facilitate regional and local levels to integrate science in their policy making processes (for example for emergency planning or risk assessment)?

Do the scientific group provide support to the local level directly or through the national authority?

9. **Communication: Are the outputs of policy-making (such as risk assessments, prevention plans, mitigation actions, maps, etc.) jointly divulgated to the general public?**

Early warning systems

Early warning systems are the set of capacities and tools needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to act appropriately and in time to reduce the possibility of harm or loss. Science input to early warning systems.

Overview of how early warning systems are developed and improved according to the needs of public bodies. In the study it is included in this point the systems to monitor and surveillance for events and the ones to warn the general public.

QUESTIONS

1. **Use of science: Do you use science to develop EWS?**

In which stage is science/expertise generally used: to design EWS, to implement them, to monitor them?

Which should be the role of science in EWS?

2. **Actors: Who provides scientist advice?**

Are there research groups/institutes/agencies which commonly work with you (your institution) providing scientific input to develop EWS? Which are these?

Do you use different expertise, from natural and social science, to support you?

3. **Research funds: Is your institution involved in research regarding EWS?**

Does your institution fund research? If so, which type of research do you fund normally, operational or academic research?

If not, is it possible for you to influence where research funds are allocated?

Are there scientists with the required expertise available to work with your institution?

Is the institution involved in bilateral agreements or partnerships with other institutions internationally regarding EWS?

4. **Mechanism for integration: How is scientific knowledge integrated in the development of EWS?**

Is it a structured process (for example, through agreements and partnerships) or experts are required for specific tasks? Is this structure convenient or could be improved?

Do you have the sufficient resources (time and money) to properly integrate the scientific information into decision making?

Are the roles and procedures clearly defined and explained to the scientists?

5. **Uncertainties: Do scientists communicate you the existing uncertainty of their studies?**

6. **Accountability: Who has to respond for the EWS systems?**

What actors are accountable in monitoring events? And in warning the population?

Are scientists accountable? What are they accountable for?

Is accountability defined by law?

7. **Difficulties: Which are the problems that your institution commonly faces when working with scientists?**

Is the information given by experts understandable? Is information presented in an easy way?

Are the products given by experts (like weather bulletins, new systems to warn population) on time and relevant?

Is the input of science evaluated in order to know its relevance?

8. **Workflow: Does your institution support regional and local level?**

Do the scientific group provide support to the regional and local level directly or through the national authority?

How do you reduce the gap between alert and response at local level?

9. **Communication: Are the outputs of EWS development jointly divulgated to the general public?**

Disaster response

The project aims to understand how authorities look for and use scientific advice while responding to an emergency. So to say, the actions to prevent further loss and to restore order and normality.

QUESTIONS

1. **Use of science: Do you use scientific support to respond to a disaster?**

Are there scientists with the required expertise available to work with your institution?

Which should be the role of science while responding to a disaster?

2. **Actors: Who provides scientist advice?**

Are there research groups/institutes/agencies which commonly work with you (your institution) providing scientific input during operations? Which are these?

Do you use different expertise, from natural and social science, to support you?

3. **Research funds: Is your institution involved in research regarding disaster response?**

Does your institution fund research? If so, which type of research do you fund normally, operational or academic research?

If not, is it possible for you to influence where research funds are allocated?

Are there scientists with the required expertise available to work with your institution?

Is the institution involved in bilateral agreements or partnerships with other institutions internationally regarding emergency operations?

4. **Mechanism for integration: How is scientific knowledge integrated in the decisions taken to respond?**

Is it a structured process (for example, through agreements and partnerships) or experts are required for specific tasks? Is this structure convenient or could be improved?

Are the roles and procedures clearly defined and explained to the scientists?

5. **Uncertainty: Do scientists communicate you the existing uncertainty of their advice and services?**

6. **Accountability: Who has to respond for the decisions made during operations?**

What actors are accountable in emergency response?

Are scientists accountable? What are they accountable for?

Is accountability defined by law?

7. **Difficulties: Which are the problems that your institution commonly faces when working with scientists?**

Is the information given by experts understandable? Is information presented in an easy way?

Is the advice given by experts (like a map, a scenario, a risk assessment) on time and relevant?

Is the input of science evaluated in order to know its relevance?

8. **Workflow: Does your institution support regional and local level?**

Do the scientific group provide support to the local level or through the national authority?

How do you reduce the gap between alert and response at local level?

9. **Communication: Is the information to the general public communicated together with scientists?**

Interviews template for Scientists

Policy-making

Policy making for risk prevention and mitigation is an important part of disaster risk management. In the study, policy-making is understood as the formulation of ideas or plans used by the government in order to make decisions and it can be summarized into three: strategy planning, design and implementation of policies (prevention, mitigation and preparedness/contingency plans), and the review of these policies. Taking into account the multidisciplinary nature of disaster risk and the effect of international movements, the study also examines the work at higher level, at policy network. These networks are sets of formal institutional and informal linkages between governments and other actors around a shared interest regarding public policy making and implementation.

QUESTIONS

1. **Use of science: Do you participate in policy making regarding risk prevention and mitigation?**

In which stage is science/expertise commonly engaged: to draft policies, to implement policies, to monitor them?

Are decision-makers willing to use the data/information/outputs provided by you?

Which should be the role of science in policy-making?

2. **Research Funds: Which institutions funds research in risk prevention and mitigation?**

Who funds this research nationally? Which type of research is funded, operational or academic research?

Have you participated in international research regarding risk prevention and mitigation? Who funded it?

Is your institution involved in bilateral agreements or partnerships with other institutions or research groups for policy making?

3. **Mechanism for integration: How is the scientific data or advice integrated in the policy-making process?**

Is it a structured process (for example, through agreements and partnerships) or experts are required for specific tasks? Is this mechanism convenient or could be improved?

Are the roles and procedures clearly defined and explained to scientists?

4. **Uncertainty: Do you communicate decision makers the uncertainty of your studies?**

How do you deal to communicate uncertainty to decision makers?

5. **Accountability: Who has to respond for the decisions, policies, plans and other regulations made regarding risk prevention and mitigation?**

Are scientists accountable? What are they accountable for?

Is accountability defined by law?

6. **Difficulties: Which are the problems that your institution commonly faces when working with decision makers?**

Do you have the sufficient resources (time and money) for providing the service/output required?

Do you have all the information you need to work?

Can you work and communicate with the necessary independence?

Do you translate and present the information in an easy way for decision makers?

Is the input of science evaluated in order to ensure quality?

7. **Communication: Are the outputs of policy-making (such as risk assessments, prevention plans, mitigation actions, maps, etc.) divulgated to the general public together with scientists?**

Early warning systems

Early warning systems are the set of capacities and tools needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to act appropriately and in time to reduce the possibility of harm or loss. Science input to early warning systems. Overview of how early warning systems are developed and improved according to the needs of public bodies. In the study it is included in this point the systems to monitor and surveillance for events and the ones to warn the general public.

QUESTIONS

1. **Use of science: Do you participate in the development of EWS?**

In which stage is science/expertise commonly engaged: to design EWS, to implement them, to monitor them?

Are decision-makers willing to use the data/information/outputs provided by you?

Which should be the role of science in EWS?

2. **Research Funds: Which institutions funds research in EWS?**

Who funds this research nationally? Which type of research is funded, operational or academic research?

Have you participated in international research regarding EWS? Who funded it?

Is your institution involved in bilateral agreements or partnerships with other institutions or research groups for policy making?

3. **Mechanism for integration: How is scientific knowledge integrated in the development of EWS?**

Is it a structured process (for example, through agreements and partnerships) or experts are required for specific tasks? Is this mechanism convenient or could be improved?

Are the roles and procedures clearly defined and explained to scientists?

4. **Uncertainty: Do you communicate decision makers the uncertainty of your studies/services provided?**

How do you deal to communicate uncertainty to decision makers?

5. **Accountability: Who has to respond for the EWS? And for the warning given?**

Are scientists accountable? What are they accountable for?

Is accountability defined by law?

6. **Difficulties: Which are the problems that your institution commonly faces when working with decision makers?**

Do you have all the information you need to work?

Do you have the sufficient resources (time and money)?

Can you work and communicate with the necessary independence?

Do you translate and present the information in an easy way for decision makers?

Is the input of science evaluated in order to ensure quality?

7. **Communication: Are the outputs of developing EWS or monitoring events divulgated to the general public together with scientists?**

Disaster response

The project aims to understand how authorities look for and use scientific advice while responding to an emergency. So to say, the actions to prevent further loss and to restore order and normality.

QUESTIONS

1. **Use of science: Do you support authorities while responding to a disaster?**

Are decision-makers willing to use the data/information/outputs provided by you?

After participating in emergency operations, are you normally engaged in assessing that response?

Which should be the role of science in EWS?

2. **Research Funds: Which institutions funds research in EWS?**

Who funds this type of research nationally? Which type of research is funded, operational or academic research?

Have you participated in international research regarding disaster response? Who funded it?

Is your institution involved in bilateral agreements or partnerships with other institutions or research groups?

3. **Mechanism for integration: How is scientific knowledge integrated in disaster response?**

Is it a structured process (for example, through agreements and partnerships) or experts are required for specific tasks? Is this mechanism convenient or could be improved?

Are the roles and procedures clearly defined and explained to scientists?

4. **Uncertainty: Do you communicate decision makers the uncertainty of your advice/services provided?**

How do you deal to communicate uncertainty to decision makers?

5. **Accountability: Who has to respond for the decisions made during operations?**

Are scientists accountable? What are they accountable for?

Is accountability defined by law?

6. **Difficulties: Which are the problems that you commonly face when working with decision makers?**

Do you have all the information you need to work?

Can you work and communicate with the necessary independence?

Do you translate and present the information in an easy way for decision makers?

7. **Communication: Is the information to the general public communicated together with scientists?**

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List of abbreviations and definitions

DRM – Disaster Risk Management

DRMKC – Disaster Risk Management Knowledge Centre

DRR – Disaster Risk Reduction

EWS – Early Warning System

NRA – National Risk Assessment

RO – Research organization

SPI – Science Policy Interface

UNISDR – United Nations Office for Disaster Risk Reduction

List of figures

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As the Commission's
in-house science service,
the Joint Research Centre's
mission is to provide EU
policies with independent,
evidence-based scientific
and technical support
throughout the whole
policy cycle.

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