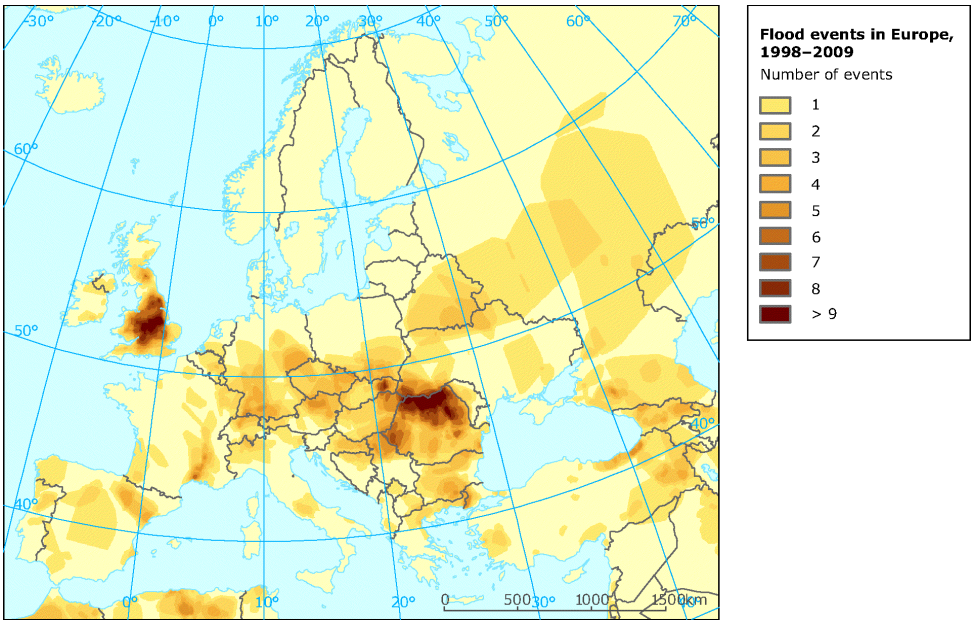
Towards a potential European flood impact database



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Executive Summary

Every year, Europe is affected by natural hazard events, notably floods, causing large but insufficiently understood and documented losses. Societal vulnerability is a key driver behind rising losses. The existing global and national disaster impact databases are ill-suited for advising the EU natural hazard, civil protection, and climate adaptation policies. There is a scope for a concerted action at the European level. A potential European Flood Impact Database could be built to advise, and draw knowledge from, the implementation of the EU Floods Directive (EC 2007a).

A better knowledge about the past flood damage can inform:

Prevention and protection	by shedding light on the pattern of practice that drive vulnerability and risk;
	by identifying the pathways through which the economic and social hardship is spread beyond the directly affected area;
	by increasing awareness about what is at stake.
Preparedness	by helping to budget resources for development of early warning and alerting systems, and for managing emergencies;
	by allowing to better tailor the information provided for different communities and groups.
Response	by helping to decide (and legitimise) how much resources need to be deployed to manage properly the emergency situations and constrain the damage and hardship suffered.
Recovery and review	by driving the information collection during and after the emergency;
	by deciding which investments can most effectively boost the recovery and welfare contributions to most vulnerable groups.

Improving knowledge about the intensity, magnitude and impacts of *significant flood events* in Europe is important as a principle of good governance, smart regulation and better law making. The proposed European Flood Impact Database will help to better understand the pattern of vulnerability across the regions and sectors, and to choose most suitable (cost efficient, equitable) risk mitigation and climate adaptation measures. Besides, an European Flood Impact Database would enable new information services that are likely to lead to a greater awareness of and preparedness for flood risk.

Several European policies and regulations recognise the need for a systematic collection of information and data related to the frequency, extent and impact of natural hazards including floods. Since 2011, the concept of an European Flood Impact Database has been explored as a joint initiative of EEA and JRC, in collaboration with the Centre for Research on the Epidemiology of Disasters (CRED) and the European Topic Centre on Climate Change Impacts, Vulnerability and Adaptation (ETC-CCA). Initially, the flood impact database can be populated for the most significant flood damaging events (SFE). Identified by the EEA or MS, the SFE should be revisited and assessed using the same methodologies and tools in order to ensure that the results are reliable and comparable. The European flood impact database could be pursued initially by voluntary policy options, driven by a concerted EU action and open method of coordination (OMC).

From a European perspective, it is desirable to establish more comprehensive information systems which would allow analysing and assessing the overall impact of different hazard types in Europe with a view of providing a more comprehensive and sound base for disaster and risk management and reduction. To do so, the European Environment Agency (EEA) and the Joint Research Centre (JRC), in collaboration with the Centre for Research on the Epidemiology of Disasters (CRED) and the European Topic Centre on Climate Change Impacts, Vulnerability and Adaptation (ETC-CCA), have explored approaches to evidence-based historical flood impact databases able to support European and national flood disaster risk reduction efforts. The successful database project is only possible when it builds upon knowledge and past efforts. One of these efforts is the further development of WISE. While improving the information base it will be important to use as much as possible existing data from various sources as well as to link to key existing initiatives in particular SEIS, INSPIRE and Copernicus.

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1 Building a strong case for the European Flood Impact Database

Europe is suffering from large yet insufficiently understood and documented losses to natural hazards, notably floods. Societal vulnerability is the key driver of increasing losses. Likely, the flood losses will be further amplified by human induced climate change.

Flood inflicted losses in Europe

Floods, along with storms (see Box 1), are natural hazards that incur the highest economic losses in Europe. Over the period 1998-2009, the direct losses wreaked by flood events recorded by EM-DAT global disaster database and for which an estimate of economic impacts is available (~ 40% of all recorded cases) exceeded EUR 60 billion in 2009 values (EEA 2010). The same events have caused fatalities of more than 1100.

Even if the direct losses were recorded for all the 213 flood events above, the **aggregation of their normalised values would still underestimate the actual social welfare losses**. From an economic point of view, floods engender exogenous, internal or external (if international trade is affected) shocks to economies, with far-reaching ripple effects. Beyond the direct structural damage, the flood-affected sectors are likely to curtail their activities and production, collect less revenues, lay-off staff, and postpone investments. These direct losses set off a sequence of 'up'- and 'downstream' reactions which affect their suppliers and customers. These ripple effects represent the indirect or higher order impacts. Environmental costs arise as a result of temporal or permanent negative effects on ecosystem quality and/or ecosystem service supply, in some situations because of the loss of biodiversity. Floods often trigger industrial accidents and pollution spills with lasting consequences. Relief and reconstruction costs include the assistance to the disaster-affected intensive sectors and communities. They may take form of subsidised loans or seeding material, compensations etc.

Box 1: Impact of floods and storm in Europe

In the overview given by Visser et al. (2012) the share of major meteorological and hydrological disasters over the period 1980-2010 is more or less equal (43 and 42 % respectively of all weather related disasters). More than half of the total economic losses are due to meteorological disasters and almost two third of all affected people is due to hydrological disasters (almost exclusively floods as the contributions of landslides and avalanches are only marginal compared to the total burden). More than half of the number of victims (people killed) is due to climatological disasters, mainly temperature extremes (heat and cold waves, and droughts).

A major remark is the dual nature of some disasters. A hurricane like Katrina (2005) is categorised as a meteorological disaster in EM-DAT (2012) but the resulting flooding highly contributed to the economic losses. Disasters can also be classified in a different category in different database like EM-DAT, NatCat or Sigma (see further in this working paper for details). Especially for associated storms and floods the same event may be recorded as meteoreological or hydrological disaster (Guha-Sapir and Below 2002).

Impact of disaster losses on EU economy

Much of the discussion in disaster economics concerns whether the disasters have positive or negative net effects on macroeconomic variables (e.g. GDP, employment), how these effects evolve in the short and long term, and whether they are transitory or permanent (Benson & Clay 2003; Baade *et al.* 2005). There is evidence that post-disaster reconstruction and relief payments may generate a boom in the economy and at a regional level, thus, to some extent offsetting the hazard losses (Albala Bertrand 1993). In addition, replacement of capital provides opportunity for productivity-raising innovations. The recurrent hydro-meteorological disasters pose different methodological challenges and there is disagreement about their cumulative effect on long-term economic development. In the short-term, disasters negatively affect income generation, investment, consumption, production, employment and financial flows, and these losses are usually manifested through a decline of macroeconomic variables such as GDP and the components that make up GDP (Benson & Clay 2003).

Trend detection in and attribution of flood losses

Recently, the economics of disasters has attracted the attention of policy makers and academics who sought to analyse the relations between empirically confirmed climate change and the frequency and intensity of the extreme climate events such as tropical an extra-tropical storms, droughts, and heavy precipitation and ensuing floods. It is important to distinguish the increase of losses in nominal or current value (trend detection) from the attribution of these trends to (human induced) climate change. The latter is very difficult and only a few studies have managed to provide evidence of a cause-effect relationship. The IPCC Special Report on Managing the Risks of Extreme Events and Disasters (IPCC 2012) has reviewed the published research in this field and concluded that with a high level of confidence that economic losses from weather- and climate-related disasters have increased in the long-term, as people and economic assets have been increasingly exposed to risks. With other words, the observed increase of losses is caused by more people living where they may be adversely affected by disasters. Similarly, the EEA (2010) founds no evidence of trends after the recorded flood-related losses have been cleaned of effects of compound factors such as population and wealth grow. Visser *et al.*(2012) found a statistically significant increase in disaster losses in the first half of the 1980–2010 period and stable level thereafter.

Projections of future flood losses

Throughout Europe, the flood related damage are expected to increase in future, in some parts significantly so (EEA 2012). Study conducted by Feyen *et al.* (2012) indicates for EU27 as a whole, current expected annual damages (EAD) of approximately €6.4 billion is projected to amount to €14–21.5 billion (in constant prices of 2006) by the end of this century, depending on the scenario. The number of people affected by flooding is projected to rise by approximately 250,000 to 400,000.

The existing global and national disaster impact databases are ill-suited for advising the EU natural hazard, civil protection, nature conservation and climate adaptation policies. There is a scope for an concerted EU action to establish a more complete and up-to-date dataset. The European Flood Impact Database could be a first step. The database would enable more sound policy advice to the implementation of EU Flood Policy (EC 2007a), serve the research community at European and Global level, but will likely be useful at national level as well.

Importance of a better understanding of flood impacts

A proper documentation and analysis of past events is the backbone of disaster risk reduction. Such an information base is needed for scientifically sound hazard and risk assessment (e.g. for trend detection, verification of damage estimation procedures, model validation), for developing future scenarios, as well as for public awareness raising. The need for a systematic collection and organisation of data on hazards and disaster events and their impacts on different levels (e.g. local, regional, national, European or global) corresponds to the second priority area of the Hyogo Framework for Action (HFA) (UN ISDR 2007), which aims at providing better risk information for sound decision making. This thought is also reflected in the recent Commission communication on a community approach on the prevention of natural and man-made disasters (EC 2009a), which identifies the creation of information base on disasters as one of the key elements of a community approach on prevention. The need also arises from EU legislation and policies, including e.g. the most recent Council Conclusions on a Community framework on disaster prevention within the EU; the Floods Directive; the EU Solidarity and Structural Funds; and the EU White Paper on adaptation to climate change (EC 2009c).

Floods defy a common categorisation. High tide, storm surge, overflow or breaks of embankments, dam failure, and extreme precipitation with impeded outflow have in common that land is temporarily submerged where this normally doesn't or shouldn't happen. Globally, floods of different kinds account for the greatest share of natural disasters, inflicted economic damage and death toll (see Box 1). The modern flood risk management approach acknowledges that floods cannot be stopped from occurring and places emphasis on how to reduce hardship and vulnerability of risk-prone communities. This shift is also backed by the European Union's Directive on the assessment and management of flood risks (EC 2007a). The Directive highlights the need of flood management plans (FMP) to consider the harmful potential of floods and identify tangible measures able to reduce exposure and sensitivity to floods, and improve risk governance.

Existing global disaster impact databases

Floods and their impacts are for example documented in global disaster databases like CRED EM-DAT, Sigma or NatCatSERVICE. These databases were established to answer specific questions at a global level, for example comparing impacts across countries, and therefore provide a good overview of the impacts produced by major events throughout Europe. Over the recent years those global databases have been harmonised, although some differences remain in respect of certain characteristics (e.g. threshold levels, specific methodologies for data recording, etc.). Europe's coverage of the EM-DAT database is insufficient for detecting the trends of flood losses or guiding the EU disaster risk mitigation and climate change adaptation efforts. In a paper of Barredo (2009), where an analysis of trends in flood losses in Europe was performed, concludes that the completeness and the degree of uncertainty in the available historic floods data is a major issue, which hampers sound scientific analysis of the data. In Italy for example, Salvati et al. (2010) reports some 2,321 flood events the 20th century and thereafter (1900-2008) that is for the period for which the more reliable in-formation is available. To compare, the EM-DAT database records only 35 flood events for the same period.

In addition, the above databases are less suitable for analysing the impacts of smaller events or for analyses at the sub national level. Additionally, the linkage between global databases and additional information from local, regional and national levels is currently rather poor. Therefore, a comprehensive analysis and impact assessment of flooding events at the European level is currently only possible in a limited way, as evidenced by EEA (EEA 2010).

Towards an European Flood Impact Database

The European Environment Agency (EEA 2010) has highlighted the need for a better cooperation of the existing publicly available inventories of flood events across European countries. The inventories, they argue, should provide accurate data and assessments which would serve as a basis for disaster prevention. The EU-wide inventory on the other hand could 'assist in tracking the trends in flood-disaster losses, and in mitigation programmes monitoring and obtaining a clearer picture of the linkages between climate change and flood losses' (EEA 2010).

A European Flood Impact Database is a first step towards a comprehensive European Disaster Impact Database. Started in 2011 the European flood impact database has been explored as a joint initiative of EEA and JRC, in collaboration with the Centre for Research on the Epidemiology of Disasters (CRED) and the European Topic Centre on Climate Change Impacts, Vulnerability and Adaptation (ETC-CCA). A European flood impact database should build upon knowledge and past efforts made by the different Commission services (ECHO, ENV, REGIO, CLIM, RTD, JRC, ENTR, MARKT, etc.), EEA, Member States and other stakeholders. EEA for instance, collects data and information for its assessment reports. These include e.g. the SOER 2010 and the upcoming 2012 reports "State of Europe's waters" and "Climate change impacts, vulnerability and adaptation". While improving the information base it will be important to use as much as possible existing data from various sources as well as to link to key existing initiatives in particular SEIS, INSPIRE and GMES.

First, a survey among selected EEA member countries has been conducted in 2011, addressing the availability of national databases and information systems on flood events and impacts. Some 18 EEA countries have responded to the survey indicating the existence of a large number of very heterogeneous data collection campaigns. An early insights from the survey indicate the practical difficulties in combining the existing data.

Second, an expert workshop has been organised in Brussels on May 19, 2011. The event was organised by EEA in collaboration with JRC and Centre for Research on the Epidemiology of Disasters (CRED), the institution hosting the Emergency Events Database EM-DAT. Main objectives of the expert meeting were (1) to get an over-view on data availability versus data needs from policy makers for flooding, (2) to discuss a common concept for flood information on EU level, (3) to present pilot exercises towards the development of a European flood impact database and (4) to provide input for the further development of this working paper. More information about the meeting is available from http://forum.eionet.europa.eu/eionet-air-climate/library/public/workshops/expert_2011_louvain/documents.

2 EU Policies

Several European policies and regulations recognise the need for a systematic collection of information and data related to the frequency, extent and impact of natural hazards including floods. A non-exhaustive list of these policies is discussed in the subsequent sections. A European Flood Impact Database, if further pursued, should build upon the knowledge and efforts made so far by the European Commission and Member States.

2.1 Community framework on disaster prevention within the EU

The Community Civil Protection Mechanism (hereafter CCPM) was first established by the European Council Decision 2001/792/EC (EC 2001) and further enhanced by the Decision

2007/779/EC (EC 2007b). In December 2011 the European Commission adopted a new legislative proposal, further reinforcing the EU's disaster management (EC 2011a). The CCPM facilitates the mobilisation of emergency services in the event of major emergencies. Between January 2007 and December 2011, the CCPM had been activated 16 times for the flood disasters in the EEA member and cooperating countries. The proposed CCPM reform includes several actions related to systematic collection and sharing of knowledge, risk assessment and mapping (EC 2011a).

The EC Communication on Reinforcing the Union's Disaster Response Capacity (EC 2008) highlighted the need for stepping up the Community capacity and effectiveness to respond to disasters, within and outside the EU. To do so, the EC proposed several tangible means for a better coordination of various EU/Community policies, instruments, services and players (at national, European and international levels). While the Communication focuses on the response to disasters, it acknowledges that a comprehensive approach to disaster management is needed comprising risk assessment, forecast, prevention, preparedness and mitigation.

The Commission communication on a community approach on the prevention of natural and man-made disasters (EC 2009a) points out several reasons why disaster prevention should be considered at the European level: The most obvious reason is that hazards and disasters do not respect national borders and can have a transnational dimension (as was e.g. the case with the 2002 floods, or the 2007 forest fires). Moreover, they can have a negative impact on existing Community policies such as agriculture and infrastructure. The economic impacts of disasters, estimated at €15 billion yearly, may adversely affect the economic growth and competitiveness of EU regions (and hence the EU as a whole). Finally, Community funding is often required to deal with the aftermath of disasters.

The Communication sets out an overall European approach to the prevention of disasters, identifies areas for action and outlines specific measures to boost disaster prevention in the future. According to the communication, the creation of an information base on hazards and disasters is one key element in such a community approach. Information on the economic impacts of hazards and disasters is thereby particularly important, since it can allow policy makers to properly assess the costs and benefits of different prevention measures.

In its Conclusions (EU Council 2009), the European Council considered that Community action to prevent disasters may enhance the protection of people, the economy and the environment from the effects of natural and man-made disasters, and improve the resilience of the EU and its economy to increasing threats of natural and man-made disasters. The Council therefore invited the European Commission to inter alia bring together existing private and public sector data and information on disasters and their social, economic and environmental impact, as well as to identify gaps and issues of comparability between national data collection systems

2.2 The European Union Solidarity Fund

The European Union Solidarity Fund (EUSF) was set up to respond to major natural disasters and express European solidarity to disaster-stricken regions within Europe. The Fund was created as a reaction to the severe floods in Central Europe in the summer of 2002 (EU Council 2002). By the end of 2010, some 42 application were approved with the financial aid summing up to 2,4 billion (EC 2011b). The EUSF can provide financial aid to Member States and countries engaged in accession negotiations in the event of a major natural disaster if total direct damage caused by the disaster exceeds 3 billion € (at 2002 prices) or 0.6% of the country's

gross national income, whichever is the lower. A neighbouring Member State or accession country that is affected by the same disaster can also receive aid, even if the amount of damage does not reach the threshold. The EUSF has an annual budget of € 1 billion. The amount available annually for extraordinary regional disasters is 7.5% of the EUSF's annual budget (or € 75 million).

EUSF's annual 2008 report (EC 2009b) addresses the weaknesses of the fund. These relate to the lack of rapidity with which financing from the Fund is made available, the transparency of the criteria for mobilising the Fund in the case of "regional disasters" and the limitation to disasters of natural origin. In 2011 the Commission has laid out options for reform of the EUSF (EC 2011b).

2.3 Floods Directive

The Directive 2007/60/EC (Floods Directive, FD) was proposed by the European Commission in 2006, and adopted by Council and Parliament in 2007 (EC 2007a). Its aim is to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity. The FD requires Member States to first carry out a preliminary risk assessment by 2011 to identify the river basins and associated coastal areas at risk of flooding. For such zones they would then need to draw up flood hazard and flood risk maps by 2013 and establish flood risk management plans focused on prevention, protection and preparedness by 2015.

The Directive shall be carried out in coordination with the Water Framework Directive, notably by flood risk management plans and river basin management plans being coordinated, and through coordination of the public participation procedures in the preparation of these plans. All assessments, maps and plans prepared shall be made available to the public. Member States shall furthermore coordinate their flood risk management practices in shared river basins, including with third counties, and shall in solidarity not undertake measures that would increase the flood risk in neighbouring countries. Member States shall in take into consideration long term developments, including climate change, as well as sustainable land use practices in the flood risk management cycle addressed in this Directive.

To support the implementation of the Directive a Working Group on Floods (WG F) has been established under the Common Implementation Strategy (CIS). WG F is inter alia in charge of developing reporting formats for the different subjects which need to be reported under the FD, whereby the results of the reporting are visualised via WISE (Water Information System for Europe, http://water.europa.eu/). Moreover, WG F has been organizing several thematic workshops as well as preparing several useful resource documents which aim at supporting the implementation of the FD. The on-going development of a resource document on "Flood Risk Management, Economics and Decision Making Support" deserves special attention, since there might be useful synergies between this document and the proposed European Flood Impact Database.

Under the PFRA scheme (Art. 4), MS have to use information on past significant floods as the basis for identifying where floods may occur in the future. To do so, MS are expected to provide information on the

- location of these floods,
- date of commencement and duration,
- type of flood,

- maximum extent of the flood,
- probability (return period),
- type and degree of adverse consequences (to human health, environment, cultural heritage, economic activity), and / or
- a summary text (where relevant).

This information shall be provided in detail if possible, or if this is not possible, in summary text format. For the significant flooding events occurring after 22.12.2011 (i.e. “future past flooding events”), MS are expected to record all the information listed above. A format for collecting information on past floods was agreed in the reporting sheet for the preliminary flood risk assessment. Additionally, further specifications with enumeration lists for types of floods, types of consequences are developed (EEA 2012), and options on how to indicate return periods and location are being settled in relation to the reporting schemas.

2.4 Climate change adaptation

The European Commission's White Paper on adaptation to climate change (EC 2009c) presented a framework for adaptation measures and policies to reduce the EU's vulnerability to the impacts of climate change. The role of the EU will be to support and complement national and regional actions through an integrated and coordinated approach, particularly in cross-border issues and policies relevant at EU level. The paper highlights that adaptation to climate change will need to be integrated into all EU policies, including e.g. the Water Framework Directive, Marine Strategy Framework Directive, Nature protection and biodiversity policies, integrated coastal zone management and disaster risk prevention. The Commission is expected to present a European climate change adaptation strategy by 2013.

Sharing of data, observations, projections and good practices on climate change vulnerability methods and adaptation actions is so far limited. However it would be essential to help improve adaptation plans, at national, sub national and local level where much of the adaptation action is already taking place and will be expanding in future, also involving increasingly the business community. The White paper proposed therefore to set up an EU Clearinghouse on climate change impacts, vulnerability and adaptation (European Climate Adaptation Platform) to address the needs. The Commission (DG CLIMA) has developed a Platform (Climate-Adapt, *climate-adapt.eea.europa.eu*) in 2011, being operational since March 2012 and managed and maintained by EEA.

3 Existing databases on past flood events and their impacts

In several European countries, but also in the rest of the world, data bases recording the impacts of natural disasters including floods already exist. They may collect data on a regional to national scale, with some collecting data on continental and even global scale (e.g. UN with EM-DAT, reinsurance companies like Swiss Re and Munich Re).

Most data bases are not flood-specific, they also refer to other natural (and man-made) disasters. Another distinction can be made according to whether they contain real historical damages, synthetic damage (functions), or both. Furthermore, some databases are object specific whereas others are event specific.

Object specific databases include the Multi Coloured Manual in the UK (Penning-Rowsell *et al.* 2005) and the German HOWAS 21 Flood Damage Database Helmholtz-Earth Observation Systems (EOS) - Natural Disasters Networking Platform (NaDiNe 2012). The second group are event-specific databases such as EM-DAT (EM-DAT 2012), NatCatService (Munich Re 2012), or Sigma (Swiss Re 2012).

3.1 Global level

3.1.1 EM-DAT International Disaster Database

The EM-DAT is one of the most comprehensive and well known global disaster databases **EM-DAT** (EM-DAT 2012), which includes the occurrence and immediate effects of all disasters in the world, from 1900 to the present. It is maintained by the WHO Collaborating Centre for Research on the Epidemiology of Disasters (CRED) which is located at the University of Louvain (Belgium). The database is compiled from various sources, including United Nations agencies, non-governmental organizations, insurance companies, research institutes and press agencies. EM-DAT includes information on date and location of an event; the numbers of people killed/affected as well as an estimation of the economic impact, although economic losses do not constitute part of the main criteria to define an event as a disaster. EM-DAT records the day on which an event has been declared as a humanitarian emergency by one of its priority sources. In contrary Sigma (Swiss Re 2012) and NatCatService (Munich Re 2012) (see further down in this document) usually record a period with a start and end date of an event (Guha-Sapir and Below 2002).

The “disaster thresholds” for an event to be included in EM-DAT are as follows:
(i) 10 or more people killed; and/or
(ii) 100 or more people affected; and/or
(iii) declaration of a state of emergency; and/or
(iv) call for international assistance.

Events that do not reach these “disaster-threshold” do not appear in EM-DAT, even if these ‘smaller’ floods may account for a considerable proportion of the total losses. Generally, EM-DAT provides recent and detailed information on disasters in European member states. However, since the data is coming from different sources (including newspapers and open sources), some quality limitations remain and there is a lack of comparability between the sources. There is public access to the data. While a valuable dataset, since the smaller floods are not included, the total flood damage may be seriously underestimated.

3.1.2 Dartmouth Flood Observatory

The **Dartmouth Flood Observatory** (Dartmouth Flood Observatory 2012) maintained by the University of Colorado provides space-based measurement and modelling of surface water for research, humanitarian, and water management applications. DFO contains global food information from 1985 until present. The information presented in this archive is derived from a wide variety of news, governmental, instrumental, and remote sensing sources. It is presented in order to facilitate research into the causes of extreme flood events, provide international warning of such floods, and improve widespread access to satellite-based measurements and mapping.

Analysis using remote sensing data is also presently underway on past events; such additional information is added to this archive as it becomes available. Each entry in the table and related map represents a discrete flood event. The listing is comprehensive and global in scope. Deaths and damage estimates for tropical storms are totals from all causes, but tropical storms without significant river flooding are not included. While also a useful global database, the wide variety of official and unofficial data used, makes the quality of the data uncertain.

3.1.3 MunichRe NATCATSERVICE

Additionally, several relevant global databases with hazard and disaster data are operated by insurance or re-insurance companies. One of the most prominent databases, the **NatCatSERVICE**, is operated by insurance company Munich Re (*www.munichre.com/geo*). It is one of the world's most comprehensive databases on natural disasters with more than 25,000 entries. It is based on over 200 sources worldwide, including news agencies, insurance companies, international agencies (UN, EU, Red Cross, etc.), scientific sources and weather and warning services, and every year records between 600 and 900 hazardous events. It keeps track of all loss events concerning natural hazards which have resulted in substantial material or human losses. Depending on the magnitude of human fatalities and economic losses, each event is assigned to one out of possible six categories, from small scale events to great natural catastrophes. While all categories have mortality or economic thresholds, the final category is qualitative and follows the United Nations definition of a large natural disaster (see **Errore. L'origine riferimento non è stata trovata.**).

***Table 1**: Classes of catastrophic natural disaster events considered by MunichRe.*

Catastrophe class		Overall losses				and/or fatalities
		Loss profile	1980s*	1990s*	2000 – 2008*	
0	Natural event	No property damage	-	-	-	none
1	Small-scale loss event	Small-scale property damage	-	-	-	1-9
2	Moderate loss event	Moderate property and structural damage	-	-	-	> 10
3	Severe catastrophe	Severe property, infrastructure and structural damage	US$ >25m	US$ > 40m	US$ > 50m	> 20
4	Major catastrophe	Major property, infrastructure and structural damage	US$ > 85m	US$ > 160m	US$ > 200m	> 100
5	Devastating catastrophe	Devastating losses within the affected region	US$ > 275m	US$ > 400m	US$ > 500m	> 500
6	Great natural catastrophe „GREAT disaster"	Region's ability to help itself clearly overtaxed, interregional/international assistance necessary, thousands of fatalities and/or hundreds of thousands homeless, substantial economic losses (UN definition). Insured losses reach exceptional orders of magnitude.				

* Losses adjusted to the decade average.

Insured losses are drawn directly from the insurance industry; including the over 60 branches of Munich Re. Insured losses reported in the NatCatSERVICE Service database are real paid losses from the insurance industry while overall losses use official figures from governmental and non-governmental sources (Löw 2009). The information provided by NatCatSERVICE is quite detailed, but the service does not provide open access to all its data. Since the main pur-

pose of the database is to gather information to assess insurance risk, information on disasters in sectors for which there is no market for insurance might potentially be missed.

3.1.4 SwissRe SIGMA

The Swiss Reinsurance Company operates the **Sigma Database** (*www.swissre.com/sigma*), a limited access global natural (excluding drought) and man-made disaster database. Events are recorded from 1970 to the present.

Sigma requires at least one of the following criteria for inclusion in the database:

- ≥20 deaths and/or
- ≥50 injured and/or
- ≥2000 homeless and/or
- insured losses in case of flood >US$35 million and/or
- total losses in excess of US$70 million.

Disasters are recorded on an event entry basis and recorded information includes dead, missing, injured, and homeless, along with detailed accounting of insured and uninsured damages. Sources of information include newspapers, Lloyds, primary insurance and reinsurance periodicals, internal reports, and online databases although no primary source is suggested. Sigma provides a yearly publication of “raw information” listing all disasters for the year.

3.1.5 GLIDE database

The **Global Disaster Identifier Number (GLIDE)** (*www.glidenumber.net/glide/public/search/search.jsp*) is a project initiated and maintained by the Asian Disaster Reduction Center (ADRC) in collaboration with ISDR, CRED, UNDP, IFRC, FAO, World Bank, OFDA/USAID, LA Red, and OCHA/ReliefWeb. A GLIDE number is generated for all disaster events with the aim being that the number is then attached to all databases documenting the same disaster thereby linking the various information sources. The GLIDE database is searchable by date, disaster type, country, and GLIDE number. Information produced by a search includes date, duration of event, location, magnitude, information source used, and a description of the event which includes human and economic loss information where available.

3.2 European level

So far, there is no comprehensive and consistent “European” database on past flood events and their impacts. Thus, any overview of the impacts of floods throughout Europe is usually based on data extracted from global databases. Nevertheless, the implementation of the Floods Directive requires the reporting of flood hazard and flood risk maps. In addition to these subjects which are explicitly listed in the Directive, the Water Directors agreed in 2009 on the creation of a database on past flood events. First steps regarding such a database were undertaken in 2011 with previous version of this working paper and a questionnaire about national flood database metadata for the European countries.

Various databases with partial coverage exist in Europe as a result of research projects. For example, HYDRATE (European Flash Flood Database, *www.hydrate.tesaf.unipd.it*) collected in-

formation about flash floods Catalonia (Spain), Cevennes-Vivarais France, Italian Alps and Liguria, Slovakia, Greece, Romania and Austria (Gaume *et al.* 2009).

3.3 Country level

3.3.1 Metadata questionnaire

Introduction

Over a period spanning 2011-2012, the European Environment Agency (EEA) and Joint Research Centre (JRC) have conducted an informal survey of existing databases of past flood events and their impacts. The survey, supported by the European Topic Centre Spatial Information and Analysis (ETC-SIA)and with European Topic Centre on Climate Change impacts, vulnerability and Adaptation (ETC/CCA), consisted of a questionnaire sent to national focal points of all EEA member countries and, in addition, to national civil protection prevention and data experts and members of the Working Group Floods (WG F) of the CIS. At the meeting of WG F in April 2012 it was decided to send again the questionnaire to its members and the national focal point, including the EEA cooperating countries.

The survey is complementary to the formal reporting obligations under the Water Framework and the Floods Directives. The Floods Directive requires reporting to the Commission of preliminary flood risk maps and past flood events. The first reports were due by the end of 2011 and, for reasons of working capacities, a number of Member States are expected to answer this questionnaire in connection with their above mentioned reporting on Preliminary Flood Risk Assessment (PFRA). Preliminary results of the reporting of the PFRA can be found in section 3.3.2.

The survey focuses on metadata, thus not on the actual data of past events, including information on impacts, spatial extent and location, information on thresholds, type of database as well as data consistency over time, transparency in methods/processes, timeliness and scientific accuracy. The questionnaire (see Annex 1) consists of a single sheet containing several fields grouped in 5 sections

Preliminary results

Some 18 of the 32 the EEA member countries responded to the questionnaire (as on 30 November 2012, see Map 1). The inventories of flood events and their impacts exist in several European countries (cf. Table 2). However, the collected information and sources are very heterogeneous and the databases are often not publicly accessible. The databases are usually in digital format and updated regularly. The type of information is mixed: some countries collect attribute data, some other only raster data (and in these cases map scales are quite variable), only in a few cases data are complete of both. Territorial coverage is good, close to 100% on a national scale.

All member countries record impacts of flood events, but most countries only consider social (fatalities and affected people) and economic impacts (economic losses or insured losses), whereas only few countries have considered cultural and ecological impacts. The latter is very probably due to the fact that a common understanding of how to assess such impacts is still lacking.

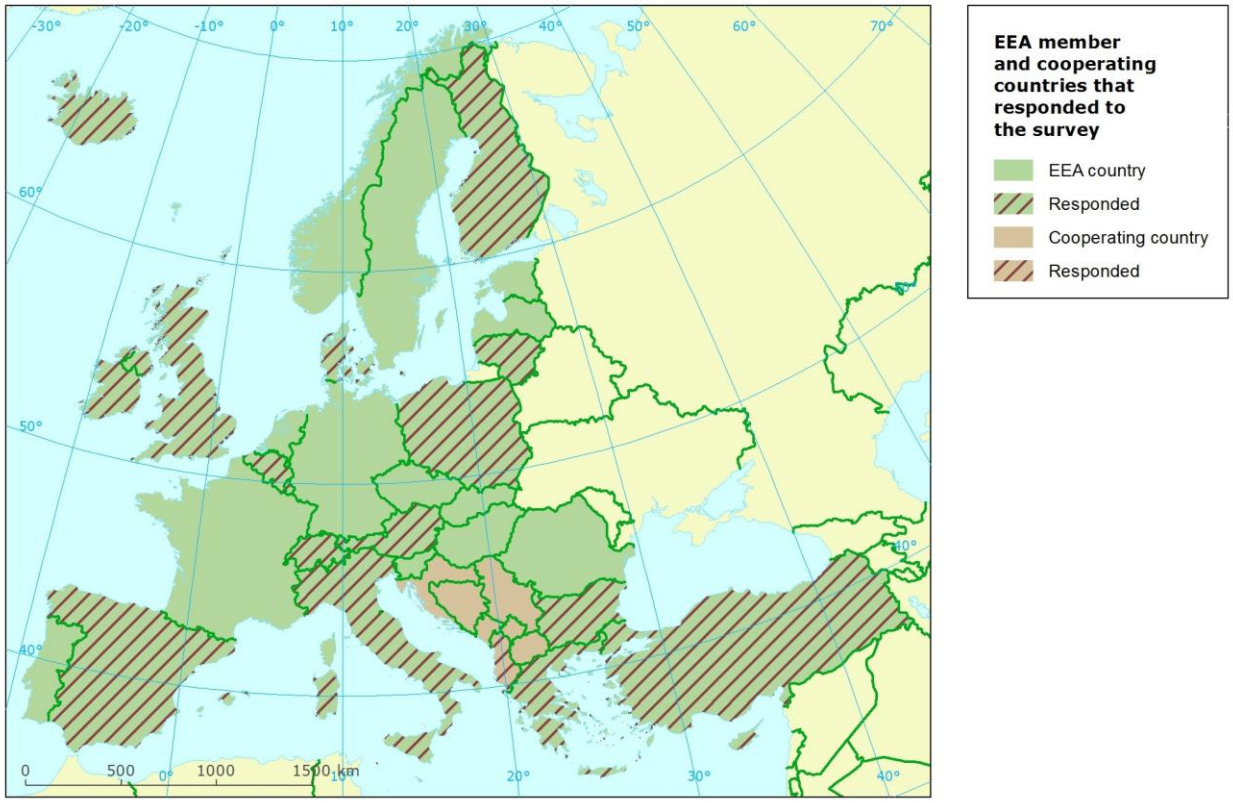
All member countries, which responded so far, have taken into account impacts in their flood events records but to a different extent. Since the responses cover only a part of the EEA mem-

ber and cooperating countries, the survey cannot be considered to be representative. Nevertheless, the provided responses highlight some important points, which need further consideration:

- a few member countries use specific entry thresholds for events to be recorded. The use of such a threshold has a significant influence on the number of recorded events (low threshold means that a relatively large number of events is recorded)
- data comparison between data sets from different countries are rather difficult, given the heterogeneity of the existing databases. Thus, in the view of a European database, some steps towards a common understanding, e.g. including common criteria in both data collection and representation (e.g. map scales, data attributes, hydrological data) as well as thresholds are necessary.
- some national databases are already fully publicly accessible, some other are accessible under restrictions. Improving public data accessibility will be a challenge in the future.

3.3.2 Floods Directive Reporting

For the EU27 member states, an additional source of information on past flood events and their impacts is the preliminary flood risk assessment (PFRA) mandated by the Floods Directive (EC 2007a). The results of the PFRA, including an assessment of the past events' impact, has to be reported by March 22, 2011. The areas of potential significant flood risk (APSFR) had to be reported shortly afterwards. Some countries made use of the transitional measures under article 13 of the directive. A summary of the reported information as on December 1st, 2012 is given in Annex 2.



***Map 1**: EEA member and cooperating countries who responded to the survey and reported on the existence of the flood impact database. From the EEA member states who responded to the survey only in*

Denmark no impact database is available. From among the EEA Cooperating Countries, only Albania responded to the survey. Note that in 2013 Croatia is expected to become a full EU and EEA member state.

3.3.3 Combined information from Questionnaire and PFRA reporting

By combining the results of the survey (section 3.3.1) and the reported information mandated by the FD (section 3.3.2), it becomes apparent that on European level (EU27, EEA32, EEA39), information about past floods is available for 40-50% of the respective territory. Furthermore, for additional 40-50% of the territory metadata is available even if the actual data are not accessible. Only for about 5-15% of the territory there is currently no information about the past flood events. This does not take into account that not always both event and impact data is available, nor that not both spatial and attribute information may be available.

***Table 2**: Overview on national flood inventories: **Legend**:* Accessibility (R restricted, P publicly available), Format (D digital, P paper archive), Information (C complete, SV spatial vector, SR spatial raster, A attribute, O other), Recorded data (E event, I impact), Economic impact (EL economic losses, IL insured losses), Social Impact (AP affected people, F fatalities)

COUNTRY	GENERALITIES					CHARACTERISTICS of the DATABASE									INFORMATION ON IMPACTS			
	Database	Access	Created	Last updated	Update frequency	Format	Information	Map scale	Coverage	% of territory	Temporal coverage	Recorded data	Threshold	Number of records (flood events)	Social impact	Economic impact	Cultural impacts	Ecological impacts
AL	Y	P	2011	2011		P	O		regional	100%		E/I	N		AP	EL	Y	Y
AT	Y	no (planned)	2010	cont.	cont.	D	C	1:1000 to 1:50:000	regional	65%	1700 to present	E/I	Y	671	F, AP	EL	N	N
BE 1	Y	R	1993	cont.	cont.	D	A		national	100%	1993 to present	E/I	N	65000	AP	EL		
BE2 – Flanders	Y	R	1988	2010	cont.	D	SV	up to 1: 10000	regional	100%		E	N					
BG	Y	P	2011	2012	cont.	D	C		regional	100%	1900-2011	E/I	Y	1903	F, AP	EL	Y	Y
CY	Y	R	2010	2011	cont.	D	C	NA	national	100%	1859 to present	E/I	N	140	F	other	Y	Y
DK	N																	
FI	Y	R	2006	2011	cont.	D	C		national	100%								
IE	Y	P	2006	2011	cont.	D	SR	variable	national	100%	1980 to present	E/I	N	5000	properties flooded	EL, IL	N	N
IT 1	Y	P	2002	2010	yearly	D	A	NA (no geographic data)	national	100%	2002 to present	E/I	Y	98	F, AP	EL	N	N
IT 2	Y	P	1999	2007		D	C	1:10.000	national	100%	1112 -2007	E/I	N	3085	F		Y	N
IS 1	Y	R	2008	2010		D	C	1:250000	regional	0,8%	1316-2007	E/I	N	69	F, AP	EL	N	N
IS 2	Y	R	2007	2011	cont.	D	C	1:5000 – 1:100000	national	100%	1953-2012	E/I	Y	23	other	other	N	N
IS 3	Y	P	1970	2005	3-10 y	D	A		national	100%	1179-2011	E	N	367			N	N
LT	Y		1931	2010	yearly	P			national	100%								
PL	Y	P	2010	2010		D	SR	1:50000	local	~15% of Poland	May June 2010	E/I	N	2			N	N
ES	Y	P	1983	2011	biannual	D	C	1:200000	national	93%		E/I	Y	2500	F, AP	EL, IL	Y	N
CH 1	Y	P	1998		cont.	D	A		national	100%	1990 to present	E/I	N	11300	F, AP	EL	N	N
CH 2	Y	R	1994	2011	cont.	D	A		national	100%	1972 to present	E/I	N	11300	F, AP	EL	N	N
TR	Y	R	2001	2010	cont.	D	C	basin scale	national	100%		E/I	N	388	F	EL	Y	Y

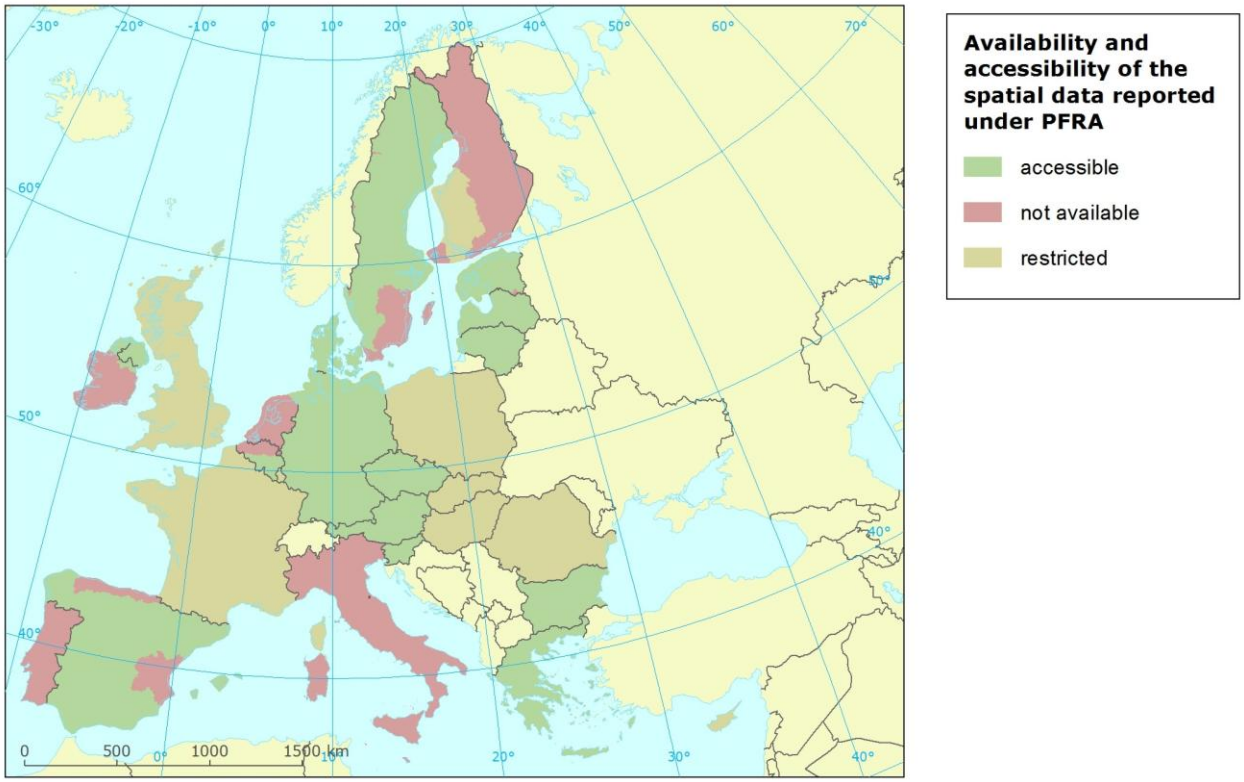
***Table 3**: European area where information on past floods is available as on 01/12/2012*

	Area (km2)	Information available (%)	Information exists (%)	No information (%)
EU 27	4.469.161	64	98	2
EEA 32	5.782.501	51	92	8
EEA 39	6.057.831	49	88	12

Note: If in any of the two data sources (PFRA/APSFR reporting or metadata questionnaire) the information on past floods is available the country is counted in the column "information available". If in any of the 2 datasets the information exists but is restricted and it is not available by the other source, the surface of the country is counted in the column "information exists". If none of the above, the surface is counted in "no information". Countries are placed in one column for their entire territory as most databases reported in the metadata questionnaire cover close to 100% of territory. Exceptions are 1) Spain and Sweden are counted in the column "information available" as this is the case for the large majority of the territory; 2) The UK is split up in Northern Ireland (counted in information available) and the rest of the country (in information exists); 3) As the database reported in the questionnaire only contains +/- 15% of Polish territory, Poland is added to "information exist" based on its reporting for the PFRA. The surfaces of the countries are rounded at 100 km². Andorra, San Marino and Vatican City are surrounded by EEA39 territory but not included in the total as this does not influence the conclusions (less than 600 km²). EEA32 includes EU27 + Iceland, Lichtenstein, Norway, Switzerland and Turkey. EEA39 includes EEA32 + Albania, Bosnia and Herzegovina, Croatia, Kosovo under the UN SCR 1244/99, Montenegro, FYR of Macedonia, Serbia

The presented data collections show a variety of different approaches used across Europe, and the different levels of detail of the existing data. In order to potentially improve the quality of data for European countries within the global disaster database EM-DAT (CRED) and understand the quality of national databases better, a pilot exercise was done for countries that volunteered to participate (Belgium and Spain) in an expert workshop. In the pilot exercise country-specific flood data (e.g. location and extent of a flood event) extracted from EM-DAT were analysed and compared with data in national databases, by experts from these two countries. For both countries gaps and 'possible errors', either in the global database or in the national database, were identified. Further analysis is needed to understand the reasons and to propose specific solutions (see for further information also Section 4).

Together with the PFRA reporting more details about the methodologies on past flooding selection and filling in the attributes were given by several member states (together with the information at the level of the RBD or in separate documents at RBD or national level).



***Map 2**: Availability and accessibility of the spatial data reported under preliminary flood risk assessment (PFRA). Only the EU MS are obliged to report under the EU Floods Directive, hence the reference area is EU27 and not EEA39 as in the Map 1. Note that the category 'not available' includes also cases when the EU MS made use of Article 13§1b of the Flood Directive, thus the PFRA as in Article 4. This exercise is not a compliance check.*

3.4 Scientific database projects

Several disaster impact databases, although initiated by national or regional administration, had been initially developed and maintained by academic institutions in the context of European research projects. Relevant examples include HOWAS21 developed under MEDIS/RIMAX project; the Disaster Database Project (see above) and DOMODIS. Several among the recent and ongoing scientific projects funded under the Framework Programmes for Research and Technological Development (FP7) or other funds address disaster risk. Several among them collect and assess data on flood risk. Prominent examples for these projects are PREEMPT, MEDIS, EMBRACE, CONHAZ and ENHANCE, described in subsequent sections more in depth.

In addition, a cluster of European projects including MEDIATION (Methodology for Effective Decision-making on Impacts and AdaptaTION), CLIMSAVE (Climate Change Integrated Assessment Methodology for Cross-Sectoral Adaptation and Vulnerability in Europe), RESPONSES (European Responses to climate change) analyse vulnerability, resilience and climate adaptation measures

3.4.1 PREEMPT

The PREEMPT project (Policy-relevant assessment of socio-economic effects of droughts and floods, (*www.feem-project.net/preempt*) is funded by the DG Humanitarian Aid and Civil Protection under the framework of the Civil Protection Financial Instrument. PREEMPT is a policy-

directed assessment exercise assisting the authorities involved in disaster risk management in better appreciation of the risks posed by hydro-meteorological and climatological hazards - droughts and floods. It does so by collecting the data about past disasters, filling-up the knowledge gaps, and by improving risk assessment methods and approaches in place in four participating countries: Italy, Spain, Belgium and Germany.

The project sets to 1) collect, harmonise and improve data about the past (2000-2010) hydro-meteorological disasters (droughts and floods) in selected river basins in Germany, Belgium, Spain and Italy; 2) harmonise practices and methodological approaches for risk assessment, particularly the economic and social effects of disasters, therefore improve the evidence-base for disaster risk prevention; 3) describe the factors which amplify or attenuate disaster's impact (vulnerability and resilience), and which are of direct importance for practical risk management; 4) examine the effectiveness of the preventive measures in place, and show potential for improvement; and 5) identify, share and disseminate best practice of disaster impact's assessment, based on the results of EC research projects.

The PREEMPT project addresses the four rivers and their basins – Ebro, Po, Scheldt and Weser – that are among the longest watercourses with the largest drainage area in the respective countries – Spain, Italy, Belgium (Flanders) and Germany. Three out of four basins (Ebro, Po and Scheldt) are international basins, although both Po (Switzerland and France) and Ebro (Andorra and France) only to a small extent. Scheldt is one of the smallest international river basins in Europe; the river arises in France and flows through Wallonia, Flanders and the Netherlands. Both Ebro and Po discharge into the Mediterranean Sea (Balearic Sea and Adriatic Sea respectively), and both Scheldt and Weser into the North Sea.

The revisited flood events are more uniformly distributed both intra- and inter-annually. The examined flood events include the January-February 2003 and March-April 2007 floods in the Ebro basin, the October 2000 flood in the Po basin, the July 2002 flood in the Weser basin and the November 2010 flood in the Scheldt basin. All the selected events have caused significant damage and influenced the way risk governance is organised in the participating countries.

3.4.2 MEDIS

The estimation of economic flood losses is a crucial component when decisions about flood defence are made on the basis of cost-benefit-analysis. However, methodological development in this area has not received much scientific attention so far. Therefore, improved and scientifically sound loss models are a fundamental step towards cost-effective flood management.

The MEDIS project (Methods and Tools for a cost efficient flood management – improved approaches for flood loss estimation) aims to develop improved and transferable methods for the estimation of direct and indirect economic flood losses for all economic sectors, primarily on basis of flood loss data from recent floods in 2002, 2005 and 2006 in the Elbe- and Danube-catchment. The new methods are to be validated using official loss data, tested on transferability and applied in the framework of a sensitivity analysis at the Lockwitzbach in Dresden.

For the improvement and harmonisation of damage data collection, guidelines for the standardised collection of flood loss data are developed and a flood loss database for Germany HOWAS 21 has been constructed.

Computer-aided telephone interviews of flood affected and have been undertaken in the aftermath of the (2002), 2005 and 2006 floods in Germany. Flood loss estimation models for private

households and companies (FLEMOps, FLEMOcs) have been developed and are available via a web-service. A web-based brochure for community information on flood precautionary measures is developed to support risk awareness and private precaution.

3.4.3 EMBRACE

The project EMBRACE - Building Resilience Amongst Communities in Europe (FP7, 2011-2015, *embrace-eu.org*) deals with data relevant for resilience assessment. The main objectives are the evaluation of existing available data, recommendations to improve data recording as well as data management relevant for disaster studies, and the contribution to the development of improved indicators for resilience measurements / evaluation. UCL (CRED) will perform an intensive review of existing data about disasters in Europe provided by EM-DAT and other databases. This review will consider variables and classification systems applied data sources used and data distribution/access policies implemented. This result is expected to provide an overview of disaster relevant data available at the regional and national levels for the human impact of disasters in Europe.

UCL supported by EURAC will analyse reasons for missing data and will provide a critical evaluation of data quality and reliability. The methodology applied is based on a standard approach that will be developed with support from the expertise and experience of EM-DAT data managers. Similar practical reviews and guidelines have been carried out by UCL in the past for six national databases in Asia. Thus a methodology already exists and can be adapted to the European context. Previous work from the European Environment Agency will also be consulted to avoid overlaps, and the EEA will be consulted in the Expert Group. An expansive list of data providers for the human impact of disasters in Europe will be compiled (i.e. Red Cross, Civil Protection Agencies, UN, etc.). UCL and EURAC will create a short survey to identify main challenges for providing the data on the chosen indicators for measuring resilience. This will be developed in consultation with external experts in a workshop. Recommendations for improvement for data base managers aiming to a more standardised registration of disaster datasets will be formulated. These recommendations will be used to improve the EM-DAT dataset in order to provide data on resilience indicators for better measurement in future disasters in Europe. This will also be discussed in a special session in the EM-DAT Technical Advisory Meeting during the analysis and recommendation phase. As well, recommendations for data providers, the potential applicants of resilience indicators, will be developed and disseminated to the aforementioned list. EURAC will concentrate on the potential to improve the integration of spatial (i.e. geolocated) information into these databases with the aim to better consider the environmental setting and context when analysing the resilience to disastrous events. There is a strong need by national and international organisations to quickly access and exchange disaster –related data. EURAC will scrutinise existing protocols for data exchange disaster related data particularly of relevance Identification of challenges to obtaining data for this report on a range of scales for these and other identified human impact variables will be explained. EURAC, with expertise in remote sensing technology and GIS analysis, will complement the UCL EM-DAT data with Earth observation data and GIS based mapping and spatial analysis. Based on these results so-called disaster footprints will be developed for a selection of hazards in Europe (envisaged: floods, earthquakes and heat waves). This includes a report identifying not only the occurrence and magnitude of events but also the disaggregation and descriptions of various human impact variables such as death, injured, homeless and affected.

3.4.4 CONHAZ

The CONHAZ – Costs of Natural Hazards (FP7, 2010-2012, *conhaz.org*) addressed classification and assessment of natural hazard impacts. Cost assessments of damages, prevention and responses to natural hazards supply crucial information to decision support and policy development in the fields of natural hazard management and climate change adaptation planning. Significant diversity in methodological approaches taken and terminology used in costs assessments of different natural hazards and impacted sectors makes it difficult to establish comprehensive, robust and reliable costs figures, and to compare costs across hazards and impacted sectors.

CONHAZ provides more insight into cost assessment methods, which is needed for integrated planning, budgeting and policy action prioritisation for the various natural hazards. In order to comprehensively capture this variability in cost assessment methods, CONHAZ assessed current knowledge, including use of terminology, on calculation methods for individual cost types (such as direct damages to housing and indirect losses in the macro-economy) and consider these methods as they are used in the context of specific climate and hydro-meteorology related hazards This comprehensive approach enables CONHAZ to clearly identify overlaps, commonalities and knowledge gaps in cost assessments of natural hazards.

3.4.5 ENHANCE

The main goal of the ENHANCE - Enhancing risk management partnerships for catastrophic natural disasters in Europe (FP7, 2012-2016, *www.enhanceproject.eu*) - project is to improve society's resilience to catastrophic natural hazards by developing new scenarios and information on catastrophic risks in selected hazard cases, in close collaboration with stakeholders and by guiding the development of new multi-sector risk management partnerships (MSPs). Innovation in MSPs is essential, as (ineffective) cooperation between public, private and civil society institutions often leads to failures in risk management. The ENHANCE proposal is unique as it studies the potential for new MSPs for managing different catastrophic hazards, related to heat waves, forest fires, flood, drought, storm surge, and volcanic eruptions. Key to successful partnerships is a common understanding of risks and the implications of proposed risk reduction instruments. Therefore, ENHANCE facilitates a participatory process to develop MSPs in cases studies at different geographical- and spatial scales in Europe. ENHANCE develops a) harmonised dynamic scenarios of vulnerability, exposure, and hazard, using existing information and new probabilistic approaches; b) guidelines and governance features for enhancing MSP interaction; c) methods for linking MSPs to novel risk scenarios and assessments; d) a toolbox of economic instruments and non-structural mitigation measures aimed at assessing risk and increasing societal resilience; e) policy recommendations delivered through a dissemination platform.

4 Towards a potential European Flood Impact Database

4.1 Recommendations from an ad-hoc expert workshop

About 25 experts from three EEA member countries (Belgium, Spain, Switzerland), the European Commission (DG ECHO, DG ENV, DG RTD, MARKT, DG CLIM, DG ENTR, JRC), EEA (including experts from the ETC-CCA, ETC-SIA), CRED/UCL, IVM-VU and Munich Re NATCATSERVICE participated in the expert meeting on flood impact data, held on May 19, 2011 (hosted by CRED, Brussels). The expert meeting's main objectives were:

1) to get an overview on data availability versus data needs from policy makers for flooding,

2) to discuss a common concept for flood information on European level and how to improve the information base on European level, and

3) to provide input into a working paper on a potential European flood impact database.

During the meeting a number of issues were discussed, based on the following questions:

- Is there sufficient clarity on EU policy needs and the data gaps in the current flood impact information at European level?
- Can the on-going activities (CRED-EMDAT; EU Flood Directive reporting) and proposed EEA/JRC initiatives on a European flood impact database address these main data gaps at European level? If not how can the data at European level be improved?
- How could countries benefit from the proposed European database?
- Which research projects may provide contributions and how to organise this?
- Can the proposed database be integrated within GMES (emergency response service and/or proposed climate change service)?
- Should comparability of flood impact data across European countries be further improved; if so how?
- Are thresholds needed and thus limit the database to large events?
- How to improve the public accessibility of the existing data at various levels (European, national, local)?
- Which quality assurance/quality control (QA/QC) is needed at various levels (EU, national, local)?

There was general recognition by the expert meeting that there is a clear need to improve the existing European wide information base. Various EU policy processes need flood impact information, including the Water Framework Directive, the Floods Directive, the disaster prevention framework, climate change, adaptation and regional policies and also regular EEA assessment reports. These policies and assessments rely on systematic collection of information and data related to the frequency, extent and impact of natural hazards including in particular floods.

Floods and their impacts are documented in global disaster databases like CRED EM-DAT and Munich-Re NatCatService, but these do not cover events below certain thresholds, lack spatial explicitness and also are not complete for all European countries. A comprehensive analysis and assessment of flooding events and their impacts at the European level is thus currently only possible in a limited way.

The Flood Directive (EC 2007a) requires that Member States report the (preliminary flood) risk assessment, including data on significant past floods and their impacts, used for the selection of

areas of potential significant flood risk. The information obtained will be included in the database Water Information System for Europe (WISE). However, the Floods Directive alone is not expected to lead to a comprehensive datasets for earlier flood events in Europe. In addition, the types of consequences are to be reported but not the magnitude of impact.

The expert meeting concluded that in general the European level approach proposed by EEA/JRC is the best way forward. It has the advantage that it starts with a simple and pragmatic approach and using existing data. The approach should, however, be further developed by in-depth analysis of data for all European countries to identify gaps and possible 'errors' and the underlying reasons for differences in the impact data, and to propose possible solutions to solve these differences. To achieve this further work would be needed (see also below).

The expert meeting briefly discussed the potential added value for countries from a future database which could include: improvements in the national database (after verification with global databases), access to data in neighbouring and/or similar countries that can be useful for national purposes.

In the expert meeting various presentations highlighted a number of on-going or (almost) finalised EU FP research projects that may have pas flood impact data available and thus which may potentially be relevant for the EEA/ETC/JRC project. A further discussion is needed with key projects to identify approaches to analyse flood impact data. The outcome of an initial analysis will be included in the working paper. However the expert meeting recognised that many research projects are often focusing on very specific case studies or methodologies/concepts and do not compile comprehensive databases for entire countries or Europe as a whole.

The expert meeting also discussed the general need for improvement of information exchange between the scientific and policy community, which still does not work properly. Furthermore data compiled in EU FP research projects is often only available for a relatively short period after the finalisation. The need for a repository at European level was mentioned. This would go beyond flood impact data and may include a substantial amount of data for which it is challenging to set up and maintain such a repository. The existing WISE and the European Climate Adaptation Platform are considering approaches to improve this general issue. However so far there are no existing or planned activities within these information systems that address specifically improvement of data on impacts of past flood events.

The timing and content of the planned Copernicus services was explained (DG ENTR) and discussed in the expert meeting. DG ENTR clarified in the meeting that the emphasis of GIO ER is on risk mapping (based on satellite data supplemented by in situ data) as part of immediate response actions. This was also the focus of the existing SAFER GMES project. However possibly a relatively minor element could be included in the future GIO ER on data on impacts of past flood events, e.g. if users would regard this as a high priority.

The expert meeting concluded that the EEA/JRC project should further clarify various detailed aspects of the proposed European flood impact database. However the meeting also concluded that on the basis of the current proposal and the outcomes of the expert meeting the needs and the proposal in general are sufficiently clear to be communicated to DG ENTR (GMES). Thus these outcomes of the expert meeting could be forwarded to the GMES bureau asking to be taken into account in the further development of the GIO ER. If it would be concluded by DG ENTR (GMES) that the proposed database is not yet advanced enough to be included in the GIO ER an alternative option could be a possible inclusion of the proposal in a FP research project.

The Floods Directive requires that a preliminary flood risk assessment is carried out to identify areas of potential significant flood risk, and then requires that flood hazard and risk maps are prepared, and it doesn't require harmonization across Europe, including harmonization of significance criteria for instance. However a comparable approach to flood risk management is required across the EU. INSPIRE will however require certain harmonization of the metadata of the maps required according to the Directive.

The expert meeting agreed that further work towards harmonisation is needed to achieve better comparable data across countries and consistent over time to allow trend analysis. As a first step, a metadata assessment should be performed of all European countries (incl. definitions, e.g. that of a single event). Spatial data will to some extent be harmonized through INSPIRE.

The expert meeting agreed on the need for some threshold for a European database, building on the experience of EMDAT. If no threshold was set there would most likely be too much data at European level and these data would not be comparable. The expert meeting also recognised that there will be a need for further discussion on the setting of thresholds.

The expert meeting considered public accessibility to flood impact data important, although the type of data could be different depending on the governance level and the expected user. For example data on the exact location of private property in past flood events may have to be limited to local users as is currently the case in various countries. More aggregated data at regional/sub-national or national level would not show such exact locations but rather large areas and categories of human assets and ecosystems that experienced past events.

The expert meeting concluded that different quality assurance and control processes and outcomes are needed at the relevant different levels: local (where the event took place), national and European level. In the pilot project some initial quality control work was done at European/national level by the comparison of EMDAT data with national data. As mentioned above further work is needed, within e.g. GMES and/or a FP project.

4.2 Guiding principles of a European flood impact database

Improving our knowledge about the intensity, magnitude and impacts of significant flood events in Europe is vital as a principle of good governance, smart regulation and better law making. The proposed flood impact database helps to better understand the pattern of vulnerability across the regions and sectors, and to choose most suitable (cost efficient, equitable) risk mitigation and climate adaptation measures. Besides, a European flood impact database enables new information services that are likely to lead to a greater awareness of and preparedness for flood risk.

Global disaster databases, in particular from EM-DAT (CRED) (human losses, economic losses) and NatCatSERVICE (Munich Re) (economic losses), provide a reasonable overview of the direct impacts produced by major disaster events throughout Europe. However, these databases were established to answer specific questions at a global level, for example a cross-country comparison of disaster impacts. Over the recent years those global databases have been harmonised, although some differences persist (e.g. threshold levels, specific methodologies for data recording, etc.). However, these databases are less suitable for analysing the impacts of smaller events or for analyses at the sub-national level. The global databases do not cover events below certain thresholds, and are neither complete nor spatial explicit.

A better knowledge about the past flood damage can inform:

Prevention and protection: by shedding light on the pattern of practice that drive vulnerability and risk; by identifying the pathways through which the economic and social hardship is spread beyond the directly affected area; by increasing awareness about what is at stake.

Preparedness: by helping to budget resources for development of early warning and alerting systems, and for managing emergencies; by allowing to better tailor the information provided for different communities and groups.

Response: by helping to decide (and legitimise) how much resources need to be deployed to manage properly the emergency situations and constrain the damage and hardship suffered.

Recovery and review: by driving the information collection during and after the emergency; by deciding which investments can most effectively boost the recovery and welfare contributions to most vulnerable groups,

The European flood impact database should be based on existing data from multiple sources, including the existing flood event/impact databases operated by the single MS and EM-DAT. A European flood impact database should be closely linked to existing information systems, notably Water Information System for Europe (WISE) and the European Floods Portal (*floods.jrc.ec.europa.eu*). The structure of the flood impact database should be compatible with the reporting scheme of the Preliminary Flood Risk Assessment (PFRA) mandated by the Floods Directive.

A European flood impact database should be designed by a steering group comprising European Commission, Water Directors (Common Implementation Strategy), and other potential users and data providers. It could be operated by the JRC and/or EEA and/or DG ENV, or an independent European academic institution (e.g. CRED).

The content of a European Flood Impact Database should be freely accessible and consist of quality controlled information on historical flooding events. The database could include the most important types of impacts (social, economic, ecological) and the spatial extent of main flooding events. Historical time series should go back as far as quality assured data exist.

The scope of a potential European flood impact database should be driven by the needs, resources and willingness to cooperate of the potential users. Potential users and their needs include among others:

- Member States (national assessments, transnational assessments, comparison across countries)
- European Commission (including DG ENV (assessments related to the Floods Directive), DG JRC (research on disaster risk reduction), DG REGIO (analysis of EU Solidarity Fund applications), DG ECHO (assessments related to disaster risk prevention), DG CLIMA (assessments related to climate change adaptation),DG SANCO (assessments related to health issues))
- European Environment Agency (State of Environment assessments),
- CRED (disaster trend data and information),
- Research institutes (research on disaster risk reduction)

The assessments of flood impacts serve different purposes. A quick preliminary assessment can guide the initial rescue and recovery operation. For this purpose, it is important to identify the

areas in most need and assign the necessary resources to respective measures. In the aftermath, the detailed event review and damage assessment serves as an information basis for the development and implementation of further disaster risk reduction measures. The most detailed type of assessment is only needed for those aspects of disaster risk management which require well informed specific policy choices. Such detailed assessments including all intangible and indirect costs of natural disasters will require major efforts and resources.

A potential European flood impact database should ensure that the records are comparable and harmonised across the flood events and EU Member States. The flood impact database records should be based on the same typology of damage and accompanied by error/uncertainty assessments. The main objectives of a potential European database will determine the design of the database and the processes of data provision and quality insurances. Therefore further clarification is needed, e.g. in consultation with Member States and the European Commission, on the main objectives of such a database.

4.3 Implementation

Initially, the European flood impact database could be populated only for the most important – significant flood damaging events (SFE). Identified by the EEA or MS, the SFE should be revisited and assessed following the same methodologies, in order to ensure that the results and reliable and comparable. Table 4 introduces the policy options through which a European Flood Impact Database could be pursued initially. It distinguishes between voluntary and mandatory policy options and summarises pros and cons. A preferred option may consist of a combination of them, initially driven by an concerted EU action and open method of coordination (OMC) (option 1), and progressively move towards a mandatory compliance (option 2). In 2013 the work will proceed focusing on the definition of the *significant flood events* for which the information could be retrieved and the development of an *meta-guidance* summarising the existing guidance documents on the assessment of the economic, social and environmental impacts of floods

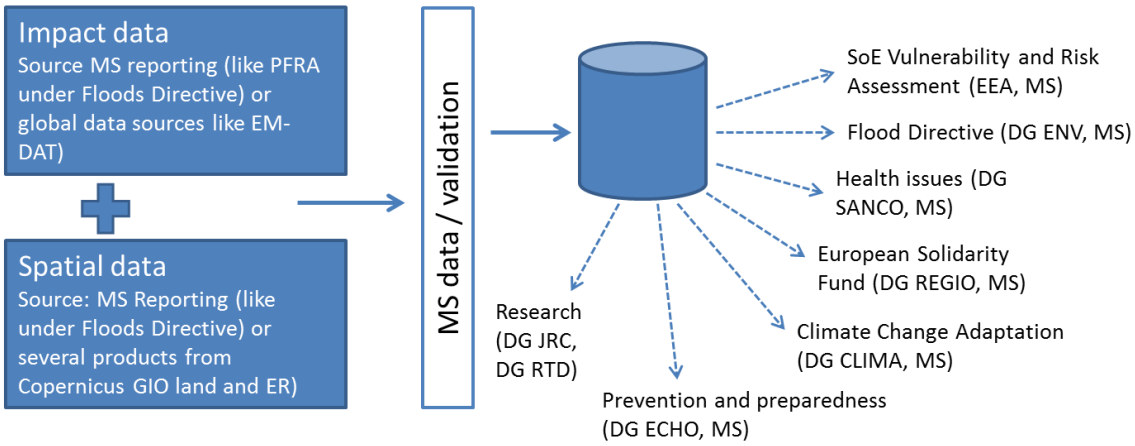


***Figure 1**: Conceptual model of an European Flood Impact Database*

***Table 4**: Policy options and delivery mechanism towards a European Flood Impact Database : (SFE - significant flood events; CIS – Common Implementation Strategy coordination platform for the implementation of the Water Framework Directive and the EU Floods Directive*

Options	Delivery mechanism	Feasibility	Ranking
1. Voluntary	- CIS Guidance document on estimating the impacts of flood impacts - EEA identifies the SFE - Member States (MS) encouraged to include assessment of the SFE along the activities related to EU Floods Directive - In addition, European Commission and EEA facilitates the data collection by commissioning research and assessment projects collecting information about SFE affecting several MS at the same time	- PROS: Practical to implement. CIS Guidance can be drawn based on the results of the past and on-going research project in particular FLOODSITE, PREEMPT, CONHAZ. - Coordination approach across the Commission, most suitable initially. - CONS: Low uptake expected and the MS are already struggling to comply with the FD - Little commitment and sustainability of the data collection and update	suitable initially
2. Mandatory	As in the option 1 but - MS to identify and assess the SFE, taking into account specific conditions of the river basin district (RBD)	- PROS: More coherent approach although differences will exist in assessment of the SFE - CONS: Mandatory requirements not easy to introduce	suitable only in a long term

5 Conclusions

The knowledge about the full economic, social and environmental impacts of floods in Europe is vital for assessment of vulnerability to floods and for designing appropriate disaster risk reduction and climate adaptation policies. Various EU policies including the Water Framework Directive, the Floods Directive, the disaster prevention framework, and climate change adaptation necessitate reliable information on flood impacts.

Full impacts of floods are insufficiently reported in the existing global disaster impact databases which concentrate on direct human and economic losses. The indirect economic losses, environmental damage and social hardship, although an important determinant of the welfare losses, are not accounted for.

The Floods Directive requires that the preliminary flood risk assessment reports include data on significant past floods and their impacts from 2011 onwards. For earlier flood events only synthesis information is required. Whereas the consequences of flood are to be reported, the full magnitude of impacts is not required. Thus the Floods Directive alone is unable to compel the information collection needed for a successful implementation of a European flood impact database answering the needs as defined at the beginning of this paper.

An in-depth and systematic review of significant flood events can help to identify the drivers of risk, shed light on the practical implementation, enforcement and effectiveness of risk management schemes, and contribute to discover the existence of perverse incentives to engage in activities that amplify the flood risk. The event analysis should also include institutional responses to disaster strikes, skills of the early warning systems and preparedness arrangements.

This background document makes a strong case for development of a European Flood Impact Database by using the existing and collecting new information. The preferred voluntary policy

approach consists of a reassessment of significant flood events as a joint undertaken of the European Commission, the European Environment Agency and the Member States.

In 2013 further work will be done by EEA/JRC, supported by ETC/CCA and ETC/SIA, on exploring the need and scope, possible content and design of a European Flood Impact Database. It will take into account developments of the reporting by countries under the Floods Directive. Possibly, another expert meeting will be organised bringing together topic experts with representatives of MS (participants of the WG Floods) involved in the pilot process.

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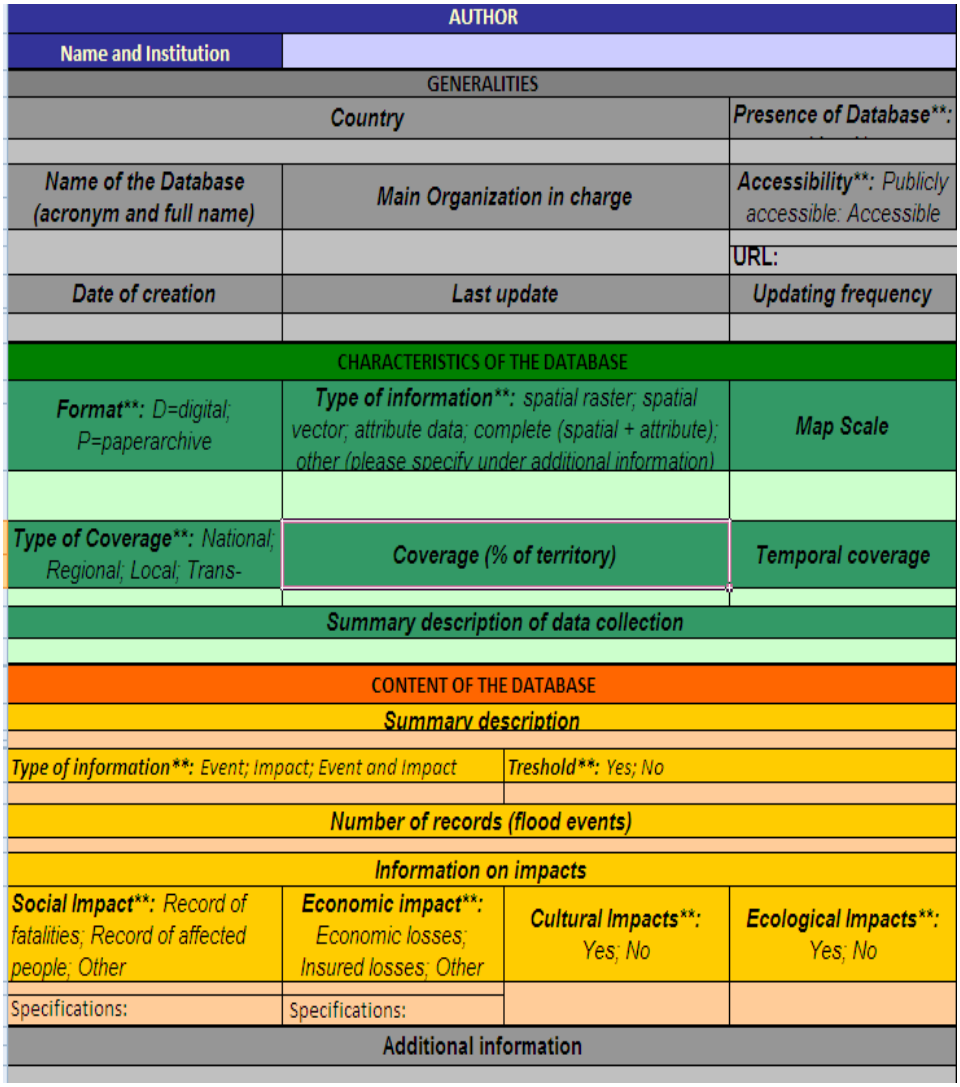
Internet links

1 http://www.swissre.com/sigma/

1 www.munichre.com/geo

ANNEXES

Annex 1 EEA/JRC metadata survey questionnaire



AUTHOR			
Name and Institution			
GENERALITIES			
Country			Presence of Database**:
Name of the Database (acronym and full name)	Main Organization in charge		Accessibility**: Publicly accessible; Accessible
			URL:
Date of creation	Last update		Updating frequency
CHARACTERISTICS OF THE DATABASE			
Format**: D=digital; P=paperarchive	Type of information**: spatial raster; spatial vector; attribute data; complete (spatial + attribute); other (please specify under additional information)		Map Scale
Type of Coverage**: National; Regional; Local; Trans-	Coverage (% of territory)		Temporal coverage
Summary description of data collection			
CONTENT OF THE DATABASE			
Summary description			
Type of information**: Event; Impact; Event and Impact		Treshold**: Yes; No	
Number of records (flood events)			
Information on impacts			
Social Impact**: Record of fatalities; Record of affected people; Other	Economic impact**: Economic losses; Insured losses; Other	Cultural Impacts**: Yes; No	Ecological Impacts**: Yes; No
Specifications:	Specifications:		
Additional information			

The sections of the questionnaire include:

- Author (blue): name and institution of the compiler;

- Generalities (grey): name of the country which the sheet refers to and, if a database is present, this section provides with the name of the DB, its accessibility, date of creation, updating frequency and last update.

- Characteristics of the database (green): this section describes the characteristics of the database such as format, type of information, map scale. A summary description of the data collection criteria is also required.

- Content of the database (yellow): this section asks the compiler to describe briefly the content of the database, the type of information, the potential presence of a threshold/criteria of data input and number of records of DB. Moreover, this field tells if information on impacts (social, economic, cultural and ecological impacts) have been considered in the DB.

- Additional information (grey): this section has been left free for additional information.

Annex 2: Floods Directive Reporting (see section 3.3.2)

Code	Report	XML_APSFR	Art.4	Art. 13 §1 a	Art. 13 §1 b	GIS files PFRA	GIS files APSFR	Remarks
Austria / AT1000 Danube	1	A	1			A	A	Documentation on methodology available at national level
Austria / AT2000 Rhine	1	A	1			A	A	Documentation on methodology available at national level
Austria / AT5000 Elbe	1	A	1			A	NA	Documentation on methodology available at national level
Belgium / BEEscaut_RW	1	A			1	A	NA	
Belgium / BEEscaut_Schelde_BR	1	A			1	NA	NA	
Belgium / BEMaas_VL	1	A			1	NA	NA	
Belgium / BEMeuse_RW	1	A			1	A	NA	
Belgium / BERhin_RW	1	A			1	A	NA	
Belgium / BESchelde_VL	1	A			1	NA	NA	
Belgium / BESeine_RW	1	A			1	A	NA	
Bulgaria / BG1000	1	NA	1			A	NA	
Bulgaria / BG2000	1	NA	1			A	NA	
Bulgaria / BG3000	1	NA	1			A	NA	
Bulgaria / BG4000	1	NA	1			A	NA	
Cyprus / CY001	1	R	99	99	99	R	R	
Czech Republic / CZ1000 Dunaj	1	A	1			A	A	
Czech Republic / CZ5000 Labe	1	A	1			A	A	
Czech Republic / CZ6000 Odra	1	A	1			A	A	
Denmark / DK1 - Jutland and Funen	1	A	1			A	A	
Denmark / DK2 - Zealand	1	A	1			A	A	
Denmark / DK3 - Bornholm	1	A	1			A	NA	
Denmark / DK4 - Vidaa Krusaa	1	A	1			A	NA	
Estonia / EE1	1	A	1			A	A	
Estonia / EE2	1	A	1			A	A	
Estonia / EE3	1	NA				NA	NA	
Finland / FIVHA1	1	(A)	99	99	99	NA	NA	error in reading xml files
Finland / FIVHA2	1	(A)	99	99	99	NA	A	error in reading xml files
Finland / FIVHA3	1	(A)	99	99	99	R	A	error in reading xml files

Finland / FIVHA4	1	(A)	99	99	99	NA	A	error in reading xml files
Finland / FIVHA5	1	(A)	99	99	99	NA	A	error in reading xml files
Finland / FIVHA6	1	(A)	99	99	99	NA	A	error in reading xml files
Finland / FIVHA7	1	(A)	99	99	99	NA	A	error in reading xml files
Finland / FIWDA	1	(A)	99	99	99	NA	NA	
France / FRA	1	A	99	99	99	R	A	error in reading xml files, additional information in file on national level
France / FRB1	1	A	99	99	99	R	A	
France / FRB2	1	A	99	99	99	R	A	
France / FRC	1	A	99	99	99	R	A	
France / FRD	1	A	99	99	99	R	A	
France / FRE	1	A	99	99	99	R	A	
France / FRF	1	A	99	99	99	R	A	
France / FRG	1	A	99	99	99	R	A	
France / FRH	1	A	99	99	99	R	A	
France / FRI	1	A	99	99	99	R	A	
France / FRJ	1	A	99	99	99	R	A	
France / FRK	1	NA	99	99	99	R	NA	
France / FRL	1	A	99	99	99	R	A	
France / FRM	1	A	99	99	99	R	A	
Germany / DE1000 Danube	1	A	1	1		A	A	
Germany / DE2000 Rhine	1	A	1	1	1	A	A	
Germany / DE3000 Ems	1	A	1			A	A	
Germany / DE4000 Weser	1	A	1	1	1	A	A	
Germany / DE5000 Elbe	1	A	1	1	1	A	A	
Germany / DE6000 Odra	1	A	1	1	1	A	A	
Germany / DE7000 Meuse	1	A	1			A	A	
Germany / DE9500 Eider	1	A	1			A	A	
Germany / DE9610 Schlei/Traven	1	A	1			A	A	
Germany / DE9650 Warnow/Peene	1	A	1			A	A	
Greece / GR01	1	A	1			A	A	
Greece / GR02	1	A	1			A	A	
Greece / GR03	1	A	1			A	A	
Greece / GR04	1	A	1			A	A	
Greece / GR05	1	A	1			A	A	
Greece / GR06	1	A	1			A	A	
Greece / GR07	1	A	1			A	A	
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Greece / GR09	1	A	1			A	A	
Greece / GR10	1	A	1			A	A	
Greece / GR11	1	A	1			A	A	
Greece / GR12	1	A	1			A	A	

Greece / GR13	1	A	1			A	A	
Greece / GR14	1	A	1			A	A	
HU1000	1	R	99	99	99	R	R	all information in 1 folder, maps and xml schemes for different zones cannot be linked based on names
Ireland / EA	1	R	99	99	99	NA	NA	over 30 xml schemes for APSFR
Ireland / GBNISH	1	R	99	99	99	NA	NA	over 30 xml schemes for APSFR
Ireland / SE	1	R	99	99	99	NA	NA	over 30 xml schemes for APSFR
Ireland / SW	1	R	99	99	99	NA	NA	over 30 xml schemes for APSFR
Ireland / WE	1	R	99	99	99	NA	NA	over 30 xml schemes for APSFR
GBNIIENB	1	NA	1			A	NA	
GBNIIENW	1	NA	1			A	NA	
ITA	1	R	99	99	99	NA	NA	
ITB	1	R	99	99	99	NA	NA	
ITC	1	R	99	99	99	NA	NA	
ITD	1	R	99	99	99	NA	NA	
ITE	1	R	99	99	99	NA	NA	
ITF	1	R	99	99	99	NA	NA	
ITG	1	R	99	99	99	NA	NA	
ITH	1	R	99	99	99	NA	NA	
LI1	99	NA				NA	NA	
Latvia / LVDUBA Daugava	1	A		1		jpg	NA	
Latvia / LVGUBA Gauja	1	A		1		jpg	NA	
Latvia / LVLUBA Lielupe	1	A		1		jpg	NA	
Latvia / LVVUBA Venta	1	A		1		jpg	NA	
MC1		NA				NA	NA	
Lithuania / LT1100 Nemunas	1	A	1			A	A	
Lithuania / LT2300 Venta	1	A	1			A	A	
Lithuania / LT3400 Lielupe	1	A	1			A	A	
Lithuania / LT4500 Dauguva	1	A	1			A	A	
Luxembourg / LU RB_000 Rhine	1	R	99	99	99	R	R	
Luxembourg / LU RB_000 Rhine	1	R	99	99	99	R	R	
MTMALTA	1	NA	1			NA	NA	only summary information, Malta has no river basins but a number of valley systems that are dry for most of the year.
Netherlands / NLEM Ems	1	A			1	NA	NA	documentation on methodology available at national level

Netherlands / NLMS Meuse	1	A			1	NA	NA	documentation on methodology available at national level
Netherlands / NLRN Rhine	1	A			1	NA	NA	documentation on methodology available at national level
Netherlands / NLSC Scheldt	1	A			1	NA	NA	documentation on methodology available at national level
Poland / PL1000 Danube	1	R	99	99	99	NA	NA	
Poland / PL2000 Vistula	1	R	99	99	99	R	R	
Poland / PL3000 Swieza	1	R	99	99	99	NA	NA	
Poland / PL4000 Jarft	1	R	99	99	99	NA	NA	
Poland / PL5000 Elbe	1	R	99	99	99	R	R	
Poland / PL6000 Odra	1	R	99	99	99	R	R	
Poland / PL6700 Ucker	1	R	99	99	99	NA	NA	
Poland / PL7000 Pregolya	1	R	99	99	99	R	R	
Poland / PL8000 Nemunas	1	R	99	99	99	R	NA	
Poland / PL9000 Dniestr	1	R	99	99	99	R	NA	
PTRH1	0	NA				NA	NA	
PTRH10	0	NA				NA	NA	
PTRH2	0	NA				NA	NA	
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PTRH4	0	NA				NA	NA	
PTRH5	0	NA				NA	NA	
PTRH6	0	NA				NA	NA	
PTRH7	0	NA				NA	NA	
PTRH8	0	NA				NA	NA	
PTRH9	0	NA				NA	NA	
Romania / RO1000	1	R	99	99	99	R	R	
Slovakia / SK30000FD Vistula	1	A	1			R	R	
Slovakia / SK40000FD Danube	1	A	1			R	R	
Slovenia / SI_RBD1 Danube	1	A	1			A	A	
Slovenia / SI_RBD2 North Adriatic	1	A	1			A	A	
Spain / ES010	1	A	1			A	A	
Spain / ES014	1	A	1			A	A	
Spain / ES017	1	A	1			NA	A	
Spain / ES018	1	A	1			NA	A	
Spain / ES020	1	A		1		A	A	
Spain / ES030	1	A	1			A	A	
Spain / ES040	1	A	1			A	A	
Spain / ES050	1	A	1			A	A	
Spain / ES060	1	A	1			A	A	
Spain / ES063	1	A	1			A	A	

Spain / ES064	1	A	1			A	A	
Spain / ES070	1	A		1		A	A	
Spain / ES080	1	A		1		NA	A	
Spain / ES091	1	A	1			A	A	
Spain / ES100	1	A	1			A	A	
Spain / ES110	1	A	1			A	A	
Spain / ES120	1	A	1			A	A	
Spain / ES122	1	A	1			A	A	
Spain / ES123	1	A	1			A	A	
Spain / ES124	1	A	1			A	A	
Spain / ES125	1	A	1			A	A	
Spain / ES126	1	A	1			A	A	
Spain / ES127	1	A	1			A	A	
Spain / ES150	1	A	1			A	A	
Spain / ES160	1	A	1			A	A	
Sweden / SE1	1	A	1			A	A	
Sweden / SE1TO	1	A	1			A	A	
Sweden / SE2	1	A	1			A	A	
Sweden / SE3	1	A	1			A	A	
Sweden / SE4	1	A	99	99	99	NA	A	
Sweden / SE5	1	A	1			A	A	
Sweden / SENO1102	1	NA				NA	NA	
Sweden / SENO1103	1	NA				NA	NA	
Sweden / SENO1104	1	NA				NA	NA	
Sweden / SENO5101	1	NA				NA	NA	
UK / UK01 Scotland	1	A	1			R	R	
UK / UK02 Solway Tweed	1	A	1		1	R	R	art 13 §1 b only for part of the basin in England
UK / UK03 Northumbria	1	A	1		1	R	NA	
UK / UK04 Humber	1	A	1		1	R	R	
UK / UK05 Anglian	1	A	1		1	R	R	
UK / UK06 Thames	1	A	1		1	R	R	
UK / UK07 South East	1	A	1		1	R	R	
UK / UK08 South West	1	A	1		1	R	NA	
UK / UK09 Severn	1	A	1		1	R	R	
UK / UK10 Western Wales	1	A	1		1	R	R	
UK / UK11 Dee	1	A	1		1	R	NA	
UK / UK12 North West	1	A	1		1	R	R	
UK / UKGBNIIENB	1	NA	1			A	NA	
UK / UKGBNIIENW	1	NA	1			A	NA	
UK / UKGBNINE	1	NA	1			A	NA	
UK / UKGI17 Gibraltar	1	A	1			A	NA	

Legend: A accessible, R restricted, NA not available, 99 unknown