LODE PROJECT

Good practices and challenges of current loss and damage data management

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Loss Data Enhancement for DRR & CCA management

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1. INTRODUCTION

Within the LODE project a network of stakeholders (hereafter ShN) – already active in the field of disaster risk reduction (DRR) and climate change adaptation (CCA) – from various International and European organizations (e.g. EU Commission, DG-ECHO, JRC), and others from national and regional levels (e.g. regional public administrations, municipalities), has been established in order to co-develop an in-depth understanding of what is considered damage in different governance, societal and territorial sectors and to discuss both technical and procedural needs across current loss and damage data management systems. Specifically, as a first step, members of the ShN have been involved in the evaluation of currently available databases and practices for damage and loss data collection and management, in order to identify current gaps and challenges ahead. This screening assessment will allow project partners to elicit the key requirements to drive the design and implementation of the LODE information infrastructure, recording loss and damage data from multiple sectors at relevant spatial and temporal scales.

The purpose of this deliverable is to document the elicited requirements of enhanced Information System to collect, organise, store and use loss and damage data, identifying common elements within different context and methodologies, classifications and indicators, analyzing the various data inventories to move towards an enhanced common structure.

2. CURRENT GOOD PRACTICES, GAPS AND CHALLENGES IN DAMAGE AND LOSS DATA COLLECTION

2.1. Publicly available loss and damage data systems

Due to the growing recognition of the significance of post-disaster loss data and given the very recent Directive on open data and the re-use of public sector information (Directive (EU) 2019/1024) which focuses on the economic aspects of the re-use of encouraging Member States to make as much information available for re-use as possible many agencies, organizations and research institutes started working on disaster data collection and management. At the present, there are three global multi-hazards databases and several national and regional databases hazard- based or sector-related.

The three global multi-peril loss databases, EM-DAT, NatCat and Sigma, which provide a global coverage for a long time span, are the most known and cited in the literature. At the global level, but hazard-based rather than impact based, there are noteworthy initiatives such as:

- the Significant Earthquake Database of the National Geophysical Data Center (NOAA) which contains information on destructive earthquakes around the globe;
- the Global Landslide Catalog (GLC) accessible from the NASA's open data portal which stores information related to injured and dead people due to mass movements triggered by rainfall around the world;
- the “Global Active Archive of Large Flood Events” managed by the Dartmouth Flood Observatory (DFO), which documents flood events and associated damages from 1985 to the present.

Other noteworthy initiatives are:

- the ‘Historical Analysis of Natural Hazards in Europe’ database (HANZE) of the Delft University of Technology which provides a compilation of past damaging floods for 37 European countries;
- SHELDUS country-level hazard database for United States which covers the period from 1960 to 2016 for several perils such as floods, wildfires, hurricanes, tornados etc.;

- the database of Mediterranean Flood Fatalities (MEFF) which stores data about flood fatalities with victim's profiles and the circumstances of the accidents for five specific areas such as Catalonia and Spanish Balearic Islands, South France, Greece and Calabria from 1980 to 2015.

At the European level, many are the satellite services which provide information on the affected areas from natural disaster such as floods, forest fires and droughts (Copernicus EMS, EFFIS, EFAS, EDO). Those monitoring services which continuously provide update information are commonly used in civil protection control rooms either for weather forecasts or to analyze damages and assess damages when a fire or a flood hit an area, as confirmed from GENCAT – Catalonia which makes use of those services. Information are reported in a schematic way in Annex 1a and 1b.

Additionally, a table with practices adopted in the different countries of the LODE project partners has been filled by the organizations (see Annex 2a and 2b). Many countries do not often have procedures and databases to collect and store post-event damage data; in many countries there are no organizations in charge of collecting data and in the few countries where databases exist non-governmental institutions operate for the collection and management of the data (Wirtz et al., 2014) and within a country more than one loss database may be available serving different application areas or categories of users.

However, it is important to highlight that most of the reported datasets are not related to specific collection process, in fact the sources of the data are generally newspapers or other agencies therefore the data do not come directly from surveys but are generally already processed information. Given this context, this deliverable wants to focus on information systems that are related to specific damage data collection and storage in order to highlight the quality and specificities of those data. Nonetheless, in the following chapters we are going to analyze good practices carried out in some European Countries.

2.2. Discussion of good practices per country

2.2.1. ITALY

FLOODCAT - The Italian Civil Protection Department has developed, with the support of the Italian National Institute for Environmental Protection and Research, and developed by

the CIMA Foundation, the web geographic information system platform FloodCat. The platform, an inventory of flood events used for collecting information on past floods in accordance with the EU floods directive, is available to regional and river basin district authorities. Each significant flood event is reported in the platform with a number of specific characteristics such as: location of the event, specificities regarding the flood itself, inundated area, and adverse consequences for human health, cultural heritage, economic sector, environment etc.. The stored information are collected by the Civil Protection.

DADO - The Italian Civil Protection Department started a project in 2014, with the support of Eucentre Foundation, aimed at developing a web-based platform, named Da.D.O. (Observed Damage Database) which stores data on buildings during the post-earthquake surveys carried out over the last 50 years in the country. The platform is a tool supporting the Civil Protection Department and the Scientific Community in their activities, it is an inventory which contains data relevant both for scientific purpose and useful for all the civil protection activities aimed at seismic risk reduction. However, since the data collected are the result of damage and usability inspections, which were modified and upgraded through the years, the datasets are not homogenous and directly comparable. The platform hosts nine different sets with georeferenced records (3000 in total) for past seismic events of national relevance such as Friuli 1976, Irpinia 1980, Abruzzo 1984, Umbria-Marche 1971, Pollino 1998, Molise 2002, Emilia 2003, L'Aquila 2009 till Emilia earthquake 2012. The form used to collect the data for each specific event is linked to every set. The evolution over time of the data collection methodology made progressively more difficult a mutual comparison. The numerous differences between the data collected for each event have prevented the creation of a single database therefore, the information collected in the various survey campaigns has been kept separate for each event.

2.2.2. SLOVENIA

AJIDA - Slovenia has developed a disaster loss estimation and validation methodology supported by a strong IT system called AJDA. The Slovenian database, cataloged as one of the best across Europe, is a country-wide and multi-hazard asset based system. The data are not publicly accessible, mainly because they are linked to the cadastre, and therefore have certain privacy-related data. The Administration of Civil Protection and Disaster Relief (ACPDR) is responsible for the data which are collected at the asset scale by specialized assessment teams and the staff is involved yearly in training courses. The

collected data are compared and cross-checked with data in different national registers therefore this process permits to create loss estimate report quickly and allows to create an inventory of evidence based information to support a variety of actions.

2.2.3. Spain

CDTE - The Spanish CDTE (Catalogue of Earthquake Damage in Spain) was developed by the Spanish Department of Civil Protection and is based on agreements signed between the Directorate-General for Civil Protection, the insurance compensation consortium, the national geographical institute and the national centre for geographical information. The project ended without completing the original objectives, available funding did only allow to develop a preliminary version (about 100 events) by adapting the same methodology used for the CNIH (National Historical Flood Catalogue). The databases stores general event data and it records also the characteristics of the event, the causes, and human losses and services, infrastructure, buildings, industries losses.

CCS - CCS Spanish database (Database from Consorcio de Compensación de Seguros) covers insured losses from extraordinary risks, including natural phenomena, terrorism and actions carried out by the Armed Forces and the Security Forces in time of peace. It is maintained by the CCS, which is by law the Spanish public insurance company responsible for paying out for these losses. CCS covers losses of property (residential, commercial, industrial, infrastructures, motor vehicles, etc.), personal damages and losses arising from interruption to business.

GenCAT - Proprietary Database regarding floods, managed by the government of Catalunya, it stores press information (local and from Government press offices) and local agents. This DB runs from 2012 and has been redefined and modified along time. It represents the main source of information to develop emergency plans, alongside with geodatabase analysis.

2.2.4. FINLAND

PRONTO - Pronto is the Finnish accident and resource usage monitoring database maintained by the Ministry of the Interior and operated by Emergency Services Academy Finland. It includes information on every accident to which the rescue authorities have

been alarmed. After every incident, a standard form is filled regarding the rescue event, containing information about the time, place and details of the event, and also the resources used by the rescue authorities. This detailed information about the event and operations are delivered to the database by the regional rescue departments. A preliminary and real-time subset of these data with imprecise location information is freely available at www.tilannehuone.fi.

Finnish Energy Disruption infoservice - Electricity distribution disruption data is provided by Finnish Energy, which represents approximately 260 companies that produce, acquire, transmit and sell electricity, gas, district heat and district cooling and offer related services. Finnish Energy is responsible for the management of collective labor agreements for the personnel of its member companies, and it provides advice and training for its members, conducts studies and disseminates information. The real-time municipality level version of the data is available at https://www.sähkökatkokartta.fi/, also containing data history for the last 7 days. For longer history, data can be obtained from Enease Ltd (fee-based service).

Forest use notifications are provided by Finnish Forest Centre. The Finnish Forest Centre is a state-funded organisation covering the whole country. It promotes forestry and related livelihoods, advising landowners on how to care for and benefit from their forests and the ecosystems therein, collecting and sharing data related to Finland's forests and enforcing forestry legislation. Landowners are obligated to send forest use notifications to Finnish Forest Centre for example in case of significant forest damages caused i.e. by forest fires or windstorms.

Remote sensing products including flood maps - Finnish Environment Institute (SYKE) /Geoinformatics systems and geoinformatics research units have produced Remote Sensing products and a database that includes satellite images starting in some cases from 2003. The products are based on NOAA-AVHRR (NOAA), TERRA / AQUA MODIS (NASA), ENVISAT MERIS (ESA), RADARSAT (CSA), AMSR-E (NASA), Landsat 8 (NASA) or Sentinel 2 (ESA) satellite observations.

Road traffic accidents database – Database of traffic accidents between years 2012-2019 including accidents related to challenging weather conditions. The database includes information on the type of the vehicles and amounts of killed, injured and seriously injured people. Also, the weather conditions are defined, weather the conditions at the accident

time were snowy, slushy, wet or dry. The database can be found also in English. The database is owned and maintained by Statistics Finland.

2.2.5. Greece

The Diractorate General of Natural Disasters Rehabilitation (GDAEFK) and the Ministry of Infrastructure and Transport maintain different datasets for Greece, more detailed information for each are reported below:

GDAEFK'S DATABASE – The Database stores data about past damaging natural disasters. Specifically it contains comprehensive and accurate information on date, location/affected built up area, type of natural disaster, number of affected buildings, the estimated budget for rehabilitation losses of past damaging events from 1978 up today, and ministerial decrees with measures in order to understand the effects of the destruction. The target of this database is to record all the incidents that GDAEFK has dealt with.

GDAEFK BUILDING DAMAGE and COST ASSESSMENT – those two datasets, which are accessible on request, collect data for damages occurred due to different kind of hazards (earthquakes – from 1999 up to now and floods, forest fires etc. from 2013 only). The GDAFK building damage assessment stores data collected through damage assessments such as details for each building affected (name of the user, location, occupancy, technical characteristics, structural type, damages, etc.) and buildings are ranked in 3 categories (green, yellow, red), following specific instructions and each category includes certain type of damages . The target of the procedure is to identify the buildings that are damaged, not damaged or totally damaged, to create a building I.D., to record the number of homeless, as also to identify the cost of rehabilitation. Moreover in the section of cost assessment the database includes also cost of repairs and total cost of rehabilitation for each natural disaster event. While for the cost assessment datasets details related to the costs of repairs.

2.2.6. France

ARIA – ARIA (Analysis, Research and Information on Accidents) dataset is maintained by the French BARPI (Bureau d’Analyse des Risques et Pollutions Industriels) and it stores information for NatTech and Industrial accident occurred in France since 1992 to present.

It stores data in tables and documents with the description of the accidents. Specifically it stores damages to people, their goods, buildings and infrastructures, to the environment, and the relative estimation of the costs.

ONRN – The ONRN (National Observatory for Natural Hazards) provides cartographic statistics of cumulated insured loss data at the municipality grid (in maps or tables) for floods over the period 1995-2010. The ONRN platform offers mainly a geographic interface and the possibility to download a set of specific indicators, calculated at municipality grid on assets exposure, cumulated insured losses for the time period of 1995-2010 onwards, progress of public reduction procedures. These indicators cover all categories of floods, storm and subsidence. Loss data producers are ONRN partners such as the French State, ministry of ecology and sustainable development (MEDDE), together with state agencies and affiliated local authorities and administration Inspectors, SISFRANCE, Meteo France, Enquête permanente sur les avalanches, NatCat and other sources. The large number of sources allows to have numerous records, however involves heterogenous records related to disparted time-span.

DAMAGIS - The DamaGIS database stores 729 damage entries caused by 23 river flood events in the South of France since 2011. The geodatabase contains polygon geometries for geographic features to identify flood events that have caused damages and shape field containing point geometries for flood-related damage. It is a multisource database, numerous sources of information have been used for comprehensiveness purposes such as corporate websites, personal blogs, local authorities, public administration, on-site observations, social and online media. Around 78% of the data are retrieved from social media, the prominence of new media accounts for three-quarters of the data collected. The available data time coverage, corresponding to 7 years, is relatively short therefore it doesn’t allow significant statistical analysis and the origin of the sources may raise concerns. DamaGIS does not take fatalities into account, but information on flood-related fatalities is included in another database called the Vict-In database which stores information related to the circumstances of death and the profiles of the flood victims in the French Mediterranean departments since 1988. Since Vict-In and DamaGIS share the same events it is easy to gather and combine multiple information.

2.2.7. Serbia

The DesInventar methodology is used across the country, multi-hazard damage data covering a time-span from 1980 to present, are stored and the main source of information is the NGDC (National Geophysical Data Center). It allows to perform statistics analysis, to create diagrams, reports, tables and a map according to information related to numbers of houses destroyed and damaged, crop damages, lost cattle, road damages, indirectly affected people, relocated.

2.2.8. Portugal

DISASTER – The Disaster project aims to bridge the gap on the availability of a consistent and validated hydro-geomorphologic database for Portugal, by creating, disseminating and exploiting a GIS database on disastrous floods and landslides for the period 1865–2010, it contains events retrieved from national/regional/local newspapers that led to casualties or injuries, and missing, evacuated or homeless people, independently of the number of people affected. A total of 1,621 disastrous floods and 281 disastrous landslides are stored in the database.

2.3. Discussion of gaps

Despite the large number of available datasets, records of damage and losses occurred due to past disastrous events are not always available, or of good quality. Availability could suffer because the datasets have not been created to be updated and managed across time with good temporal resolution or they are not accessible anymore after a project ends or the access is limited. It may also be that relevant databases exist, but are proprietary to private companies, such as insurers, and hence are not publicly available or are available only at high level of aggregation. As it is evident from the information collected in the tables 2a and 2b, most of the available databases are not updated or maintained and they cover a limited period of time. On the other hand, even in databases that are maintained and accessible, the data itself can have particular shortcomings in quality, regarding for example spatial coverage or ability to connect the observed impacts to a certain event unambiguously.

It is fundamental to highlight that even if countries have procedures to collect damage and loss data, rarely they have databases to store and manage post- event damage data. For example the CARM (Murcia Regional Government) Cultural Heritage Unit which has a detailed information monitoring the recovery after the Lorca 2011 earthquake or the CECLOR (Confederación Comarcal de Organizaciones Empresariales de Lorca) which compiled estimated damage and losses in local business few days after the earthquake distributing a paper based form, but data are stored in flat file based systems and not in a proper Data Base Management System (DBMS); therefore analysis and interrogation of data becomes costly in terms of time and needed resources even for the same organization. However, in many countries there are no organizations in charge of collecting data and open datasets available often have questionable quality of data. Global datasets provide low resolution data as they contain aggregations of information; many assumptions are performed on the data in order to have spatially homogeneous information that can cover large areas. The lack of consistency of data collection, which is the result of different methodologies used during the collection, the different scope and the different spatial scale considered lead to data which have a questionable accuracy and that can be hardly comparable.

Disaster loss datasets are based on different methodologies, such as the definition or threshold for what qualifies a disaster, as well as in the procedures used to collect the data. Disaster loss and damage datasets do not provide a complete picture of the events and often they do not include records for "smaller" but often recurrent events. In order to make use of historical damage datasets for issuing early warnings for forecastable phenomena the records should cover data from the full range of events, from low to high impact. In fact, smaller phenomena are more frequent and may provide statistical basis on which to tailor and calibrate early warnings, being able to correlate meteorological indicators with expected levels of impact and the consequent damage to different sectors.

Damage and loss data available for statistics and analyses present many weaknesses. Principally, the reason is due to a lack of standardized methodologies for the collection and consistent definitions. For example, the basis for economic losses may differ from sector to sector, and from market-based to contractual or administrative basis. Moreover, data are sometimes collected from public sources (newspapers, public insurance reports etc.). The original information is transferred from one source to another so the information can be easily affected by errors. However, many initiative and activities are nowadays

carried out in the JRC (see Annex 1b), but those datasets have a different nature since the data are collected for policy reason given that the institution has already an official mandate and this situation proves that steps forward have been done according to some years ago when no single institution had the role of prime provider of verified data (GFDRR, 2002). However, when considering more detailed data, the situation is still characterized by gaps and high level of fragmentation that needs to be improved.

2.4. General Overview

Based on the information collected and the contributions from the partners, an analysis and comparison has been carried out, specifically regarding the dataset which cover European countries or regions (Table 1).

Table 1. Subset of analysis

GLOBAL	EM-DAT	NatCAT	SIGMA Explorer	NOAA	GLC	DFO	COPERNICUS EMS	DAILY MAPS		
EUROPEAN	HANZE	eMARS	EFFIS	EFAS	EDO					
NATIONAL	DISASTER	CDTE	CNIH	CCS	GDAEFK'S DATABASE	GDAEFK BUILDING DAMAGE and COST ASSESSMENT	FloodCat	D.a.Do	AVI	WSL
	PRONTO	ARIA	ONRN	Flood Loss Statistics database for Finland	Forest use notifications	Electricity distribution fault data	DesInventar Serbia	DamaGIS	AJDA	Finnish Traffic Accident Database
LOCAL	GENCAT DB	2014 Secchia River Flooding	MEFF	RASDA						

The main findings indicate that:

- 19 datasets are public, 4 are partially public (i.e. raw data are not available, only statistical analysis are available), 7 store data that can be acquired on request, 1 is unfinished/unavailable and 4 have reserved access;
- 20 out of the 31 datasets related to European countries or regions are still updated and maintained;

- 14 of the datasets analyzed allow to retrieve data in tabular format, while 8 give graphics on number statistics, loss amount diagrams, percentage distributions, tables and a maps with aggregated values as output; alongside 8 dataset present an interactive interface with Web map viewer and platforms; both static maps and tables are the output of 4 datasets considered;

In order to have a clearer overview regarding the typology of hazards considered and the time span covered, Figure 1 qualitatively illustrates the different characteristics of the datasets considered in this work.

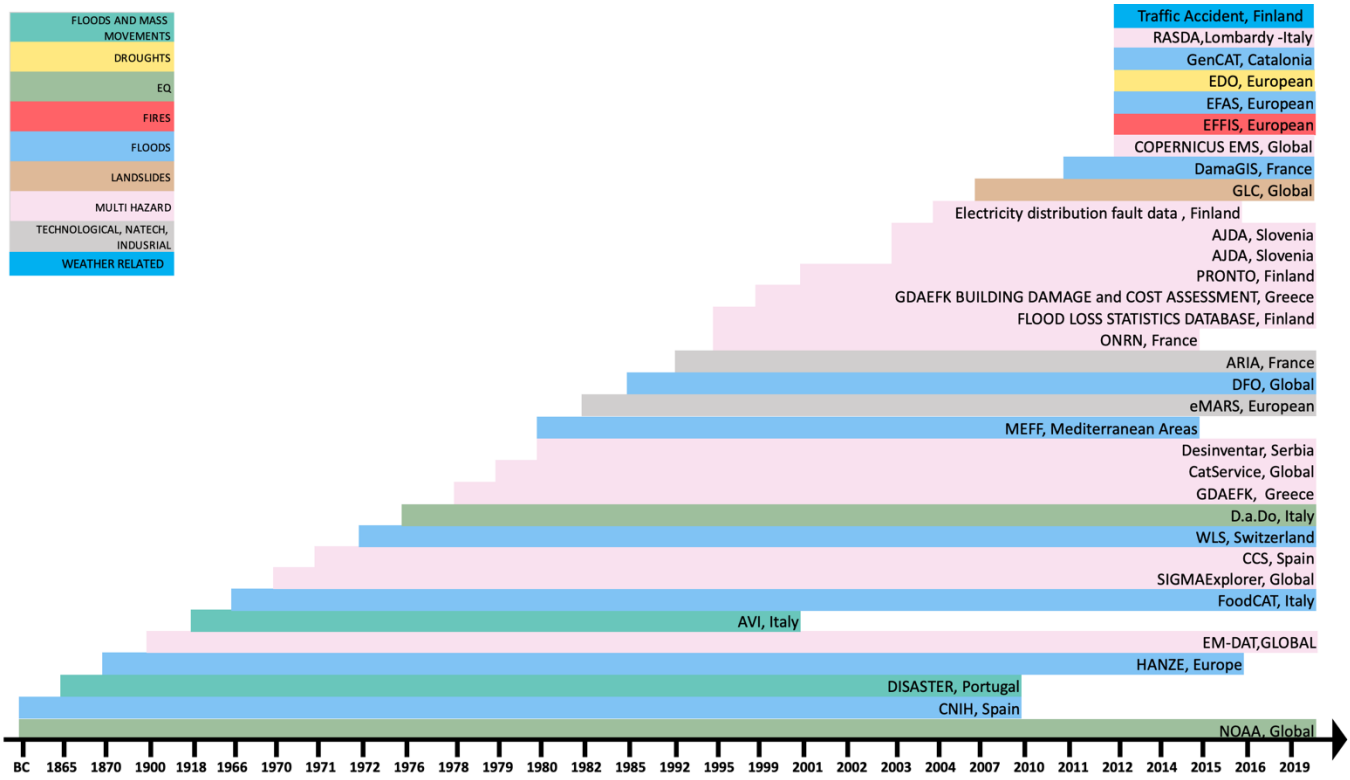

Figure 1. Characteristics of the datasets (time and spatial coverage, type of hazards) (NB: time frame not in scale, qualitative representation)

2.5. Discussion of challenges

Based on the overall view gained through the information exchange with the partners from different European Countries, many challenges to overcome have been highlighted. Considering the different datasets analyzed and knowing that the stored data are collected with different approaches and for different scopes, it becomes difficult to have homogeneous data that can be used according to the potential they could have if collected with appropriate methodologies and tools.

Some of the main challenges to overcome are not only related to the use of an appropriate data collection methodology, in fact some issue that need to be addressed are related to aspects such as the definition of the event and its time of occurrence/duration, the classification of the disaster (i.e. in the case of floods and landslides), the spatial extent and the exact location of an event.

However, when referring to an appropriate data collection methodology the main steps to undertake are:

- Understanding of the societal sector under analysis
- Understanding of the damage on the specific asset/system depending on the scale
- Definition of the damage attributes, obtaining a common set of information for every hazard in order not to miss any relevant information
- Adoption of terminologies and common classification with well-defined definitions
- Inclusion of all sectors with their own specific characteristic and connections with other sectors
- Establishing an understanding of the quality and limitations of data
- Documentation of the data collection process

Moreover, the actual situation needs to move not only forward the fragmentation of data but also and especially the fragmentation of responsibilities in which lies the strongest influence for data quality.Once data collection features are delineated, in order to be compliant with the various relevant directives and initiatives (Sendai Framework, National Risk Assessment, Flood Directives etc.), it is essential to tailor a proactive IT system which allows an easier data management enabling users to manipulate data for different purposes. Though, it becomes extremely challenging to design and built a complex but flexible database which considers all hazards, without losing valuable information.

3. REQUIREMENTS OF AN ENHANCED INFORMATION SYSTEM

3.1. General data quality requirements

For any database, appropriate data quality standards should be established. For this purpose, it is instructive to examine the quality requirements for insurance data as set by EU in the Solvency II directive (2009/138/EC) and related regulations. At the high level,

the directive requires that Member States shall ensure that insurance undertakings have internal processes and procedures in place to ensure the appropriateness, completeness and accuracy of key data. These characteristics are further defined in the Delegated Regulations (COMMISSION DELEGATED REGULATION (EU) 2015/35) as follows; data is deemed:

- accurate if
    - the data are free from material errors;
    - data from different time periods used for the same estimation are consistent;
    - the data are recorded in a timely manner and consistently over time.
- appropriate if
    - the data are consistent with the purposes for which they will be used;
    - the amount and nature of the data ensure that the estimations made on the basis of the data do not include a material estimation error;
    - the data are consistent with the assumptions underlying the actuarial and statistical techniques
    - the data appropriately reflect the risks to which the insurance undertaking is exposed
    - the data were collected, processed and applied in a transparent and structured manner, based on a documented process that comprises all of the following:
        - the definition of criteria for the quality of data and an assessment of the quality of data, including specific qualitative and quantitative standards for different data sets;
        - the use of and setting of assumptions made in the collection, processing and application of data;
        - the process for carrying out data updates, including the frequency of updates and the circumstances that trigger additional updates;

- Insurance undertakings shall ensure that their data are used consistently over time

While the both the data and its uses may differ from insurance context, this example highlights the need to establish appropriate data quality standards to ensure databases are and stay fit for purpose. However, as public hazard databases are at the stage of development and innovation, it has to be accepted that in the beginning not all ultimate data quality requirements will be met, and these too will progressively develop along the databases themselves.

3.2. Data Collection

In order to overcome the actual situation we propose the design of a relational database which takes into consideration all the phases of damage and loss collection:

- recording,
- storing,
- managing,
- maintaining an up-to-date documentation of the database, and
- performing continuing quality controls of data

This design will be conducted according to comprehensive studies of:

- policies,
- current practices (more detailed analysis of the previous described practices) with their strength and lacks;
- societal sector characteristics (intrinsic features and individual behavior under hazards impacts)
- appropriate taxonomy and terminologies
- proper temporal and spatial scales.

The whole development will be carried out with the purpose of designing a tool which could be implemented from institutional organizations. The process could lead to definition and development of metadata system like has been done in meteorological co-operation (World Meteorological Organization).

3.3. Data Organization

Data should be collected according to precise schemes delineated sector by sector with the objective to serve different purpose. In order to have an efficient system, data should be organized through a relational database which consists in a collection of tables that store interrelated data. By designing a relational database it is possible to create a structure that eliminates redundancy and inconsistency.

3.4. Data Storage

A relational database management system allows to store and retrieve data represented in tables through different types of queries elaborated in advance to support a range of different purposes.

3.5. Data Use

The proposed approach steps forward the actual situation. Most of the damage assessments are carried out manually filling forms with data that lose their interrelation or datasets function only as a storage of data collected from different and heterogeneous sources (newspaper, media, social networks).

A relational database system anticipates the use of data for multiple objectives allowing to properly collect them and to store of large amount of data, permitting efficient search performance through prefigurated queries. The use of a well-designed database management system, would enhance the comprehension of the impacts through timely availability and large-scale accessibility of the information. Moreover, the collection of the data through an ICT (Information and Communications Technology) application user-interface would allow to insert the data directly into the archive. Database management system has many advantages over tradition Flat File management system offering a variety of techniques to store and retrieve data with specific functions keeping data Integrity and Security and eliminating redundancy and inconsistency.

ANNEX

Annex 1a: Existing damage and loss datasets

	EM-DAT	NatCat Service	SIGMA Explorer	NOAA	GLC	DFO	DesInventar	SHELDUS	CCD
Full name	The international disaster database	Natural catastrophe service		Significant Earthquake Database	Global Landslide Catalogue	Global Active Archive of Large Flood Events		Spatial Hazard Events and Losses Database for the United States	Canadian Disaster Database
Organization	Centre for Research on the Epidemiology of Disasters (CRED)	MUNICH RE	SWISS RE	National Geophysical Data Center / World Data Service (NGDC/WDS)	NASA	Dartmouth Flood Observatory	Network for Social Studies on Disaster Prevention in Latin America (LA Red)	Arizona State University	
Access	Public	Partially public - raw data are not accessible, only statistical analyses	Partially public - raw data are not accessible, only statistical analyses	Public	Public	Public	Public	Pay in function of the amout of records required	Public
Disasters Considered	Natural, epidemics, technological, conflicts	Natural	Natural, man-made	Earthquakes	Landslides	Floods	Muti-hazard	Muti-hazard	Natural, technological and conflicts
Spatial Coverage	Global	Global	Global	Global	Global	Global	Regional	Regional	Regional
	-	-	-	-	-	-	Latin America	United States	Canada
Temporal Coverage	1900-present	1979-present	1970-present	from 2150 B.C	2007-present	1985-present	1944-present	1960 - 2017	1900-present
Granularity/Scale	Country	Country	Country	Country	Country	Country		County	
Data format	Tabular	Graphics on statistics, loss amount, percentage distributions, tables, map	Graphics on statistics, loss amount, percentage distributions, tables, map	Tables and interactive map	Tables and interactive map	Tables and interactive map	Tool for statistics, diagrams, reports, tables and a map	Tabular	Tables and interactive map
Main Sources	Un agencies, Lloyds, press agencies	Lloyds, internal reports, reinsurance periodicals	Lloyds, internal reports, reinsurance periodicals	NGDC, NCEI/WDS Historical Tsunami and Volcanic Eruptions DB	Media, disaster databases, scientific reports	Governmen, academia, news media and satellite-based sources	Government agencies, NGOs, and research institutes	National organizations	Government, emergency management and insurance organizations
Sectors considered									
Fatalities	X	x	x	x	x	x	x	x	x

Type of damage and loss data	Injured	X		x	x	x		x	x	x
	Affected People	x								
	Estimated Economic Losses	x	x	x	x		x	x		x
	Missing	x		x						
	Homeless	x								
	Evaquated	x					x			x
	Affected Area - km2, ha..	x					x			
	…				# houses destroyed, # houses damaged				Direct property and crop losses, Insured crop	

Annex 1b: Existing damage and loss datasets

	WSL	MEFF	HANZE	eMARS	COPERNICUS EMS	EFFIS	EFAS	EDO	DAILY MAPS
Full name	Swiss Flood and Landslide Damage Database	Mediterranean Flood Fatalities	Historical Analysis of Natural Hazards in Europe	Major Accident Reporting System	Copernicus Emergency Management Service	European Forest Fire Information System	European Flood Awareness System	European Drought Observatory	
Organization	Swiss Federal Research Institute WSL		Delft University of Technology	JRC	JRC	JRC	JRC	JRC	Emergency Response Coordination Centre - ECHO
Access	On request	Public	Public	Public	Raw data on request (maps available online)	Raw data on request (maps available online)	Raw data on request (maps are available online)	Raw data on request (maps available online)	Public
Disasters Considered	Flood and mass movement	Floods	Floods	Technological		Fires	Floods	Drought	Muti-hazard
Spatial Coverage	National	Local	Regional	European	Global	European	European	European	Global

		Switzerland	Catalonia and Spanish Balearic Islands, South France, Greece, Calabria	European			(recently upgrated Global)	(recently upgrated Global)	(recently upgrated Global)	-
Temporal Coverage		1972-present	1980 to 2015	1870 to 2016	1982 - present	2012-present	2012-present	2012-present	2012-present	
Granularity/Scale		Municipality					Burnt area	Flooded area		Affected area
Data format		Tables and map		Tabular	Statistics, tabular, reports	Maps based on satellite imagery	Web map viewer, GIS	Web map viewer, GIS	Web map viewer, GIS	Static maps
Main Sources		Swiss newspapers and magazines, insurance companies and the internet	Local databases, newspaers and literature	International and national databases, scientific publications, and news reports	Seveso Directive reports	Satellite Earth Observations	Satellite Earth Observations	Satellite Earth Observations	Satellite Earth Observations	Satellite Earth Observations
Sectors considered			Population							
Type of damage and loss data	Fatalities	x	x	x	x					x
	Injured	x		x	x					x
	Affected People			x						
	Estimated Economic Losses	x		x						
	Missing									
	Homeless									
	Evaquated	x								
	Affected Area -km2, ha..			x	x	x	x	x	x	x

Annex 2a: Good practices of damage and loss data collection and storage adopted in some European countries

	AJDA	DISASTER	CDTE	CNIH	Database from Consorcio de Compensación de Seguros (CCS)	GENCAT DB	GDAEFK'S DATABASE	GDAEFK BUILDING DAMAGE and COST ASSESSMENTS	RASDA	FloodCat	D.a.Do
Full name		Disaster Project	Catalogue of Earthquake Damage in Spain	National Historical Flood Catalogue		Base de dades del servei de Planificació	Database of Diractorate General of Natural Disasters Rehabilitation	Database of Diractorate General of Natural Disasters Rehabilitation	Regional on-line system for the Collection of the Damage Forms	Flood Catalogue	Database di Danno Osservato
Organization	Ministry of Defence of the Republic of Slovenia	Centre for Geographical Studies;Institute of Geography and Spatial Planning,Faculty of Sciences-University of Lisbon; Centre for Social Studies-University of Coimbra; Faculty of Arts-University of Oporto	Spanish Civil Protection, National Geographic Institute and Centre for Geographic Information, Consorcio de Compensación de Seguros	Spanish Civil Protection (DGPCE)	Consorcio de Compensación de Seguros (CCS)	GENCAT Civil Protecion	Diractorate General of Natural Disasters Rehabilitation, Ministry of Infrastructure and Transport	Diractorate General of Natural Disasters Rehabilitation, Ministry of Infrastructure and Transport	Regione Lombardia	Italian Civil Protection Department	Italian Civil Protection
Access		Public	Not available. Unfinished	Public	On request	Reserved	Public	On request	Reserved	Reserved	Reserved
Disasters Considered	Multi-hazard	Flood and mass movement	Earthquakes	Floods	Multi-hazard (extraordinary risks)	Floods	Earthquakes, forest fires, floods	Earthquakes (from 2013 also other natural disasters)	Multi-Hazard	Floods	Earthquakes
Spatial Coverage		National	National	National	National	Regional	National	National	Local	National	National
	Slovenia	Portugal	Spain	Spain	Spain	Catalonia	Greece	Greece	Lombardy region, Italy	Italy	Italy
Temporal Coverage	2003-present	1865-2010	Not available. Unfinished	BC - 2010	1971-present	2012-Present	1978-present	1999-present	2003- present	1966-2012	1976- to present
Granularity/Scale	Asset			Municipality	Postal code, Census code	Flooded area	Affected built up area	Affected built up area	Municipality	Asset	Asset
Data format			Access and SQLServer	Tables, maps and bar graphs	Excel tables	Tabular	Table of incidents	Damage Assessments of buildings,Tables, statistics, diagrams, reports	Tables containing data inserted from the council offices (pdf or excel)	Web-GIS platform	geo-referenced data and CSV tables

Main Sources		external sources, cadastral data, prices for material and repairs	National, regional and local newspapers	IGN Spanish Catalogue	DGPCE, CCS	Own sources	Local Press, Government press offices and local agents	GDAEFK database	GDAEFK'S On the field Damage Assessments of buildings	Public Administration	Public administrations	Public administrations
Sectors considered		Multi-sector		Multi-sector	Multi-sector	Multi-sector	Land	Affected built up area	Residential - Built environment	Multi-Sector	Multi-sector	Residential
Type of damage and loss data	Fatalities		x	x	x	x					x	
	Injured		x	x	x						x	
	Affected People										x	
	Estimated Economic Losses			x	x	Only for those insured		X	X		x	
	Missing		x								x	
	Homeless		x						X		x	
	Evaquated		x								x	
	Affected Area (km2 or other units)						x	x	x		x	
	…			damage to households, infrastructure, agriculture, livestock, industry, services	damage to households, infrastructure, agriculture, livestock, industry, services			Affected buildings	Affected buildings	Damages to both private and public sectors (structures, infrastructures, residential buildings, productive sector..)	buildings, streets (Km), cultural heritage, economic activities, ICT	Damages to residential buildings

Annex 2b: Good practices of damage and loss data collection and storage adopted in some European countries

	AVI	2014 Secchia River Flooding	PRONTO	Forest use notifications	Electricity fault data	Flood Loss Statistics database for Finland	ARIA	Trafic accidents	ONRN indicators	DamaGIS	DesInventar_ Serbia
Full name	Aree Vulnerate Italiane	Secchia River Showcase	Finnish rescue services' Internet-based accident statistics system	Forest Use Notifications	Power system fault data	Flood Loss Statistics database for Finland	Analysis, Research and Information on Accidents	Road trafic accident database	Database on sinistrality		
Organization	GNDCI, National Group for prevention of hydrological risk	Municipalities of Modena, Bastiglia, Bomporto	Emergency Services Academy Finland	Finnish Forest Centre	ENEASE OY operating for Energia.fi	Finnish Environment Institute	BARPI (Bureau d'Analyse des Risques et Pollutions Industriels)	Statistics Finland (stat.fi)	Observatoire National des Risques Naturels	Research insitute	
Access	Public	On request	Parcially public		Parcially public (raw data accessible on requested, statistical analyses are published)	Public	Public	Public	Public	Public	Public
Disasters Considered	Landslides and floods	River flood	Natural, man-made	Natural	Natural	Natural	Natech, industrial	Multi-hazard	Natural hazards	Floods	Muti-hazard
Spatial Coverage	National	Local	National	National	National	National	National	National	National	National	National/Regional
	Italy	Italy	Finland	Finland	Finland (with some restrictions)	Finland	France	Finland	France	France	Serbia
Temporal Coverage	1918-2001	2014	2001-present		2004-2018 possibly also earlier data available	1995-2015	1992 -present	2012-present	1995-2015	2011- to present	1980-present
Granularity/Scale	Municipality	Individual residential address	Rescue misson		electricity transmission fault event	Postcode, month, flood type	National	National	National	Asset	
Data format	Tabular	Tabular	CSV		Excel file	Excel file	Table, documents with description of accidents.	Multiple formats available	Indicators, exl files, reports		Tool for statistics, diagrams, reports, tables and a map
Main Sources	Historical newspapers	State compensation of flood losses	Regional Rescue Authority		Energy companies, ENEASE OY	Finnish State, Insurance companies	Industry and State services (Inspection)	Police, Traficom, Ministry of Transport	Insurance, State	Media, websites, local authoritie	NGDC Natural Hazards Website

									and Communications, Finnish Road Safety Council		s, social network	
Sectors considered		Multi -sector	Residential					Industrial	All		Multi-sector	
Type of damage and loss data	Fatalities	x		x				x	x			x
	Injured	x		x				x	x			x
	Affected People	x				affected customers		x				x
	Estimated Economic Losses		x				x	x				x
	Missing	x						x				x
	Homeless	x						x				
	Evaquated	x						x				x
	Affected Area (km2 or other units)	x	x (Approximated from affected buildings)	x	x			x				
	…	Available information depends on the specific cases		Over 100 parameters related rescue missions		fault location and duration, lost KWh, cause of the fault, households without electricity				Insured losses	Agriculture, Economic activity, Electric and road network, services	# of houses destroyed or damaged, crop damages, lost cattle, road damages, affected people, relocated