264

UCL
Université
catholique
de Louvain

Working paper

Disaster Category Classification and peril Terminology for Operational Purposes

Common accord
Centre for Research on the Epidemiology of Disasters (CRED) and
Munich Reinsurance Company (Munich RE)

Regina Below, CRED
Angelika Wirtz, Munich RE
Debarati GUHA-SAPIR, CRED

October 2009

Munich RE

WHO Collaborating
Centre for Research
on the Epidemiology
of Disasters
CRED

1. Introduction

One of the major current challenges in the field of disaster data is to overcome the limitations induced by the lack of clear standards and definitions, which leads to inconsistent reliability and poor interoperability of different disaster data compilation initiatives. The Centre for Research on the Epidemiology of Disasters (CRED) militates for years for the creation of internationally recognized standards and definitions.

In 2006, CRED undertook an analytical review of selected data set on natural disasters and impacts[1]. The objective was to provide a comprehensive overview of current global disaster database initiatives to better identify gaps or differences in information and strengths in our individual interpretations. The paper highlights the strengths and weaknesses of all those efforts that have taken place to better document the impacts of disasters and draws attention to the problems and the areas in which management of disaster information could improve. Some of the areas identified include:

- Disaster definition: Differences and lack of standardization of the terminology complicate comparisons of data
- Disaster typology/classification: Databases have to cope with disaster (sub)type classifications as well as their primary and secondary effects. Without standardized terminology, databases continue to face a decreased accuracy in reporting disaster related impact.

Georeferencing, temporal aspects, methodology and sourcing were other issues that have been identified. Although these issues are not new, they represent areas where we should focus our attention, and also remind us of the challenges that this area of research continues to face. The standardization of methods and definitions is clearly the key issue to be addressed in order to improve data quality and to ensure comparability between data sets.

[1] Tschoegl L., with Below R. and Guha-Sapir D. (2006). An Analytical review of selected data sets on natural disasters and impacts. Paper prepared for the UNDP/CRED Workshop on Improving Compilation of Reliable Data on Disaster Occurrence and Impact. Bangkok, 2-4 April 2008.

2. Context

In 2002, under the request of the ProVention Consortium, CRED has led a comparative study of three global data sets: EM-DAT (CRED), NatCatSERVICE (Munich RE) and Sigma (Swiss RE)[2]. The aim was to assess the comparative strengths and weaknesses of these three databases.

The analysis was based on 4 countries - Vietnam, India, Honduras and Mozambique - over a period of 15 years (1985-1999). All records were extracted from the 3 databases and were tabulated in a matrix where the disaster entries from each source could be cross-referenced by each variable of interest. The variables included for comparison were: date, disaster type, number of people killed, homeless, injured, affected and overall damage costs.

Taking into account that each of these databases has its own specificity, one of the conclusions was that a disaster event may be classified as a different type of disaster by different databases. This occurs particularly for associated disasters or secondary disasters. For example, a flood which was a consequence of a wind storm may be recorded as one or the other; or a flood recorded as such in one database could be recorded as a cyclone in another.

A further example is the use of different terminologies to define the same event: a winter storm could be registered as cold/frost; or similarly a heat wave as drought. Taxonomy is also difficult to standardize since perfectly credible sources will also differ as to whether an event was a landslide, a mudslide, a flood, or whether they occurred simultaneously or sequentially.
Difference in typology and taxonomy make the comparison of data sets difficult. Transparent standards would improve the credibility of all databases significantly.

It is in this context that in 2007, CRED and Munich RE led a collaborative initiative, agreed on and implemented as a common “Disaster Category Classification and Peril Terminology for Operational Databases". This new common classification has been established through several technical meetings and working groups that brought together CRED, Munich RE, Swiss Re, Asian Disaster Reduction Center (ADRC) and United Nations Development Programme (UNDP) and represents a first and important step in the development of a standardized international classification of disasters and terminology of perils.

[2] Guha Sapir D., Below R. (2002). The quality and accuracy of disaster data: A comparative analysis of three global data sets, ProVention Consortium

Table 1: Overview of EM-DAT and NatCatSERVICE databases

	EM-DAT (CRED)	NatCatSERVICE (Munich RE)
Period covered	1900 – present	0079 - present
Number of entries	17,000	26,000
Type of disasters	Natural and technological disasters	Natural disasters
Entry criteria	10 or >deaths and/or 100 or > affected and/or Declaration of a state of emergency/call for interantional assistance	• Entry if any property damage and/or any person sincerely affected (injured, dead) • Before 1970 only major events
Main sources	UN agencies, US Government agencies, official governmental sources, IFRC, research centres, Lloyd's, Reinsurance sources, press, private	Munich RE branch offices; Insurance Associations; Insurance press; Scientific sources; Weather services; Governmental and non-governmental organisations
Priority source	Priority is given to the UN agencies	For monetory losses priority is given to Munich RE branch offices and Insurance Associations
Access	Public	Partially accessible
Web address	www.emdat.be	www.munichre.com/geo

The table gives an overview of the meta information and criteria applied in the EM-DAT and NatCatSERVICE databases.

3. Goals

The goals of this initiative are:

1. Create and agree on a common hierarchy and terminology for all global and regional databases on natural disasters;

2. Establish a common and agreed definition of disaster groups, main types and sub-types that is simple and self-explanatory.

The conditions are to allow all global databases to compare and exchange data at a detailed level, as well as all other databases using this standard to do the same.

4. Disaster category classification and peril terminology: Methodology

The classification of different types of disasters into main categories was primarily based on a matrix including the existing disaster categories from the main database owners: ADRC (GLIDE), CRED (EM-DAT), La Red (DesInventar), Munich RE (NatCatSERVICE) and Swiss Re (Sigma). The same exercise was done for the definitions of the disaster categories. Taking into account each database specificities, a first working group meeting was set up in order to reach a common disaster category classification and terminology to fit all databases.

4.1 Hierarchy of disaster categories

The new classification distinguishes two generic disaster groups: natural and technological disasters. The natural disaster category being divided into six disaster groups: Biological, Geophysical, Meteorological, Hydrological, Climatological and Extra-Terrestrial. Each group covers different disaster main types, each having different disaster sub-types. Tables 2 – 7 give an overview of the grouping of natural disasters.

Table 2: Grouping of geophysical disasters

Disaster Generic Group	Disaster Group	Disaster Main-Type	Disaster Sub-Type	Disaster Sub-sub Type
Natural Disaster	Geophysical	Earthquake	Ground shaking	
			Tsunami	
		Volcano	Volcanic eruption	
		Mass movement (dry)	Rockfall	
			Avalanche	Snow avalanche
				Debris avalanche
			Landslide	Mudslide Lahar Debris flow
			Subsidence	Sudden subsidence
				Long-lasting subsidence

Table 3: Grouping of meteorological disasters

Disaster Generic Group	Disaster Group	Disaster Main-Type	Disaster Sub-Type	Disaster Sub-sub Type
Natural Disaster	Meteorological	Storm	Tropical storm	
			Extra-tropical cyclone (Winter storm)	
			Local/Convective storm	Thunderstorm/ Lightning
				Snowstorm/Blizzard
				Sandstorm/Duststorm
				Generic (severe) storm
				Tornado
				Orographic storm (strong winds)

Table 4: Grouping of hydrological disasters

Disaster Generic Group	Disaster Group	Disaster Main-Type	Disaster Sub-Type	Disaster Sub-sub Type
Natural disaster	Hydrological	Flood	General (river) flood	
			Flash flood	
			Storm surge/coastal flood	
		Mass movement (wet)	Rockfall	
			Landslide	Debris flow
			Avalanche	Snow avalanche
				Debris avalanche
			Subsidence	Sudden subsidence
				Long-lasting subsidence

Table 5: Grouping of climatological disasters

Disaster Generic Group	Disaster Group	Disaster Main-Type	Disaster Sub-Type	Disaster Sub-sub Type
Natural disaster	Climatological	Extreme temperature	Heat wave	
			Cold wave	Frost
			Extreme winter conditions	Snow pressure
				Icing
				Freecing rain
				Debris avalanche
		Drought	Drought	
		Wild fire	Forest fire	
			Land fires (grass, scrub, bush, etc. …)	

Table 6: Grouping of biological disasters

Disaster Generic Group	Disaster Group	Disaster Main-Type	Disaster Sub-Type	Disaster Sub-sub Type
Natural disaster	Biological	Epidemic	Viral Infectious Diseases	
			Bacterial Infectious Diseases	
			Parasitic Infectious Diseases	
			Fungal Infectious Diseases	
			Prion Infectious Diseases	
		Insect infestation	Grasshoper/Locust/Worms	
		Animal stampede		

Table 7: Grouping of extra-terrestrial disasters

Disaster Generic Group	Disaster Group	Disaster Main-Type	Disaster Sub-Type	Disaster Sub-sub Type
Natural disaster	Extra-terrestrial	Meteorit/Asteorit		

4.2 Methodology

The hierarchy of the new classification is based on a "triggering hazard/event" logic. Indeed, the triggering hazard/event is used as the reference root to classify the disaster. For example, a mass movement can be triggered by either a geophysical or a hydrological phenomenon. The triggering hazard will then determine if the disaster is assigned to enter into the "mass movement dry" or "mass movement wet" category. Table 8 shows examples of how disasters are classified following this hierarchy. Tables 9 and 10 show the percentage distribution of events by disaster groups and disaster main types for the period 2000 – 2008 in both databases after the implementation of the new classification

Table 8: Examples of classification of disasters

Example	Disaster Generic Group	Disaster Group	Disaster Main-type	Disaster Sub-type	Disaster Sub-sub type
1999: Landslides, Venezuela	Natural disaster	Hydrological	Mass movement (wet)	Landslides	
2004: Tsunami, South Asia	Natural disaster	Geophysical	Earthquake	Tsunami	
2008: Cyclone Nargis, Myanmar	Natural disaster	Meteorological	Storm	Tropical storm	Storm surge
2009: „Victoria-Fires", Australia	Natural disaster	Climatological	Wild fire	Bush fire	

Table 9: Repartition of events by Disaster Group, 2000-2008

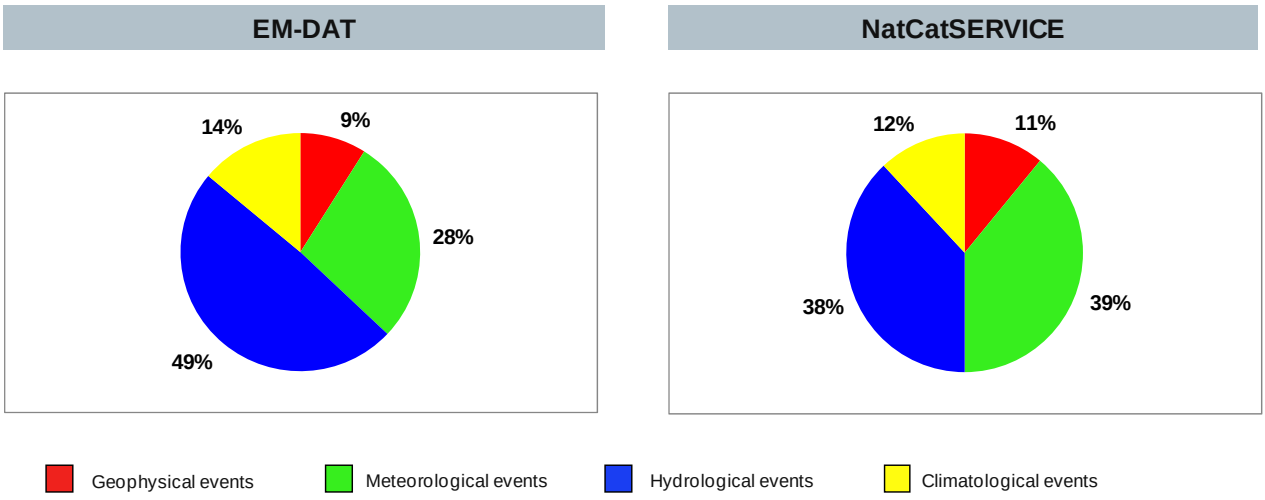
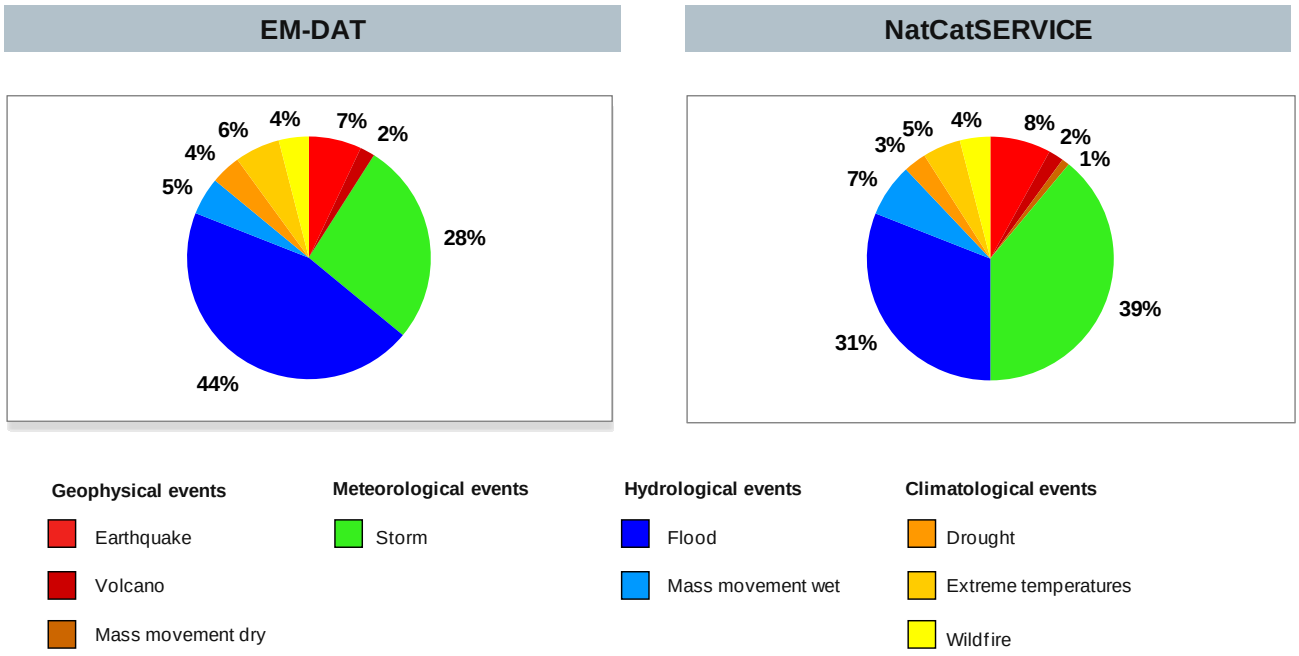


Table 10: Repartition of events by Disaster Main type, 2000-2008



The differences in distributions for EM-DAT and NatCatSERVICE are due to different entry criteria. For example, the storm segment in NatCatSERVICE is higher (39 %) than the storm segment in EM-DAT (27 %). One reason is that numerous storm events in NatCatSERVICE are registered due to their monetary impact. Those events, however, are not registered in EM-DAT since in these cases neither fatalities occurred nor a state of emergency was declared.

5. Conclusion/Recommendations

The harmonizing of the disaster category classification between two of the most important global disaster databases - NatCatSERVICE and EM-DAT – as well as the definition of common standards is an important contribution to the improvement of quality and reliability of the international disaster databases. Both disaster classification and definition of common standards serve the international community, users and developers of databases at national or sub-national levels to have a better understanding of the management of disaster data. It demonstrates the importance to develop the capacity of information exchange, integration and comparability between disaster databases.

CRED and Munich RE are aware of the limitations of and/or differences in concepts which may occur. This classification of perils does not claim to be exhaustive or to fit into each database specification. However, it is a valuable tool which facilitates the exchange and comparison of disaster events and their impacts and also allows interoperability between disaster databases.

© 2009 CRED/Munich RE

Munich Reinsurance Company
Geo Risks Research
Koeniginstrasse 107
80802 Munich
Germany
www.munichre.com/geo

Catholic University of Louvain
Centre for Research on the Epidemiology of Disasters - CRED
30.94 Clos Chapelle-aux-Champs
1200 Brussels
Belgium
www.cred.be

ANNEX 1: Definition table

Avalanche: Avalanche describes a quantity of snow or ice that slides down a mountainside under the force of gravity. It occurs if the load on the upper snow layers exceeds the bonding forces of the entire mass of snow. It often gathers material that is underneath the snowpack like soil, rock etc (debris avalanche). Any kind of rapid snow/ice movement

Biological Disasters: Disaster caused by the exposure of living organisms to germs and toxic substances

Climatological Disasters: Events caused by long-lived/meso to macro scale processes (in the spectrum from intraseasonal to multidecadal climate variability)

Cold wave: A cold wave can be both a prolonged period of excessively cold weather and the sudden invasion of very cold air over a large area. Along with frost it can cause damage to agriculture, infrastructure, and property. Damage caused by low temperatures

Drought: Long-lasting event triggered by a lack of precipitation. A drought is an extended period of time characterized by a deficiency in a region's water supply that is the result of constantly below average precipitation. A drought can lead to losses in agriculture, affect inland navigation and hydropower plants, and cause a lack of drinking water and famine.

Earthquake: Shaking and displacement of ground due to seismic waves. This is the earthquake itself without secondary effects. An earthquake is the result of a sudden release of stored energy in the Earth's crust that creates seismic waves. They can be of tectonic or volcanic origin. At the Earth's surface they are felt as a shaking or displacement of the ground. The energy released in the hypocenter can be measured in different frequency ranges. Therefore there are different scales for measuring the magnitude of a quake according to a certain frequency range. These are: a) surface wave magnitude (Ms); b) body wave magnitude (Mb); c) local magnitude (ML); d) moment magnitude.

Epidemic: Either an unusual increase in the number of cases of an infectious disease that already exists in the region or population concerned, or the appearance of an infection disease previously absent from a region.

Hydrological Disasters: Events caused by deviations in the normal water cycle and/or overflow of bodies of water caused by wind set-up.

Insect infestation: Pervasive influx and development of insects or parasites affecting humans, animals, crops and materials.

Landslide: Any kind of moderate to rapid soil movement including lahar, mudslide and debris flow. A landslide is the movement of soil or rock controlled by gravity and the speed of the movement usually ranges between slow and rapid. It can be superficial or deep, but the materials have to make up a mass that is a portion of the slope or the slope itself. The movement has to be downward and outward with a free face.

Local Windstorm (orographic storm): Local windstorm refers to strong winds caused by regional atmospheric phenomena which are typical for a certain area. These can be katabatic winds, foehn winds, Mistral, Bora etc.

Meteorological disasters: Events caused by short-lived/small to meso scale atmospheric processes (in the spectrum from minutes to days).

Rockfall: Quantities of rock or stone falling freely from a cliff face. It is caused by undercutting, weathering or permafrost degradation.

Storm surge: Coastal flood on coasts and lake shores induced by wind. A storm surge is the rise of the water level in the sea, an estuary or lake as result of strong wind driving the seawater towards the coast. This so-called wind setup is superimposed on the normal astronomical tide. The mean high water level can be exceeded by five and more metres. The areas threatened by storm surges are coastal lowlands.

Subsidence: Downward motion of the Earth's surface relative to a datum (e.g. the sea level). Dry subsidence can be the result of geological faulting, isostatic rebound, human impact (e.g. mining, extraction of natural gas). Wet subsidence can be the result of karst, changes in soil water saturation, permafrost degradation (thermokarst), etc.

Extreme winter condition: Damage caused by snow and ice. Winter damage refers to damage to buildings, infrastructure, traffic (esp. navigation) inflicted by snow and ice in the form of snow pressure, freezing rain, frozen waterways, etc.

Flash flood: Rapid inland floods due to intense rainfall. A flash flood describes sudden flooding with short duration. In sloped terrains the water flows rapidly with a high destruction potential. In flat terrains the rainwater cannot infiltrate into the ground or run off (due to small slope) as quickly as it falls. Flash floods typically are associated with thunderstorms. A flash flood can occur at virtually any place.

Flood: Significant rise of water level in a stream, lake, reservoir or coastal region.

Forest fire: Fires in forests that cover extensive damage. They may start by natural causes such as volcanic eruptions or lightning, or they may be caused by arsonists or careless smokers, by those burning wood, or by clearing a forest area.

General flood: Gradually rising inland floods (rivers, lakes, groundwater) due to high total depth of rainfall or snowmelt. A general flood is caused when a body of water (river, lake) overflows its normal confines due to rising water levels. The term general flood additionally comprises the accumulation of water on the surface due to long-lasting rainfall (water logging) and the rise of the groundwater table above surface. Furthermore, inundation by melting snow and ice, backwater effects, and special causes such as the outburst of a glacial lake or the breaching of a dam are subsumed under the term general flood. General floods can be expected at certain locations (e.g. along rivers) with a significantly higher probability than at others.

Geophysical disasters: Events originating from solid earth.

Heat wave: A heat wave is a prolonged period of excessively hot and sometimes also humid weather relative to normal climate patterns of a certain region.

Tropical cyclone: A tropical cyclone is a non-frontal storm system that is characterized by a low pressure centre, spiral rain bands and strong winds. Usually it originates over tropical or sub-tropical waters and rotates clockwise in the southern hemisphere and counter-clockwise in the northern hemisphere. The system is fuelled by heat released when moist air rises and the water vapour it contains condenses ("warm core" storm system). Therefore the water temperature must be >27 °C. Depending on their location and strength, tropical cyclones are referred to as hurricane (western Atlantic/eastern Pacific), typhoon (western Pacific), cyclone (southern Pacific/Indian Ocean), tropical storm, and tropical depression (defined by wind speed; see Saffir-Simpson-Scale). Cyclones in tropical areas are called hurricanes, typhoons and tropical depressions (names depending on location).

Volcanic eruption: All volcanic activity like rock fall, ash fall, lava streams, gases etc. Volcanic activity describes both the transport of magma and/or gases to the Earth's surface, which can be accompanied by tremors and eruptions, and the interaction of magma and water (e.g. groundwater, crater lakes) underneath the Earth's surface, which can result in phreatic eruptions. Depending on the composition of the magma, eruptions can be explosive and effusive and result in variations of rock fall, ash fall, lava streams, pyroclastic flows, emission of gases etc.

Wildfire: Wildfire describes an uncontrolled burning fire, usually in wild lands, which can cause damage to forestry, agriculture, infrastructure and buildings.

These definitions have been established by Munich RE Risks Research and CRED. More definitions can be found on the EM-DAT website in the "Glossary" section and at Munich RE/Geo website in the "NatCatSERVICE" section.

ANNEX II

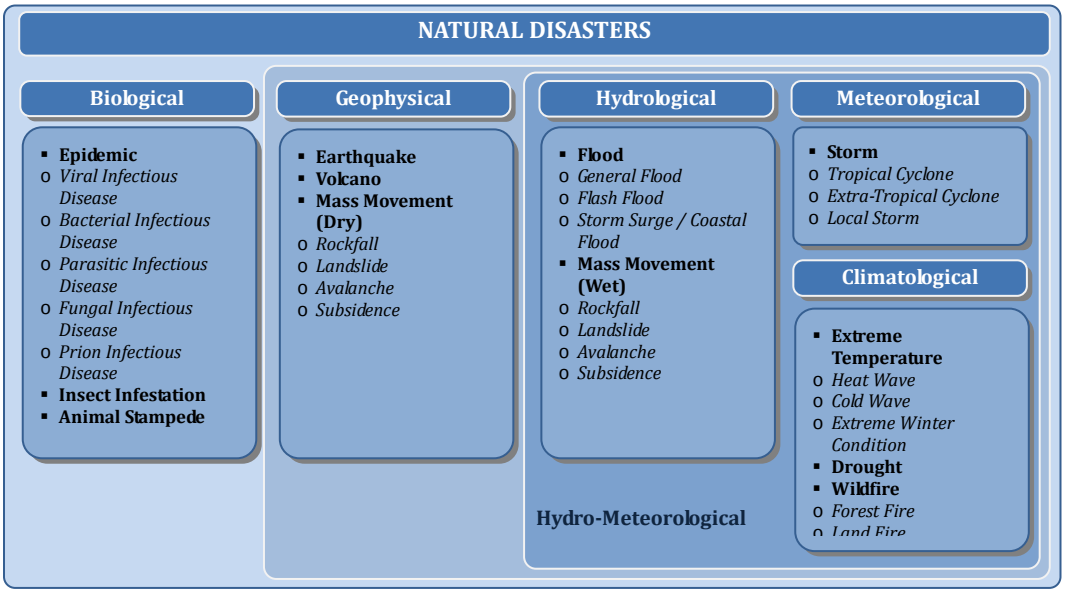
EM-DAT - Data definitions, criteria and content

CRED defines a disaster as “a situation or event which overwhelms local capacity, necessitating a request to a national or international level for external assistance; an unforeseen and often sudden event that causes great damage, destruction and human suffering”.
For a disaster to be entered into the database, at least one of the following criteria must be fulfilled: 10 or more people reported killed; 100 or more people reported affected; declaration of a state of emergency; call for international assistance.
EM-DAT distinguishes 2 generic categories for disasters (natural and technological), the natural disaster category being divided into 5 sub-groups, which in turn cover 12 disaster types and more then 30 sub-types (tables 1 and 2).

Table 1 – Disaster sub-group definition and classification

Disaster Subgroup	Definition	Disaster Main Type
Geophysical	Events originating from solid earth	Earthquake, Volcano, Mass Movement (dry)
Meteorological	Events caused by short-lived/small to meso scale atmospheric processes (in the spectrum from minutes to days)	Storm
Hydrological	Events caused by deviations in the normal water cycle and/or overflow of bodies of water caused by wind set-up	Flood, Mass Movement (wet)
Climatological	Events caused by long-lived/meso to macro scale processes (in the spectrum from intra-seasonal to multi-decadal climate variability)	Extreme Temperature, Drought, Wildfire
Biological	Disaster caused by the exposure of living organisms to germs and toxic substances	Epidemic, Insect Infestation, Animal Stampede

Table 2 – Natural Disaster Classification



DISNO:	Unique disaster number for each disaster event (8 digits: 4 digits for the year and 4 digits for the disaster number – for example, 19950324).
Country:	Country (ies) in which the disaster occurred.
Disaster generic group:	2 groups are distinguished in EM-DAT – natural and technological disasters.
Disaster sub-group:	5 sub-groups of natural disasters have been defined: geophysical, meteorological, hydrological, climatological and biological.
Disaster main type and sub-type:	Description of the disaster according to a pre-defined classification (for example, type: flood; sub-type: flash flood).
Date (start and end):	Date when the disaster occurred and ended (month/day/year).
Killed:	Number of people confirmed dead and number missing and presumed dead.
Injured:	Number of people suffering from physical injuries, trauma or an illness requiring immediate medical treatment as a direct result of a disaster.
Homeless:	Number of people needing immediate assistance for shelter.
Affected:	Number of people requiring immediate assistance during a period of emergency; this may include displaced or evacuated people.
Total affected:	Sum of injured, homeless and affected.
Victims:	Sum of killed and total affected.
Estimated damage:	Global figure of the economic impact of a disaster; it is given in US dollars.
Additional fields:	Other geographical information (such as latitude and longitude, location), value and scale of the events (such as the Richter scale value for an earthquake), the international status (OFDA response, request for international assistance, disaster/emergency declaration), the aid contribution (in US dollars), and the different sectors affected.

ANNEX III

NatCatSERVICE - Data definitions, criteria and content

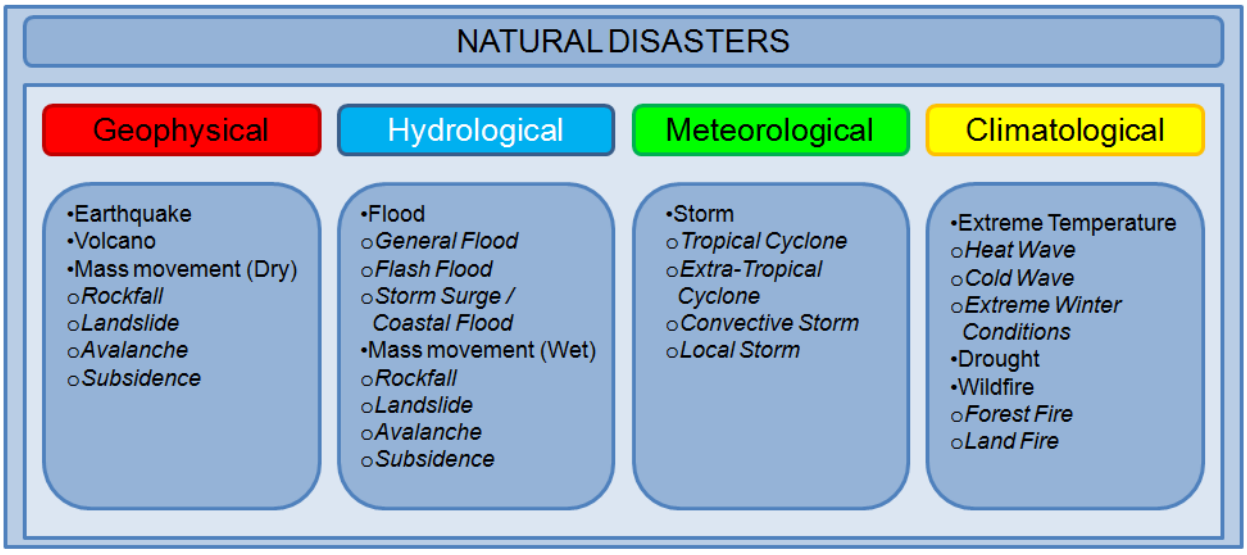
Munich RE NatCatSERVICE distinguishes between small-scale and moderate loss events, severe and major catastrophes, and devastating and great natural catastrophes. Entered are such events which have resulted in human or material loss, they are then grouped into defined catastrophe categories.

NatCatSERVICE covers natural disasters and distinguishes between 4 groups (geophysical, meteorological, hydrological and climatological), which in turn cover 9 disaster main-types and about 20 sub-types (tables 1 and 2).

Table 1 – Disaster group definition and classification

Disaster Subgroup	Definition	Disaster Main Type
Geophysical	Events originating from solid earth	Earthquake, Volcano, Mass Movement (dry)
Meteorological	Events caused by short-lived/small to meso scale atmospheric processes (in the spectrum from minutes to days)	Storm
Hydrological	Events caused by deviations in the normal water cycle and/or overflow of bodies of water caused by wind set-up	Flood, Mass Movement (wet)
Climatological	Events caused by long-lived/meso to macro scale processes (in the spectrum from intra-seasonal to multi-decadal climate variability)	Extreme Temperature, Drought, Wildfire
Biological	Disaster caused by the exposure of living organisms to germs and toxic substances	Epidemic, Insect Infestation, Animal Stampede

Table 2 – Natural disaster classification



NatCatSERVICE includes the following main fields:

MR-Number:	Unique number for each loss event giving the year, month, disaster group (A = Geophysical, B = Meteorological, C = Hydrological, D = Climatological), and a 3 digit cat-number. For example: MR200901A005.
Geographical information:	Continent, Sub-continent, Country, State/Province, County, Longitude/Latitude.
Generic group:	Natural disasters
Disaster group:	4 groups of natural disasters have been defined: geophysical, meteorological, hydrological, and climatological.
Disaster main type and sub-type:	Description of the disaster according to pre-defined classification. For example, disaster main-type is flood and sub-type is flash flood.
Date (start and end):	Date when the disaster occurred and ended (month/day/year). This date is strongly linked to the impact and not to the natural phenomenon itself. For example, the start date for a hurricane will be the first loss date and not the birth date of the hurricane.
Killed:	Number of people confirmed dead.
Missing:	Number of people declared missing.
Injured:	Number of people suffering from physical injuries.
Homeless:	Number of people needing immediate assistance for shelter.
Evacuated:	Number of people forced to leave their homes.
Overall loss:	Direct, tangible monetary impact of a disaster. Loss is given in original values, in USD, EUR and the country's original currency. The exchange rate is the "end-of-the-month" rate of that month when the event occurred.
Insured loss:	Monetary loss paid out by the worldwide insurance industry. Loss is given in original values, in USD, EUR and the country's original currency. The exchange rate is the "end-of-the-month" rate of that month when the event occurred.
Additional fields:	In addition to the basic parameters there are about 200 fields for each loss event allowing detailed analyses. For example, scientific parameters (magnitude, intensity, precipitation, wind force), lines of business and sectors (industry, infrastructure, agriculture, transport, offshore), as well as number of claims and average losse