

Definition of Catastrophe

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Topic Owners of CATRISK
– subgroup of Strategic areas

Agenda

- Etymology
- Background
- General definitions
- Insurance definitions
- Current situation in Europe
- Conclusions
- Open issues

Etymology of the catastrophe

- From the Ancient/modern Greek **καταστροφή**
- compound word
- two words **κατά** (“against”) + **στροφή** (strophē “turn”)
- to turn something upside down

- Something sudden happens and you make a turn against your current route. Something derails you.
- For most countries today catastrophe is a synonym of disaster
- Perceptions of Hazard - Risk - Catastrophe

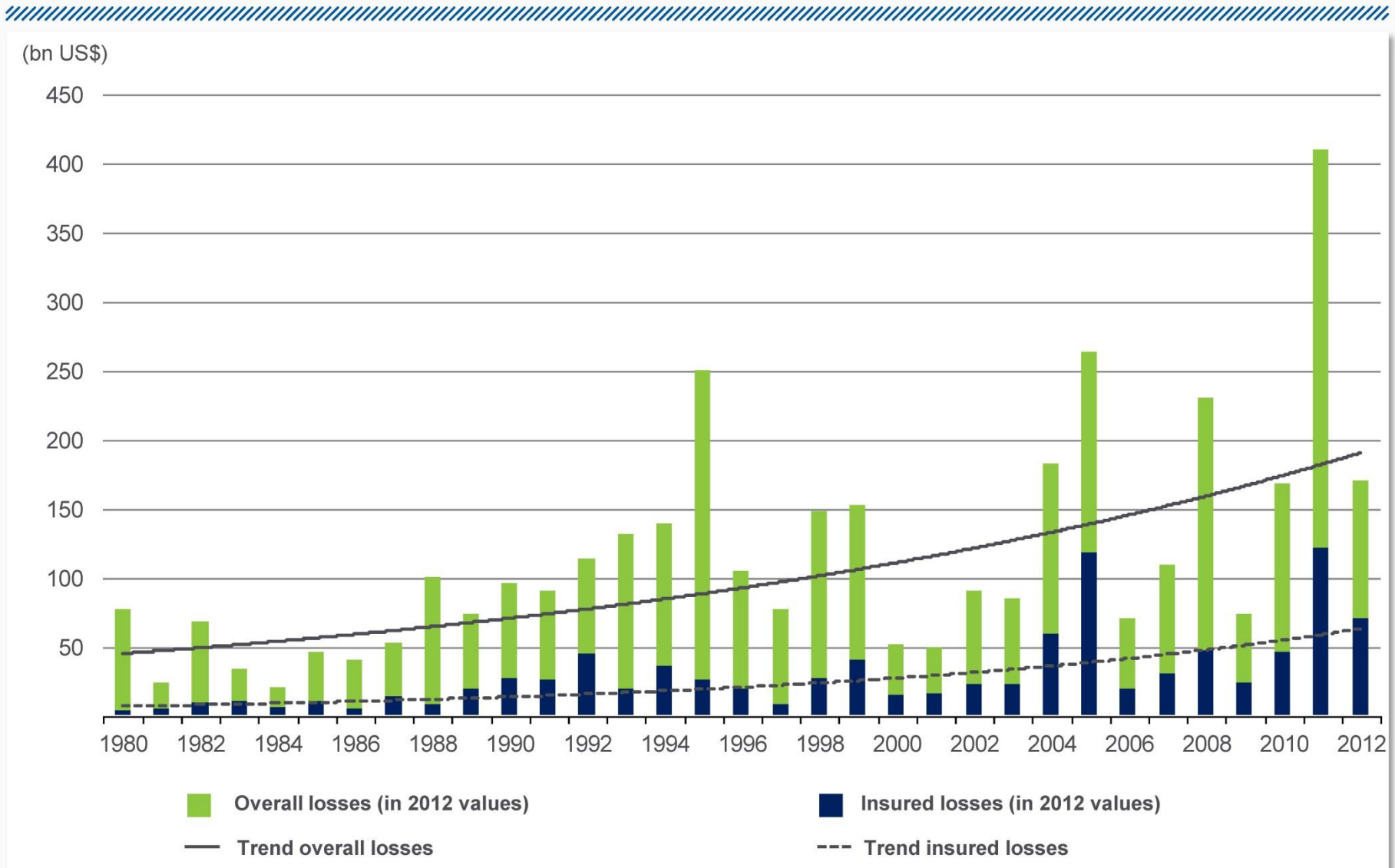
Catastrophes and humans

One viewpoint suggests that catastrophes emerged with humans, therefore it supports an anthropocentric approach

- Natural processes internal (e.g. earthquakes, volcanic eruptions) and external (e.g. floods, landslides, debris flows, erosion/sedimentation) shape the landscape and the Planet over the last 4.6 Billion years.
- These natural processes have now turned into catastrophes due to human intervention. Humans have increased the vulnerability, thus increasing the catastrophic events and their costs through time. Therefore, catastrophes now are not infrequent, but have a higher frequency and shorter recurrence intervals thus acquiring a new interpretation / meaning.

Natural catastrophes worldwide 1980 – 2012

Overall and insured losses with trend



Background

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Table 1.1 Number of great natural catastrophes and economic losses for every decade since 1950 – A comparison. Natural catastrophes are classed as great if the ability of the region to help itself is distinctly overtaxed, making interregional or international assistance necessary (After Munich Re Group, 1999)

	Decade 1950-1959	Decade 1960-1969	Decade 1970-1979	Decade 1980-1989	Decade 1990-1999
Number	20	27	47	63	82
Economic losses	38.5	69.0	124.2	192.9	535.8

Comparison of decades 1950 -1999

	Factor 90s:80s	Factor 90s:70s	Factor 90s:60s	Factor 90s:50s
Number	1.3	1.7	3.0	4.1
Economic losses	2.8	4.3	7.8	13.9

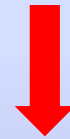
Since the 1950s

The number of “great” natural catastrophes have increased by a factor of 4

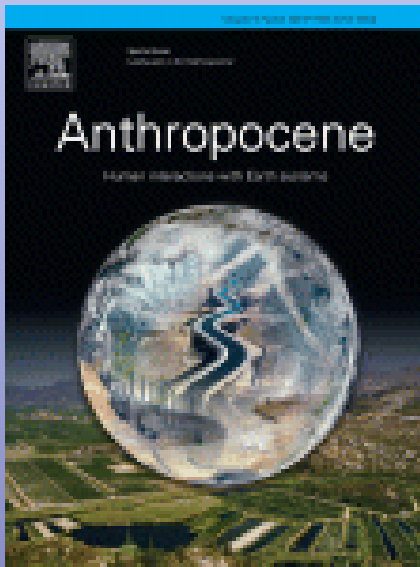
Economic losses have been increased by a factor of 14

Background

Geologists today debate on whether to officially declare the existence of a new geological epoch, the “**Anthropocene**” to acknowledge that humans are radically reshaping the earth’s surface processes leading to higher vulnerability



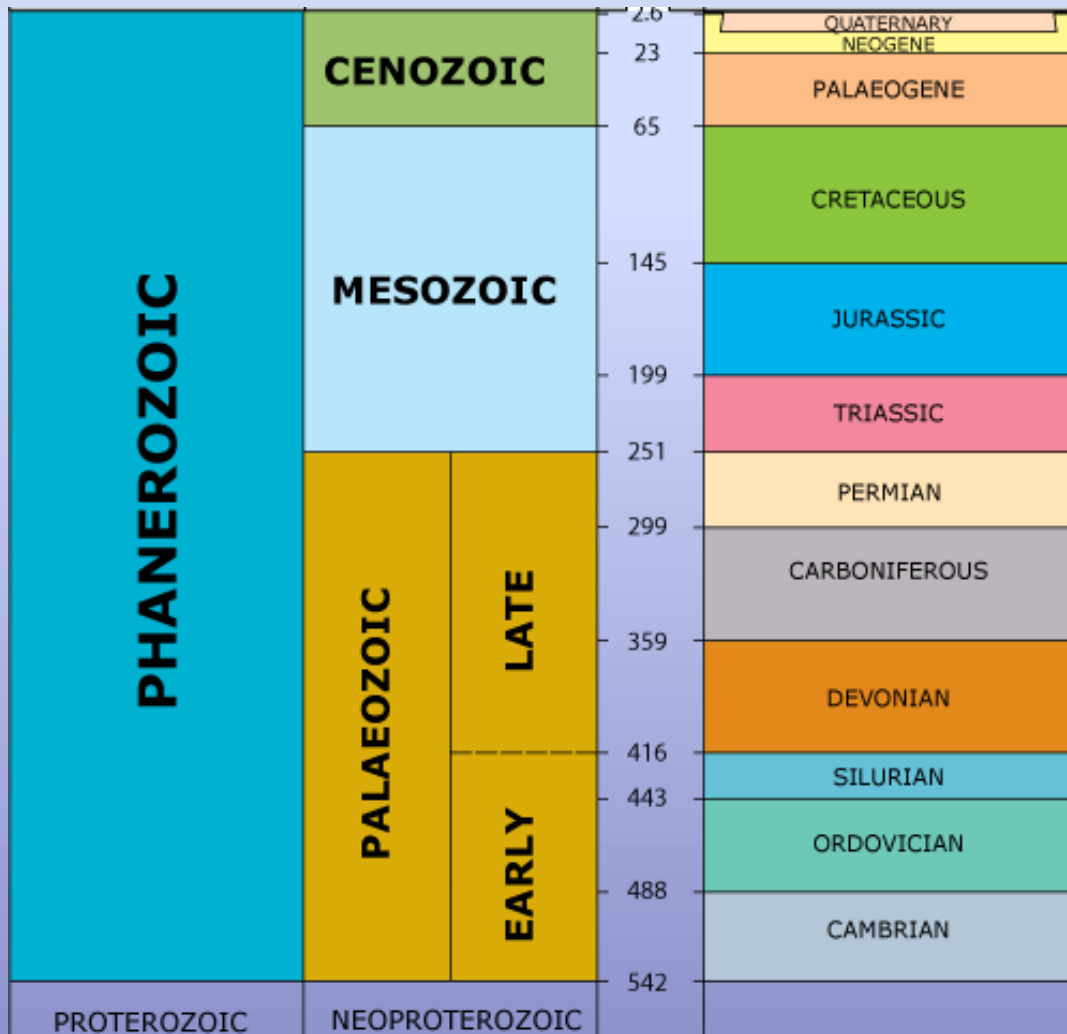
More catastrophes



Catastrophes in the geological record

- Some early scientists used catastrophism to explain geologic changes on Earth
- Catastrophism is the principle stating that all geologic change occurs suddenly by short-lived, violent events, affecting the globe
- The geological record and the geological time scale are set and bounded by catastrophes. These catastrophes are evidenced by major changes in the fossil record and the geological strata, indicating abrupt environmental changes and mass species extinctions
- Therefore Catastrophes pre-existed humans but they were infrequent. However, they played a key role in the evolution of species

Simplified Geological Time Scale and Catastrophes



Each geologic period is marked by major changes in the fossil record and the geological strata, indicating abrupt violent events.

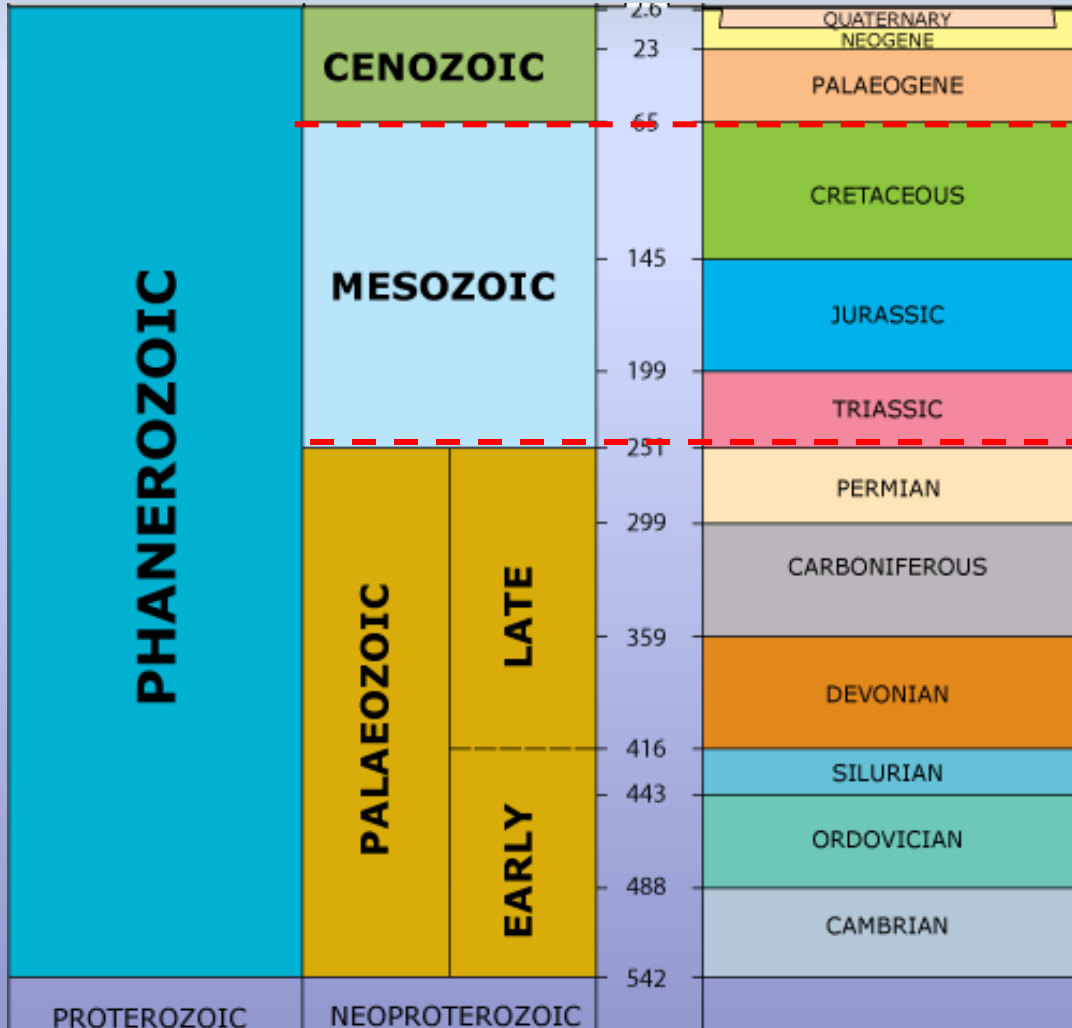
These relate to catastrophic environmental changes and mass species extinctions

Due to asteroid or comet impact, volcanic activity or climatic changes

At least 5 divisions of geological time related to mass extinction catastrophic events

Simplified Geological Time Scale and Catastrophes

Background



→ Top-5 mass extinction catastrophic events

→ ~50% extinction of all species including dinosaurs comet impact ~65Myrs ago

→ Earth's largest extinction killed ~90% of all species ~251Myrs ago

→

→

Catastrophes are an integral part in the evolution of species and the natural selection

General definitions

The catastrophe is defined Qualitatively and Quantitatively

Qualitatively (No threshold or scale is given)

An event concentrated in time and space, in which a community undergoes severe danger and incurs such losses to its members and physical appurtenances that the social structure is disrupted and the fulfilment of all or some of the essential functions of the society is prevented (UNDRO 1984).

Qualitatively

According to WHO (World Health Organization)

Disaster of special magnitude (although there has been no known attempt to quantification, yet). It has a "narrative", descriptive value and, mostly, an advocacy purpose. Conceptually, it relates best to reconstruction activities.

According to United Nations (1992, 2009),

A serious disruption of the functioning of society, causing widespread human, material or environmental losses which exceed the ability of affected society to cope using only its own resources.

According to EM-DAT (CRED)

Situation or event, which overwhelms local capacity, necessitating a request to national or international level for external assistance; An unforeseen and often sudden event that causes great damage, destruction and human suffering. Though often caused by nature, disasters can have human origins.

General definitions

Quantitative (using thresholds or scale)

At least 100 people dead or 100 injured or 1million US\$ damage (Sheehan and Hewitt 1969)

The threshold for the total number of people killed and injured for inserting them as disasters in the database varies per type of hazard between 25 for earthquakes and volcanoes to 50 for weather related disasters to 100 in man-made disasters (US office of foreign disaster assistance (OFDA 1995).

A disaster is inserted in the EM-DAT dataset (CRED) if it killed at least 10 people or affected at least 100, or there was a declaration of a state of emergency or an appeal for international assistance. Then disasters are classified as “significant” based on the following criteria: 100 or more deaths per event, damage is 1% or higher of the total annual GNP, the number of the people affected equals or exceed 1% of the total national population.

General definitions

Quantitative (using thresholds or scale)

Sigma (2001), a database of man-made and natural catastrophe losses set up by reinsurer Swiss Re, uses the following thresholds as entry criteria: if a given annual inflation-adjusted economic loss (2010:US\$ 86.5 million) and/or 20 fatalities/people reported missing, and/or 50 people injured and/or 2,000 homeless are reached or exceeded.

The NatCatSERVICE database developed by Munich Re creates a loss data set for catastrophe as soon as harm to humans (fatality, injury, homelessness) happens or property damage occurs. The events are classified in six catastrophe classes (Category 1 to 6), depending on the severity of the monetary or humanitarian impact: from a natural occurrence with very low economic impact (Category 1) to a “great natural catastrophe” (Category 6) (Munich Re, 2006). A “great natural catastrophe” is in line with definitions used by the United Nations, when it clearly overstretches the affected region’s ability to help itself and interregional or international assistance is consequently required.

Lack of common definitions among different bodies and datasets affects the interpretation of the available data, creating problems of classification induced by the lack of clear standards. This variability in definitions complicates comparisons of data and leads to inconsistent reliability and poor interoperability of different disaster data compilation initiatives (e.g. Wirtz et al. 2014).

This has negative effects in:

- a) research studies (by increasing the uncertainties in several modules of the Cat Risk modelling, estimated losses and damage scenarios)
- b) Evaluation of companies since NatCat risk is a rating factor on corporate credit quality (e.g. S&P uses exposure and treatment of Natcat risk in downgrading 60 companies since 2005).
- c) disaster management
- d) policymaking

Following the above in 2007, CRED and Munich RE initiated an agreement and implemented a common "Disaster Category Classification and Peril Terminology for Operational Databases". This is an important first step.

General definitions

Future technological threats

- Definitions of Catastrophes refer to victims (deaths, injuries) and material damages (buildings, infrastructures) whereas a few others refer to losses thresholds. What about new emerging technological threats that are not directly classified as catastrophes based on the traditional definitions? And whose losses are not easily assessed or modelled?
- For example, the Cyber-risk threat grows with the rapid expansion of data-driven technologies (e.g. see the Davos 19th of January 2015 meeting of The World Economic Forum)
- Companies are insufficiently prepared to protect themselves against cyber-risk, whereas the lack of standardization of threat level measures and assessments of firm vulnerability form major obstacles for the insurance industry. However, the definition of this risk is also evolving and volatile. It is a concentration risk and systemically important for technology enterprises

Insurance definitions

'Catastrophe Insurance'

Insurance to protect businesses and residences against natural disasters such as earthquakes, floods and hurricanes, and against man-made disasters such as terrorist attacks. These low-probability, high-cost events are generally excluded from standard hazard insurance policies, and so catastrophe insurance is required. A catastrophic event results in an extremely large number of claims being filed at the same time. This makes it difficult for catastrophe insurance issuers to effectively manage risk. (Investopedia).

For property and casualty insurers according to the American Academy of Actuaries (2001), catastrophes are infrequent events that cause severe loss, injury or property damage to a large population of exposures. Whether losses arising out of an event are defined as a catastrophe depends on the size of the loss to the company or to the entire industry.

Insurance definitions

Quantitative

In the U.S. the working definition of Catastrophe is set by the Insurance Services Office (ISO): “A natural or man-made event that causes more than \$25 million in insured losses as defined by Property Claims Services”.

This is a relatively narrow definition based solely on a dollar threshold.

Interestingly the definition was modified in 1997 since the threshold was significantly raised from \$5 to \$25 million in insured damage. This 5 fold increase reflects predominantly higher vulnerability, and to lesser extent enhanced insurance penetration and inflation adjustments.

Insurance definitions

Qualitative and Quantitative

The Insurance Council of Australia (ICA) defines catastrophe events as “large natural or man-made disasters that cause a significant number of insurance claims in a region”.

However, no definition is offered on “significant numbers of insurance claims”. ICA assess each natural disaster event against 4 factors and determine if a catastrophe should be declared.

These factors include:

- i) Community impact,
- ii) Project claims volume (projected claims cost exceeding 50 million\$),
- iii) Predicted government response (activation of recovery taskforce),
- iv) Media impacts.

Some of these factors can be regarded as subjective.

Insurance definitions

Europe

Qualitative

In Germany, the term “catastrophe” is legally defined as “a state of necessity where life, health or the absolutely necessary supply for a great number of persons or important property values are endangered or substantially impaired. The term catastrophe has no specific meaning in relation to the compensation of damage (Magnus, 2006) .

No legislation

In Italy no organic legislation was ever enacted to cover the issue of natural catastrophes. Under Italian law catastrophes, whether man-made or natural, are generally treated from a legal standpoint just like any other event and thus follow the general rules outlined by the legal system for events causing damage to persons or things (Monti and Chiaves, 2006).

Europe

Solvency II Definitions

Solvency II Directive (2009/138/EC): Catastrophe risk is the risk of loss, or of adverse change in the value of insurance liabilities, resulting from significant uncertainty of pricing and provisioning assumptions related to extreme or exceptional events (ref p.53).

Solvency II Glossary (by CEA – Groupe Consultatif (2007)): Catastrophe risk is the risk that a single event, or series of events, of major magnitude, usually over a short period (often 72 hours), leads to a significant deviation in actual claims from the total expected claims.

The notion of catastrophe risk is per definition relative to the financial position of the individual insurer and any significance will need to be defined in mathematical terms. The exact definition of what constitutes a catastrophe hence varies per insurer.

Conclusions

- The definition of catastrophe is complicated and a unified concept for different disciplines and bodies is lacking. Catastrophes predate humans, but were by definition extremely rare events. Humans have increased the vulnerability and catastrophes are now more frequent
- Definition evolves through time
- A common definition is required for datasets for assisting research cat-modelling, disaster management studies and policymaking
- Modern technology introduces emerging threats (e.g. cyber-risk) that are excluded from traditional definitions of catastrophes; an update is probably required to embody these new threats
- The definition in the insurance industry also varies significantly involving both qualitative (e.g. Europe) and quantitative (e.g. US) interpretations. Qualitative definitions introduce more flexible, but some subjective criteria, whereas quantitative definitions introduce thresholds
- In Solvency II the exact definition of what constitutes a catastrophe is not defined quantitatively and hence varies per insurer

Open Issues

- Cyber-risks? Should they be incorporated in CatRisk?
- Following the subjective criteria of the catastrophe definition in Europe, should the EU introduce a quantitative threshold regarding the definition of catastrophe? (like the US?)
 - If yes which body would have the authority to decide on this?
 - If yes which criteria should be taken into account?
- What happens if a catastrophic event affecting several EU member states is classified differently in neighbouring countries?
- Is the declaration of catastrophe necessary for activating claims (e.g. in compulsory schemes? France?)

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