Tracking insurance industry exposures to CAT risks and quantifying insured and economic losses in the aftermath of disaster events: a comparative survey.

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EXECUTIVE SUMMARY

This paper surveys existing initiatives in the field of collection and dissemination of data on CAT risk exposures and losses arising out of disaster events, drawing comparative observations and conclusions.

The availability, accuracy and reliability of data and information on the social and economic impact of catastrophic ("CAT") events play a fundamental role in the design and implementation of efficient financial management strategies to cope with large-scale disaster risks. Notwithstanding the existence of several highly qualified initiatives, we observed a general lack of international consensus regarding good practices for collecting, elaborating and disseminating these data (especially with respect to the quantification of total economic losses, insured and uninsured), as well as a huge variability in definitions, methodologies, tools and sourcing. Certain geographical areas, including Asia, moreover, appear to be somehow neglected by current initiatives, especially those developed by the private (re)insurance sector. To improve the current situation we suggest the opportunity to consider the adoption of the following policy measures:

- The promotion of standardised definitions and terminology;
- The development of consistent relevance and classification criteria for disaster events, which would allow easier comparison of data and statistics;
- The development of a consistent methodology to collect and elaborate data on CAT risks and losses, which would lead to greater transparency and reliability;
- For very large-scale disaster events affecting large geographical areas, the establishment of an international platform that would allow the collection and dissemination of reliable data on the economic effects on a global scale;
- The coordinated involvement of governmental authorities in the process of collecting and disseminating information on total economic losses (insured and uninsured) caused by disaster events.

While these are very difficult tasks, the OECD could play a role in the standardisation and/or harmonisation process, thereby contributing, *inter alia*, to the establishment of impartial and reliable financial indexes, such as an international insurance industry-loss index that could be used to further develop the market for CAT-linked securities.

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1. Introduction

The availability, accuracy and reliability of data and information on the social and economic impact of catastrophic ("CAT") events play a fundamental role in the design and implementation of efficient financial management strategies to cope with large-scale disaster risks. The ability of domestic and international (re)insurance markets to absorb losses from catastrophes can be effectively evaluated and monitored only if data and information on losses and exposures are readily available.

This paper surveys existing initiatives in the field of collection and dissemination of data on CAT risk exposures and losses arising out of disaster events, drawing comparative observations and conclusions.

Notwithstanding the existence of several highly qualified initiatives – some of which have been promoted by or in the interest of the (re)insurance industry, while others under the auspices of non-profit international organisations – we observed a general lack of international consensus regarding good practices for collecting, elaborating and disseminating these data (especially with respect to the quantification of total economic losses, insured and uninsured), as well as a significant variability in definitions, methodologies, tools and sourcing. Certain geographical areas, including Asia, moreover, appear to be somehow neglected by current initiatives, especially those developed by the private (re)insurance sector, perhaps due to the relatively low level of insurance penetration.

In our view, the harmonisation of data collection and elaboration methodologies (e.g., insured values, insured losses, total economic losses, public expenditures for recovery and reconstruction) would support catastrophe risk management strategies and facilitate the expansion of insurance coverage worldwide. The development of an impartial, transparent and reliable international platform capable of promptly providing estimates of insured natural catastrophe losses across the globe could also facilitate the development of industry loss indices for use with CAT-linked securities, such as exchange-traded futures and options, Industry Loss Warrants (ILWs), CAT-bonds and CAT-swaps ([1]). The OECD could consider playing a role in this harmonisation process.

([1]) According to a recent Swiss Re's *Sigma* study, both (re)insurers and investors benefit when clearly defined and regularly updated indices are used in insurance-linked securities (ILS) and other risk-transfer instruments. A typical index-linked contract links payments to an index that tracks, or approximates, the development of insurance losses in a certain region. For investors, indices are often more transparent and easier to understand than individual insurance risks. In addition, index-based instruments may be standardised more easily, which lowers costs and could help create greater liquidity in insurance risk markets. See: Swiss Re *Sigma*, *The role of indices in transferring insurance risks to the capital markets*, n. 4/2009, August 2009. See also: OECD, *CAT-linked securities and capital markets* (draft report, forthcoming).

2. ISO's Property and Claims Service (PCS)

Property and Claims Service ("PCS") is a division of ISO, a wholly owned subsidiary of ISO Investment Holdings, Inc. which itself is a subsidiary of Insurance Services Office, Inc., a for-profit Delaware stock corporation that is the leading provider of information on property/casualty insurance, including statistical information, actuarial analyses, standardized policy language, and a variety of insurance rating and underwriting services in the United States ([2]).

PCS is the internationally recognized authority on insured property losses from catastrophes in the United States, Puerto Rico, and the U.S. Virgin Islands and it performs a variety of services including: weather monitoring, catastrophe identification, monitoring judicial decisions relating to property insurance issues, and monitoring proposed and actual regulations relating to property claims handling. PCS provides a series of bulletins, monthly previews, reports, and news to its subscribers concerning the foregoing information and other issues of interest to the property/casualty industry.

From its inception in 1984 PCS has maintained a program under which it designates and numbers sequentially as catastrophes various natural or man-made events and prepares estimates of total insured property damage believed to have been caused by each such event ([3]).

2.1 Definitions and classifications

a. Scope of datasets and estimates

All the data collected, elaborated and disseminated by PCS are related to property insured losses in the United States, Puerto Rico, and the U.S. Virgin Islands. As a result: ***a)*** the geographical scope of PCS's datasets is limited to U.S., Puerto Rico and U.S. Virgin Islands; ***b)*** PCS's estimates concern only insured property losses, as defined.

b. Definition and classification of catastrophes

As mentioned, PCS provides estimates of anticipated industrywide insured losses arising from catastrophes.

To this purpose, "**catastrophes**" are currently defined by PCS as events that:

- cause USD 25 million or more in direct insured losses to property <u>and</u>
- affect a significant number of policyholders and insurers.

([2]) See: http://www.iso.com/pcs/ (last visited 10 September 2009).

([3]) From 1949, a similar program was carried out by predecessor organisations.

The above mentioned monetary threshold was established in January 1997. Previous thresholds were USD 1 million (1949 to December 1982) and USD 5 million (1983 to December 1996).

Catastrophes are classified and divided by name into: fire – other, hurricane, utility service disruption, wind and thunderstorm, winter storm. The types of insured "perils" that have caused insured losses deemed catastrophic by PCS include, without limitation, tornadoes, hurricanes, storms, floods, ice and snow, freezing, wind, water damage, hail, earthquakes, fires, explosions, volcanic eruptions and civil disorders. Terrorism and workers compensation bodily injury are newly added perils.

c. Definition of insured property losses

For the purposes of the data collection activities performed by PCS, "**insured property losses**" are only those losses incurred in personal and commercial property lines of insurance covering: real property, building contents, time-element losses (business interruption and additional living expense), vehicles, boats and property insured under certain inland marine and specialty coverages.

PCS estimates also typically include amounts paid to insureds by state wind pools, joint underwriting associations and certain other residual market mechanisms.

PCS's estimates do not include uninsured property losses (e.g., uninsured publicly owned property and utilities), neither insured losses belonging to other lines of business (e.g., life insurance, liability insurance). The estimates also exclude: loss involving agriculture or aircraft; property insured under the national flood insurance program (NFIP) or certain specialty lines (such as ocean marine), and loss adjustment expenses.

2.2 Sources of data and methodology

a. Serial number of catastrophic events

When PCS estimates that a natural or man-made event within the United States, the U.S. Virgin Islands, or Puerto Rico is likely to cause USD 25 million or more in total insured property losses, as defined, and determines that such event is likely to affect a significant number of policyholders and property/casualty insurance companies, PCS identifies the event as a catastrophe and assigns it a *catastrophe serial number* ("PCS Identified Catastrophe").

The assigned serial number is generally released to subscribers within 24-48 hours after the occurrence of a PCS Identified Catastrophe. The designation of an official date(s) of occurrence of a PCS Identified Catastrophe is also a matter within

PCS' judgment and sole discretion ([4]). The PCS catastrophe serial number lets insurers track losses and reserves related to a single, discrete event. Under many reinsurance contracts, this number may be important for determining which losses will trigger reinsurance coverage.

As anticipated, in defining PCS Identified Catastrophes, PCS includes only those events judged to have occurred within the United States, the U.S. Virgin Islands, and Puerto Rico. Those states or territories, in PCS' judgment, that were affected by a PCS Identified Catastrophe are identified in the Catastrophe Bulletin released to subscribers. The designation of a geographic area or territories affected by a PCS Identified Catastrophe is also a matter within PCS' judgment and sole discretion ([5]). PCS also determines in its sole discretion whether various insured property losses occurring close in time to one another are to be considered the result of a single or multiple and separate PCS Identified Catastrophes ([6]). In determining whether one or more PCS Identified Catastrophes have occurred, PCS's staff members analyze the geographic and temporal proximity of the events; review meteorological, seismological and other scientific data concerning the event; and/or consider factors such as an inability on the part of field adjusters to distinguish the damage caused by the various events.

b. Estimates of insured property loss

PCS' methodology for estimating the insured property losses resulting from a PCS Identified Catastrophe is highly dependent on the exercise of the professional judgment of PCS's staff and varies significantly depending on the nature of the PCS Identified Catastrophe under consideration.

PCS generally combines two methods to develop the best estimate in the shortest possible time. First, PCS conducts confidential surveys of insurers, agents, adjusters, public officials, and others to gather data on claim volumes and amounts (to preserve the confidentiality of information reported by individual insurers, only industry-wide or other aggregated estimates are released). PCS analyzes the data and combines it with trend factors to determine a loss estimate. Second, ISO maintains a proprietary database (the National Insurance Risk Profile) containing information on the number and types of structures, by ZIP code, for every state in the country. Using that information, PCS can determine the number of insurable risks in a specific geographic area. Combined with survey information and with the

([4]) In making these judgments, PCS states that its staff may consider factors such as meteorological, seismological and/or other scientific data, as well as information provided by national and local authorities as it deems appropriate in the particular circumstances.

([5]) In making these judgments, PCS states that its staff may consider factors such as meteorological, seismological and/or other scientific data, as well as information provided by national and local authorities or insurance industry sources, as it deems appropriate in the particular circumstances.

([6]) In making this judgment with respect to hurricanes and tropical storms, PCS states that its staff typically consolidate insured property loss estimates by reference to the names assigned to such storms by the U.S. National Hurricane Center, considering all resultant insured property losses to have been caused by a single PCS Identified Catastrophe. In other cases, for instance when two separate weather fronts may cause insured property losses at or near the same time in the same geographic area, PCS' judgment may be more complex.

result of limited on-site inspections of the geographic areas where a PCS Identified Catastrophe has occurred, the structure data forms the basis for damage estimates.

All insurance companies and individual agents and adjusters that participate in PCS' surveys do so voluntarily. There is no industry, legal or contractual requirement that insurers, agents or adjusters participate in PCS data collection efforts. Moreover, PCS does not independently verify or audit the accuracy of reported loss data as part of its estimation methodology. Thus, there can be no assurance that the data provided to PCS has been, is or will be accurate, timely or complete. Furthermore, since PCS does not simply sum up the loss data reported by those it surveys, but instead applies subjective judgments to and makes extrapolations from the data it has gathered and considered in the exercise of its judgment, ISO and PCS do not guarantee that the PCS estimates have accurately reflected actual industry insured property losses in the past or will do so in the future.

PCS also recognises that since the scope of property/casualty coverage varies by insurance carrier, policy type, line of insurance, claims adjustment variation and also changes over time, there is a significant measure of imprecision and variability in determining whether any particular loss will be covered and thus should be included in overall estimations of insured property loss. As a result of such imprecision, variability and the exclusions described above, as well as the inherently judgmental nature of the estimating process, PCS estimates may be materially different from the actual insured property losses experienced by the industry.

In determining its estimate of insured property losses, PCS generally takes into account coverage limits, coinsurance, deductible clauses and other factors that may result in certain property losses not being eligible for insurance coverage. Estimates are provided separately for each line of business (e.g., personal property, commercial property, vehicle and workers compensation).

From an operational viewpoint, normally within two weeks after the occurrence of a PCS Identified Catastrophe, PCS compiles the loss estimates reported by participating insurers, and calculates and releases to subscribers a preliminary estimate of anticipated industry-wide insured losses ([7]).

If PCS considers it appropriate it may conduct additional surveys of property/casualty insurance companies from time to time concerning insured property losses resulting from a PCS Identified Catastrophe and, if PCS deems it appropriate in the exercise of its judgment, it may issue adjusted estimates. PCS generally resurveys PCS Identified Catastrophes that, based upon its preliminary estimate, appear to have caused more than USD 250 million of insured damage or that, because of their infrequency or other unusual characteristics, appear to PCS to warrant additional inquiry. Generally, PCS completes such resurvey estimates and

([7]) In certain relatively rare circumstances, PCS may prepare and release in advance of the Preliminary Estimate certain aggregate components of such Preliminary Estimate. For instance, it released the estimated total losses for Hurricane Andrew in the state of Florida some days before the overall Preliminary Estimate for that particular PCS Identified Catastrophe (which also included the state of Louisiana) was released.

releases the final data to subscribers within six months of the occurrence of a PCS Identified Catastrophe ([8]).

c. IsoNet PCS - Technical Info on Catastrophe and Insurance Losses

Preliminary and resurvey estimates are officially disseminated by PCS to subscribers via *ISOnet PCS*, an Internet service, with limited distribution by electronic mail or facsimile transmission. In addition to publishing preliminary estimates and resurvey estimates, PCS also releases to subscribers via *ISOnet PCS* a variety of textual reports, bulletins and updates regarding PCS Identified Catastrophes. ISO makes subscriptions to *ISOnet PCS* available to any organization or individual seeking such subscription at then current subscription rates. Certain of PCS' other electronic services are available only to insurance companies and certain other organizations and are not available to individuals or other non-insurance industry organizations.

Once the access is granted, clients can receive the followings:

- *Daily Severe Weather Summaries* — descriptions of severe weather plus current weather information, including conditions, forecasts, and satellite and radar maps;
- *Catastrophe Bulletins* — with information selectable by date, state, perils, or catastrophe serial number;
- *Storm and Event Tracking Reports* — providing the latest information on tropical storms and events on land;
- *Catastrophe News* — monthly and quarterly summaries of catastrophe losses, as well as periodic news bulletins on recent catastrophes and other issues affecting the insurance industry's response to catastrophes;
- *Catastrophe History Reporter* — a new PCS service that delivers five value-packed reports to help compare and analyse the effects of catastrophic events;
- *Claims Information Services*, including:
    - *PCS Help Bulletins* — guidelines and procedures for claims adjusters;
    - *Catastrophe Claims-Handling Laws & Regulations* — catastrophe-only information about state adjuster licensing laws, valued-policy laws, unfair claims practices acts, and other laws and regulations;
    - *Claims Digest* — summaries and analysis of court decisions pertaining to property claims management.

([8]) However, the resurvey process could last for a longer period in connection with certain PCS Identified Catastrophes where the amount and type of insured losses may be relatively more difficult to estimate or become known more slowly than usual. For example, PCS did not disseminate its final insured property loss estimate for the 1994 Northridge, California earthquake until approximately 20 months after the event.

d. CatCube and FlatCat Services

PCS maintains a database of information on catastrophe losses since 1949. Access to data in PCS's database are granted through "CatCube" and "FlatCat" subscription services.

FlatCat is only an alternate delivery method for PCS catastrophe data which gives the user the possibility to access the entire PCS catastrophe-history database.

CatCube catastrophe-history database is a web-based application that reportedly combines a wealth of information about catastrophes, offering to PCS clients a multidimensional approach to analyzing data on catastrophes in the United States since 1950. Information can be retrieved based on: catastrophe serial number, year of occurrence, state(s) affected, type of catastrophe, amount of loss (estimated payment, average payment, number of claims, and total dollars), type of estimate (preliminary, resurvey, or final).

This database appears to be the only source of U.S. insured-loss evaluations for catastrophic events. ISO's *CatCube* catastrophe-history database can be used for catastrophe planning, reinsurance purchase, resource allocation, and underwriting and marketing programs. For example, insurers and reinsurers can use the industry's loss data to help anticipate their specific catastrophic experience. Entities involved in securitizing risk can use the information to measure the effect of catastrophes by state or region and by peril or time period. Monetary estimates of insured property loss data contained in PCS databases are <u>not</u> adjusted for inflation.

e. Catastrophe Loss Index

It is worth noting that PCS estimates are widely accepted as triggers in many traded financial-market instruments, including exchange-traded futures and options, catastrophe bonds, catastrophe swaps, industry loss warrants (ILWs), and other catastrophe derivative instruments. PCS estimates are deemed to be recognized and highly regarded within the insurance industry as a valuable resource. Anyway, the index is calibrated only on PCS's geographical scope.

3. PERILS AG

PERILS AG (Pan-European Risk Insurance Linked Services) was founded in January 2009 and incorporated as a joint stock company in Zurich, Switzerland ([9]). The company is backed by a group of major insurance, reinsurance and intermediary companies ([10]), each with equal shareholding.

Starting from 2010, PERILS will offer two mains products:

- European industry exposure data and
- European industry loss estimates.

3.1 Definitions and classifications

a. Scope of datasets and estimates

All the data collected, elaborated and disseminated by PERILS are related to property insured losses in Europe. More precisely: ***a)*** the geographical scope of PERILS's datasets is currently limited to Belgium, Denmark, France, Germany, Ireland, Luxembourg, the Netherlands, Switzerland, and the United-Kingdom; ***b)*** PERILS' estimates concern only property windstorm losses.

Initially, PERILS will focus on European wind events for which total insured losses exceeded the threshold of EUR 200 million. Expansion into other geographies and insurance-relevant perils such as earthquake and flood are planned for the future.

PERILS exposure data are updated once a year. PERILS loss data are available six weeks after the event date and updated after three, six, and twelve months ([11]).

3.2 Sources of data and methodology

PERILS collects its data in a standardised format directly from insurance companies writing property business in Europe. Data are made anonymous on reception with no private information being kept. Data confidentiality is assured by means of a contract entered between the data provider (the insurance company) and PERILS and by a purpose-built IT infrastructure.

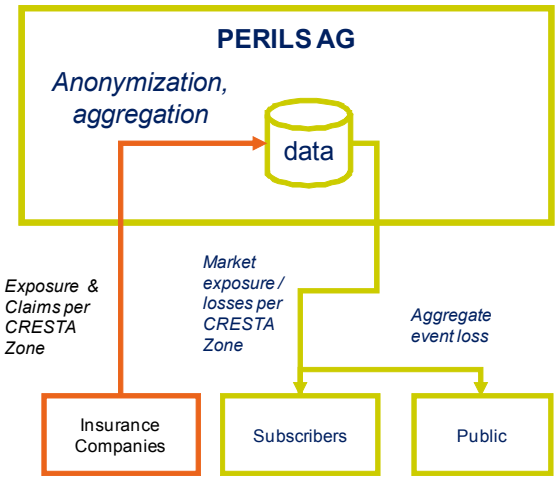
After compiling the provided exposure and loss data on a CRESTA (defined geographical zones for the uniform aggregation of natural catastrophe insurance

([9]) See: www.perils.org (last visited: 10 September 2009).
([10]) AXA, Allianz, Groupama, Guy Carpenter, Munich Re, Partner Re, Swiss Re, Zurich.

([11]) In May 2009, the company issued its loss estimate for Windstorm Klaus to illustrate its methodology and to allow future subscribers to better evaluate the benefits of PERILS.

data) level ([12]) and occupancy type basis, aggregates are extrapolated to market level using property market premiums. The latter are thereby disaggregated to CRESTA zones and occupancy types, using proxy data such as population and GDP distributions as well as patterns dynamically derived from the collected data.

According to PERILS, no reverse engineering of market data is possible, i.e. the data providing sources cannot be reconstructed and their anonymity is assured.



Source: Perils AG

It is generally recognised that the services provided by PERILS fulfill the needs of many stakeholders in the insurance industry.

First, independent event loss estimates for European windstorms may lead to increased capacity through Insurance Linked Securities (ILS) and Industry Loss Warranties (ILW). Industry loss triggered ILS are notably absent outside the US where, according to figures supplied by PERILS, they make up approximately 40% of all ILS Cat risk transactions. The primary reason for this hiatus was the lack of an entity providing independent loss estimates to the markets.

Second, PERILS not only provides event loss data, but also industry-wide exposure data (sums insured). By comparing this market exposure with a company's own portfolio, for example by modelling the identical stochastic windstorm event set over both portfolios, deviations can be mapped and the basis risk of an industry loss triggered transaction can be minimised by adjusting the trigger mechanism with different geographical or risk-type weightings.

([12]) The CRESTA (*Catastrophe Risk Evaluating and Standardizing Target Accumulations*) organisation was established by the insurance and reinsurance industry in 1977 as an independent body for the technical management of natural hazard coverage. CRESTA globally determines country-specific zones for the uniform aggregation of insurance data, mainly for property business. CRESTA's main goal is to establish a uniform and global system to transfer, electronically, aggregated exposure data for accumulation risk control and modelling among insurers and reinsurers. The data to aggregate typically relates to natural hazards, terror or other exposure data with an inherent accumulation risk. Today, the standards are generally accepted and applied throughout the insurance industry worldwide. See: www.cresta.org (last visited: 10 September 2009).

Third, both windstorm loss estimates and market exposure are available on a CRESTA zone basis (first two postal digits zones in most European countries) and per property occupancy type (residential, commercial, industrial, agricultural) and coverage type (building, content, business interruption). Comparing these two data sets after large events will prove an invaluable source for validating windstorm vulnerability functions in probabilistic CAT models.

Fourth, PERILS market exposure and event loss data allow for new market share measures. Traditionally, and in the absence of a better measuring stick, market shares in the insurance industry are measured using premiums. Premiums, however, may contain non-uniform price fluctuations which lead to distortions in year-on-year market share numbers. Market shares on a sums insured basis using the PERILS market exposure do not have this drawback. Likewise, market share considerations based on PERILS event losses are new measures which enable insurers and reinsurers to identify portfolio outliers and to adjust their portfolios accordingly. Both new measures are also very much in line with the risk-based focus of modern insurance regulation.

PERILS Market Exposure Data

Aggregated Sum Insured	Sum Insured Split	Timing	Availability
Per Country and CRESTA Zone	**Residential Property** • Buildings • Contents • Business Interruption **Commercial Property** • as above **Industrial Property** • as above **Agricultural Property** • as above	**Yearly updates**	**PERILS subscribers only**

PERILS Market Event Loss Data

Event Loss	Loss Split	Timing	Availability
Total of all covered Countries	**none**	**Available after six weeks of event** **Update after 3, 6, and 12 months**	**Public**
Per Country	**As above**	**As above**	**PERILS subscribers only**
Per CRESTA Zone	**Residential Property** • Buildings • Contents • Business Interruption **Commercial Property** • as above **Industrial Property** • as above **Agricultural Property** • as above	**Available after six months of event** , **Update after 12 months**	**PERILS subscribers only**

4. Swiss RE *Sigma*

Since 1970 Swiss Re's Economic Research & Consulting team collects data from various sources about natural catastrophes and man-made disasters ([13]). Each year an issue of the *Sigma* publication series presents data related to catastrophic risks. Most of the statistical content is standardized and graphs, figures and tables are updated yearly. The bulk of the publication is the collection of tables and data for the public, even though each issue contains a specific focus on topics of overwhelming importance for the reinsurance business. The analysis in this section is mainly based on the last 10 numbers of *Sigma* reports, related to the reporting years 1999-2008, unless otherwise indicated.

4.1 Definitions and classifications

a. Definition and classification of natural catastrophes

In the context of *Sigma* publications ([14]), the term **"natural catastrophe"** refers to an event caused by natural forces. Such an event generally results in a large number of individual losses involving many insurance policies. The scale of losses resulting from a catastrophe depends not only on the severity of the natural forces concerned, but also on the man-made factors, such as building design or the efficiency of disaster control in the afflicted region.

This definition seems more qualitative than quantitative, but if it shall be noted that catastrophes are considered in *Sigma* statistics only if they exceed some thresholds yearly updated. At present, *Sigma* requires at least one of the following for inclusion in the database: ≥20 deaths and/or, ≥50 injured and/or, ≥2000 homeless and/or, insured losses >USD 14 million (Marine), >USD 28 million (Aviation), >USD 35 million (all other losses), and/or total losses in excess of USD 70 million.

In *Sigma* studies, natural catastrophes are subdivided into the following categories: floods, storms, earthquakes, drought/forest fires/heat waves, cold waves/frost, hail, tsunami and other natural catastrophes.

b. Definition of total losses ('total damage' or 'economic loss')

Sigma defines "**total losses**" as all the financial losses directly attributable to a major event, i.e. damage to buildings, infrastructure, vehicles etc. The term also includes losses due to business interruption as a direct consequence of the property damage. In *Sigma* studies and databases, a figure identified as 'total damage' or 'economic loss' includes all damage, insured and uninsured. Total loss figures, however, do not include indirect financial losses – i.e. loss of earnings by suppliers

([13]) See: www.swissre.com (last visited: 10 September 2009).

([14]) See e.g., Swiss Re *Sigma* n. 2/2009, pp. 39-41.

due to disabled businesses, estimated shortfalls in gross domestic product and non-economic losses, such as loss of reputation or impaired quality of life.

Generally, total (or economic) losses are estimated and communicated in very different ways. As a result, they are not directly comparable and, according to Swiss Re's Economic Research & Consulting team, they should be seen only as an indication of the general order of magnitude. This notion is seldom used in *Sigma* reports, even if it gives an absolute magnitude of the natural catastrophe under analysis.

c. Definition of insured losses

"**Insured Losses**" refer to all insured losses except life insurance losses and liability losses. On the one hand, leaving aside liability losses allows a relatively swift assessment of the insurance year; on the other hand, however, it tends to understate the cost of man-made disasters.

The notion of **"insured losses**" is of prominent importance to quantify the impact of a natural catastrophe loss on the insurance industry. Insured losses are better estimated than total losses because they are directly affecting the financial exposure of the industry, so this is a book value rather than a statistical value.

The *Sigma* catastrophe database also includes flood damage covered by the National Flood Insurance Program (NFIP) in the US, provided that it fulfils the *Sigma* selection criteria.

d. Thresholds

Sigma has been publishing tables listing major losses since 1970. Thresholds with respect to casualties – the number of dead, missing, severely injured, homeless – also make it possible to tabulate events in regions where insurance penetration is below average.

As mentioned before, an event is included in the statistics if insured claims, total losses or the number of casualties exceeds a certain limit. Each year the claims threshold is adjusted for inflation. The yearly setting of selection criteria and threshold allows a better comprehension of charts, but not of the phenomena. Currently it is sufficient for a catastrophic event to exceed one of the thresholds (actuarial or casualty) to be included in the statistics.

e. Adjustment for inflation

Sigma converts all losses for the occurrence year not given in USD into USD using the end-of-year exchange rate. To account for inflation, these USD values are extrapolated using the US consumer price index to give current values. This can be illustrated by examining the insured property losses arising from the floods which occurred in the UK between 29 October and 10 November 2000:

- Insured loss at 2000 prices: USD 1045.7 m
- Insured loss at 2008 prices: USD 1307.6 m

Alternatively, were one to adjust the losses in the original currency (GBP) for inflation and then convert them to USD using the current exchange rate, one would end up with an insured loss at 2008 prices of USD 1624.2m, 24% more than the standard *Sigma* method. The reason for the difference is that the value of GBP rose by 33% against the USD in the period 2000-2008, i.e. more than the difference between the US (25%) and the UK (16.6%) over the same period.

f. Changes to published data

If changes to the loss amounts previously published events become known, *Sigma* takes these into accounts in its database. However these changes only become evident in *Sigma* publications when an event appears in the table of the 40 costliest insured losses or the 40 disasters with the most fatalities since 1970.

4.2 Sources of data and methodology

a. Sources of data

Information is collected from newspapers, direct insurance and reinsurance periodicals, specialist publications (in printed or electronic form), reports from insurers and reinsurers, PCS and online databases, although no primary source is suggested.

The description of the sources of information is quite general. The complete list of the sources used is not made publicly available, even though sometimes there are footnotes explaining the origin of data, particularly if referred to geological or geographic indexes.

In light of the above, we are induced to think that the main sources of information are Swiss Re's direct market contacts. A quick overview of *Sigma* shows that most of the elaborations and graphs are based on Swiss Re's own data.

b. Corporate databases: CatNET

CatNET is the company's online natural hazard information and mapping system provided to Swiss Re's clients. According to the company, the new *CatNET* functions and data facilitate the overview and assessment of natural hazard exposure for any location worldwide. *CatNET* can be used to prepare local, regional and cross-regional risk profiles: natural hazard information combined with Google maps and satellite imagery is also available for Swiss Re's clients.

The benefits from the use of this web-based service are remarkable. According to the website, it is possible to make swift hazard checks for regions which the professional is not familiar with, prepare maps and satellite images, import data, illustrate risk exposure with natural hazard data, consult and analyze country-specific insurance conditions, claims experience and natural disaster loss dimensions, etc.

5. Munich Re GEO Risks Research

Munich Re has been researching geoscientific phenomena, their risks and their loss potentials, since 1974.

The database *NatCatSERVICE,* developed by Munich Re's *Geo Risks Research* department collects information on natural disasters (excluding technological disasters) from 79 AD – date of the eruption of Vesuvius in Italy, as reported by Pliny the Younger – ([15]) and is one of the most important sources of information for insurance professionals. A light version of this database is freely accessible on the Internet ([16]).

Munich Re also publishes every year several issues of *Topics Geo – Natural Catastrophes: Analyses, assessments, positions*, differentiated by geographical area (e.g., Europe, US, Oceania, Australasia).

5.1 Definitions and classifications

a. Definition and classification of natural catastrophes

According to the *NatCatSERVICE* user's guide, the question of what constitutes a natural catastrophe depends on the position of the observer, with the result that there are many possible definitions. *NatCatSERVICE* uses the catastrophe classes listed below, ensuring that all the different requirements are accounted for. Events of regional significance, for instance, are identified as such, as opposed to others which count as major disasters in global terms too.

Disaster events are classified according to the following categories:

Category 1 *Small-scale loss event*: 1–9 deaths and/or minor and small-scale damage

Category 2 *Moderate loss event*: 10–19 deaths and/or damage to buildings and other property damage

Category 3 *Severe catastrophe*: More than 20 deaths and/or overall loss of more than USD 50 million.

Category 4 *Major catastrophe*: More than 100 deaths and/or overall loss of more than USD 200 million.

Category 5 *Devastating catastrophe*: More than 500 deaths and/or overall loss of more than USD 500 million.

([15]) More precisely, the Munich Re database contains all loss events from 1980 (for the U.S. and selected countries in Europe all loss events since 1970); retrospectively all great disasters since 1950 and, in addition, all major historical events starting from 79 AD.

([16]) See: http://www.munichre.com/en/ts/geo_risks/natcatservice/default.aspx (last visited: 10 September 2009).

Category 6 *Great natural catastrophe*: the affected region's ability to help itself is distinctly overtaxed, if one or more of the following factors are happened:

- Interregional or international assistance is necessary
- Thousands are killed
- Hundreds of thousands are made homeless
- Substantial overall losses
- Considerable insured losses

The long-term statistics and trend analyses are based on what Munich Re calls "*Great natural catastrophes*", i.e. **Category 6** events ([17]).

The *NatCatSERVICE* database distinguishes among the following types of event:

- *Geological catastrophes* (earthquakes, volcanic eruptions, land subsidence)
- *Storms* (e.g. tropical cyclones, winter storms, severe weather)
- *Floods* (storm tides, river floods, flash floods)
- *Droughts* (heat waves, forest fires)
- *Other occurrences* (e.g. cold spells, avalanches, snow pressure)

b. Definition of insured losses and total losses

We could not find working definitions of "**insured losses**" and "**total (overall) losses**" in the documents made publicly available by Munich Re, but our understanding is that the notion of "**insured losses**" covers losses sustained by the insurance industry in all property insurance classes.

c. Definition of fatalities

Fatalities are defined by Munich Re as: people dead as a result of natural catastrophes. Missing people and homeless are <u>not</u> included in this notion. However, the description of catastrophic events listed in the database usually gives an account of these missing numbers (for instance: "*more than 85,000 people were killed alone by Cyclone Nargis, which crossed Myanmar at the beginning of May. 54,000 people are still missing, whilst over a million were made homeless" – "a strong earthquake in the Chinese province of Sichuan – also in May – claimed the lives of at least 70,000 according to the authorities and a further 18,000 are still missing"*).

([17]) According to Munich Re, when great natural catastrophes are involved, historical events can still be classified reliably even decades after their occurrence.

5.2 Sources of data and methodology

a. Assessment methodology

Munich Re describes the methodology used to determine the loss amounts as follows:

"*Initial reports on losses and victims are usually available immediately after a natural catastrophe has occurred; but reliable figures and information normally take longer to emerge. Details on insured losses are usually reliable, as they stem from primary insurers, i.e. our clients, or from insurance associations. Assessing economic losses is incomparably more difficult, although rough indications are often published in the media at the time of the disaster or immediately afterwards. The scale of the losses is often overestimated by governments, public authorities, and relief organisations. This is because it is not unusual for the affected municipalities, regions, or countries to be granted more generous government or humanitarian aid in the light of statements about high loss amounts. Precise loss analyses and reports are only compiled after significant natural catastrophes. These particularly valuable reports are provided by government representatives, relief organisations, research facilities, and scientists. In the case of medium and especially small natural hazard events, the figures initially reported and published by the media are often those that prevail although at the time they were nothing more than a rough estimate. As soon as the extent of claims paid is known, the scale of the economic losses can be gauged accurately on the basis of the insurance density in the affected regions. There are fixed ratios of insured losses to overall losses for each type of event and country. The NatCatSERVICE database is based primarily on official reports and information on the claims that are paid. The entries are updated whenever new data become available. The most important facts are normally available within a few weeks, although occasionally it may take months or even years before final figures become known"* ([18]).

b. NatCatSERVICE database

There is a database entry for each loss event. It contains, in addition to the basic parameters (date of occurrence, type of event, and main areas affected), all other information of relevance, such as economic and insured losses as well as human losses (the number of people killed, injured, or homeless). Important scientific parameters such as wind forces, amounts of precipitation, and earthquake intensities are included in *NatCat* reports. Events are classified according to the categories listed above.

c. NATHAN (NATural Hazards Assessment Network)

NATHAN (*NATural Hazards Assessment Network*) is another source of elaboration of data. This is a web application for assessing natural catastrophe risks based on a '*"geographical underwriting" approach which uses geocoded portfolio*

([18]) NatCat*SERVICE* - A guide to the Munich Re database for natural catastrophes, pp. 12.

and loss data to perform highly precise spatial/geographic portfolio analyses' ([19]). From the public website it is possible to access to a light version of the application, without insurance-market statistics or information on insured losses and insurance zones (CRESTA).

NATHAN is composed of three modules:

1. "*Natural Hazard Maps*" that use the interactive world map to depict the precise distribution of natural hazards and their respective intensities
2. The "*Major Disasters*" module, which provides information on the recurrence intervals of natural catastrophes in defined areas and offers a variety of sorting options for generating clearly organised reports
3. The "*Country Profiles*" module, a detailed lexicon that provides a statistical overview of the geography, population, economy and natural-hazard situation of countries around the world and thus supports decision-making processes.

d. List of sources

Sources are listed in the *NatCatSERVICE* user manual ([20]). According to Munich Re, the reports of events are based on a large number of very different sources and are only entered in the *NatCatSERVICE* database after thorough review and verification.

([19]) http://www.munichre.com/en/ts/geo_risks/nathan/default.aspx (last visited: 10 September 2009).

([20]) Listed sources include: '*News agencies (Factiva/Dow Jones, dpa, AP, etc.); National insurance associations (ABI, GDV, Japan Rating Agency, etc.); Trade press and information services for the insurance industry (Lloyd's List, World Insurance Report, DYP letters, Property Claims Service, etc.); Press and media reports; Reports and expertises by the UN, EU, and other organisations (International Red Cross, World Health Organization, World Meteorological Organization, etc.); Data from scientific and academic sources (seismological, geophysical, meteorological institutes and facilities, data centres, universities, conferences, historical archives, etc.); Worldwide weather and warning services (National Hurricane Center, Tsunami Warning Center, Météo France, Deutscher Wetterdienst, Japan Meteorological Agency, etc.); clients in more than 150 countries and our subsidiaries, contact offices, branches, service companies, and liaison offices provide valuable information in the form of loss advices, loss reports, and descriptions of events'.* NatCat*SERVICE* - A guide to the Munich Re database for natural catastrophes, pp. 10-11.

6. Centre for Research on the Epidemiology of Disasters (CRED): EM-DAT

The *Emergency Disasters Data Base* (EM-DAT) managed by the *Centre for Research on the Epidemiology of Disasters* (CRED) at the Catholic University of Louvain, Belgium is a publicly accessible international database collecting information on natural and technological disasters ([21]).

6.1 Definitions and classifications

a. Definition and classification of natural catastrophes

Criteria for inclusion of natural disaster in the database are as follows:

- ≥ 10 people killed, and/or
- ≥ 100 people reported affected, and/or
- a declaration of a state of emergency, and/or
- a call for international assistance.

Natural disaster events are classified according to the following categories:

Geophysical - Events originating from solid earth: Earthquake, Volcano, Mass Movement (dry).

Meteorological - Events caused by shortlived/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.

b. Definition of people killed/injured/affected

The following definitions are offered by the EM-DAT glossary:

"**Killed**" means persons confirmed as dead <u>and</u> persons missing and presumed dead.

([21]) See: http://www.emdat.be/index.html (last visited: 10 September 2009).

"**Injured**" means people suffering from physical injuries, trauma or an illness requiring medical treatment as a direct result of a disaster.

"**Homeless**" means people needing immediate assistance for shelter.

"**Affected**" means people requiring immediate assistance during a period of emergency; it can also include displaced or evacuated people.

"**Total affected**" means the sum of injured, homeless, and affected.

c. Definition of estimated damage

According to the EM-DAT glossary, the economic impact of a disaster usually consists of direct (e.g., damage to infrastructure, crops, housing) and indirect (e.g., loss of revenues, unemployment, market destabilisation) consequences on the local economy. In EM-DAT estimated damages are given in USD ('000). For each disaster, the registered figure corresponds to the damage value at the moment of the event, i.e. figures are shown true to the year of the event.

6.2 Sources of data and methodology

The data collected in the EM-DAT database are mainly derived from the following sources: UN agencies (UNEP, OCHA, WFP, and FAO), US Government Agencies, official governmental sources, IFRC, research centres, Lloyd's, reinsurance sources, press, private (see *below*), although reportedly priority is given to UN agencies.

Events are entered on a country-level basis and information collected includes location, date, number of people killed/injured/affected, number homeless, and estimated damage costs. The database is searchable by country, disaster type, or timeframe.

Table of sources of EM-DAT database

Source Type	Source Information	Type of disasters covered
United Nations	OCHA IRIN WFP UNEP WMO WHO/OMS FAO	Natural disasters Natural and technological disasters (Africa) Droughts/Famine Natural and technological disasters Natural disasters Epidemics Droughts/Famine
National Governments	National Governments ADRC CDERA	Natural and technological disasters Natural disasters Natural disasters
US Governments	FEMA NOAA OFDA USGS Smithsonian DFO CDC	Natural disasters (America) Natural disasters Natural and technological disasters Earthquakes Volcanoes Floods, slides and windstorms Epidemics
NGO's	IFRC	
Inter-Governmental Organisations	World Bank	Major natural disasters
Reinsurance Companies	Lloyd Casualty Week SwissRe MünichRe	Natural and some major technological disasters Natural and technological disasters Major natural and technological disasters
Press	AFP	Natural and technological disasters
Others	AirDisaster Emerg.Manag. etc…	Air accidents Natural and technological disasters

7. ADRC: Global Disaster Identifier Number (GLIDE)

The *Global Disaster Identifier Number* (GLIDE) is a project initiated and maintained by the Asian Disaster Reduction Center (ADRC) in collaboration with the UN/ISDR, CRED, UNDP, IFRC, FAO, World Bank, OFDA/USAID, LA Red, and OCHA/ReliefWeb ([22]).

A GLIDE number, a globally common Unique ID code for disasters, 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.

7.1 Definitions and classifications

The same criteria for inclusion of natural disasters in the EM-DAT database apply. A GLIDE number was issued every week by EM-DAT at CRED for all new disaster events that meet the EM-DAT criteria from 2002-2003. Ways to cover disasters that fall out of EM-DAT criteria was being sought and may be provided in the future. From the beginning of 2004, "Automatic GLIDE Generator" begins to generate new GLIDE for all new disaster events.

7.2 Sources of data and methodology

The components of a GLIDE number consist of two letters to identify the disaster type (e.g. EQ – earthquake, TC – tropical cyclone, TS - tsunami); the year of the disaster; a six-digit, sequential disaster number; and the three-letter ISO code for country of occurrence. For example, the GLIDE number for Hurricane Katrina in the United States is: TC-2005-000144-USA, while the GLIDE number for the 2004 tsunami in Indonesia is: TS-2004-000147-IDN.

This number is posted by the above organizations on all their documents relating to that particular disaster and gradually other partners will include it in whatever information they generate. As information suppliers join in this initiative, documents and data pertaining to specific events may be easily retrieved from various sources, or linked together using the unique GLIDE numbers.

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 will include human and economic loss information where available. Information on economic losses is not always available, and there is no specific reference to insured losses.

([22]) See: http://www.glidenumber.net/ (last visited: 10 September 2009).

8. Comparative remarks

From this survey of existing initiatives aimed at the collection and dissemination of data on CAT risks exposures and damaging effects of disaster events we can draw a number of comparative observations.

- *First*, the purpose of the initiative clearly determines its main focus (for instance, humanitarian databases are more concerned with the number of fatalities and affected people, while insurance industry initiatives are more focused on industry exposures and insured losses);
- *Second*, the definitions and classification criteria used to collect and disseminate data on CAT losses greatly vary, giving rise to several discrepancies, as we shall discuss in more details below;
- *Third*, assessment methodologies often rely on high degrees of discretion and sources of data are not always disclosed to the public, which may generate a lack of transparency and confidence;
- *Fourth*, the evaluation of total economic losses appears to be an extremely difficult exercise, and none of the existing initiatives has developed a consistent methodology to perform this task, which in fact is extremely important in the context of the design and implementation of *ex ante* CAT risk management strategies at governmental level ([23]).
- *Fifth*, in a number of geographical areas, including Asia, there seem to be a lack of consistent efforts to collect and disseminate data on insurance industry exposures to CAT risks and on the economic impact of disaster events.

In order to better understand the issues that may be raised by different assessment methodologies, definitions and classifications, we shall now compare sample data provided by PCS, Swiss Re, Munich Re and EM-DAT and briefly investigate the effects of such discrepancies on the presentation of loss data and rankings.

Table 1 contains the data related to a sample of five US disasters with very high insured losses in the timeframe 1980-2008.

Table 2 contains the data of a sample of 10 natural disasters worldwide with very high fatalities in the timeframe 1980-2008.

The data used to draw the tables are extrapolated from Swiss Re's *Sigma* 2/2009, Munich Re Topics Geo 2008, EM-DAT database, PCS trial version of Cat Cube – Table '50 Worst US disasters' and additional data directly provided by PCS.

([23]) See: A. Monti, *Policy Approaches to the Financial Management of Large-Scale Disasters*, in OECD, Policy Issues in Insurance n°12: Financial Management of Large-Scale Catastrophes (2008)

TABLE 1 - Sample of 5 US natural disasters w/ high insured losses (1980-2008)

Ev#	Loss event	Region	Overall loss (1)			Insured Loss (1)			Fatalities			Ranking (3)			Dates (start)		
			PCS	Swiss Re	Munich Re	PCS	Swiss Re	Munich Re	PCS	Swiss Re	Munich Re (2)	PCS	Swiss Re	Munich Re	PCS	Swiss Re	Munich Re
1	Hurricane Katrina	USA	nc	nc	125.000	41.100	71.300	61.600	nc	1.836	1.322	1	1	1	nc	25/08/2005	25/08/2005
2	Earthquake	USA, Northridge	nc	nc	44.000	12.500	20.337	15.300	nc	61	61	3	4	4	nc	17/01/1994	17/01/1994
3	Hurricane Ike	USA, Caribbean	nc	nc	38.000	11.500	20.000	15.000	nc	136	168	4	5	5	nc	06/09/2008	06/09/2008
4	Hurricane Andrew	USA	nc	nc	26.500	15.500	24.552	17.000	nc	43	62	2	2	8	nc	23/08/1992	23/08/1992
5	Hurricane Ivan	USA, Caribbean	nc	nc	23.000	7.110	14.680	13.800	nc	124	125	7	6	10	15/09/2004	02/09/2004	07/09/2004

Source of data:
PCS, CatCube® Demo: The top 50 Catastrophes + data provided by PCS.
Swiss Re, Sigma no.2/2009, p. 37, Table 8: The 40 most costly insurance losses 1970-2008 (considered only loss events from 1980 onwards).
Munich Re, NatCatSERVICE® (as at January 2009): Natural disasters 1980-2008, 10 costliest natural disasters ordered by overall losses.

TABLE 2 - Sample of 10 natural disasters w/ high fatalities, worldwide (1980-2008)

Ev#	Loss event	Region	Overall loss (1)			Insured Loss (1)			Fatalities			Ranking			Dates (start)		
			EMDAT	Swiss Re	Munich Re	EMDAT	Swiss Re	Munich Re	EMDAT	Swiss Re	Munich Re (2)	EMDAT	Swiss Re	Munich Re	EMDAT	Swiss Re	Munich Re
1	Earthquake, Tsunami	South Asia	nc	nc	10.000	nc	2.280	1.000	182.097	220.000	220.000	1	1	1	27/12/2004	26/12/2004	26/12/2004
2	Cyclone, Storm Surge	Bangladesh	nc	nc	3.000	nc	3	100	138.866	138.000	139.000	-	3	2	29/04/1991	29/04/1991	29/04/1991
3	Earthquake	Pakistan, India	nc	nc	5.200	nc	0	5	73.338	73.300	88.000	3	5	3	08/10/2005	08/10/2005	08/10/2005
4	Cyclone Nargis	Myanmar	nc	nc	4.000	nc	0	0	138.366	138.373	84.500	-	2	4	02/05/2008	02/05/2008	02/05/2008
5	Heat wave	Europe	10.450 (4)	nc	13.800	nc	0	10	67895 (4)	35.000	70.000	-	7	5	Jul-Aug '03	July 2003	07-08 2003
6	Earthquake (aftershocks)	China, Sichuan	85.000	nc	85.000	nc	366	300	87.476	87.449	70.000	2	4	6	12/05/2008	12/05/2008	12/05/2008
7	Earthquake	Iran	8.000	nc	7.100	nc	190	100	40.000	40.000	40.000	4	6	7	21/06/1990	21/06/1990	21/06/1990
8	Flashflood, landslides	Venzuela	nc	nc	3.200	nc	284	220	30.000	10.000	30.000	-	15	8	15/12/1999	12/12/1999	08/12/1999
9	Earthquake	Iran	nc	nc	500	nc	0	19	26.796	26.271	26.200	6	8	9	23/12/2003	26/12/2003	26/12/2003
10	Earthquake	Armenia	14.000	nc	14.000	nc	0	0	25.000	25.000	25.000	9	9	10	07/12/1988	07/12/1988	07/12/1988

Source of data:
Swiss Re, Sigma no.2/2009, p. 38, Table 9: The 40 worst catastrophes in terms of victims 1970-2008 (considered only loss events from 1980 onwards and re-arranged ranking).
Munich Re, NatCatSERVICE® (as at January 2009): Natural disasters 1980-2008, 10 deadliest natural disasters.

Note:
(1) Data are expressed in USD mn
(2) Figures do not include missing people: e.g. Nargis 54.000, Sichuan 18.000
(3) Munich Re's ranking is based on overall losses instead of insured losses.
(4) Partial result obtained from an incomplete dataset.

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The discretional selection of a specific geographic area for the collection of data on disasters (also referred to as geo-referencing) constitutes a first explanation of the different estimates: in the case of PCS, for instance, this area is limited to the U.S., U.S. Virgin Islands and Puerto Rico.

When a catastrophe occurs, it is very difficult to identify the geographic area: for instance hurricanes may affect a specific state of the U.S., and go further affecting areas which are not included in the PCS range. Estimates would then only concern losses occurred in the PCS geographic area, excluding losses beyond such boundaries. This could entail divergences in the estimate of the loss caused by the same event, which is furthermore limited by the fact that complete and accurate total estimates for some disasters appear only after several months, sometimes years, and that the estimates of PCS are focused only on certain types of insured property losses.

Both Munich Re and Swiss Re base their U.S. estimates on PCS data for natural hazards occurred in the US area, but add other information and criteria to underpin their estimates. It is noteworthy that only Munich Re publicly disseminates data on overall losses.

Moreover, estimates of the insured losses related to the same catastrophic event may differ because of different definitions of what constitutes **"insured losses"**. Also the use of different methods to adjust estimates for inflation – or the lack of such an adjustment - can affect the comparability of insured loss estimates over time. Reported number of fatalities can differ as well. Figures may include only deaths, or also missing people, injured and homeless. The last two are included in humanitarian organizations' databases (EM-DAT and GLIDE), as their classifications are different from those used for insurance purposes.

Reported starting dates of catastrophes are important to estimate insurance losses. We note that in the case of Hurricane Ivan (see **Table 1**, record 5) there is disagreement on the starting date. Starting date is determined by newspapers, scientific and other sources on a discretionary basis.

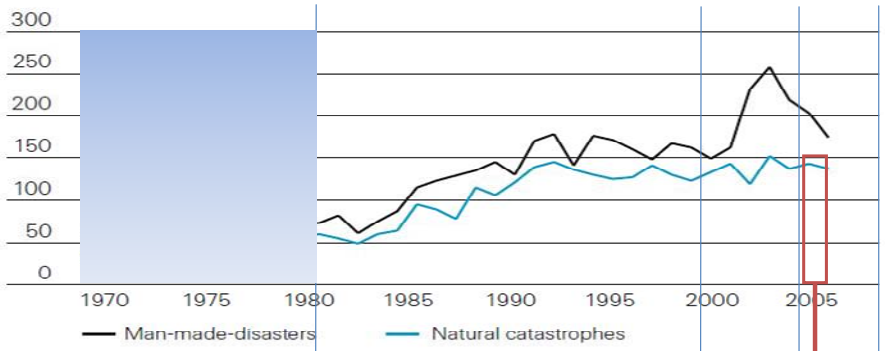
The **Tables** show a remarkable divergence in the representation of the same disaster event under different aspects. An interesting example is offered by the case of Hurricane Ivan (see again **Table 1**, record 5), with respect to which PCS's rating and estimate are determined by all the above quoted factors (e.g., geo-referencing, definitions, classifications, lack of adjustment for inflation, selection of starting date).

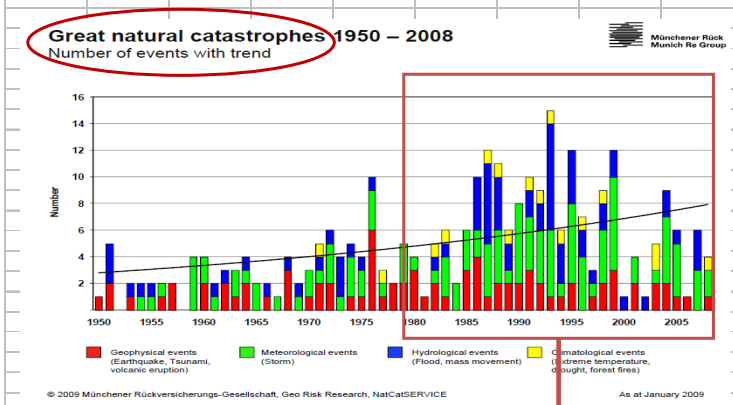
Another problem related to classification and estimates based on insured losses is that in many instances, due to the low level of insurance penetration in various regions, including many countries in South East Asia, catastrophes causing severe economic losses are not highlighted in the reports since most of such losses are uninsured. Uninsured overall losses appear only in rankings showing fatalities and sometimes in humanitarian databases, such as EM-DAT and GLIDE, but no consistent methodology for their assessment has been developed to date.

Table 3 (*below*) suggests a comparison between Munich Re's and Swiss Re's representation of the number of natural catastrophes in the timeframe 1980-2008.

TABLE 3 - Number of Catastrophes (1980-2008)

Number of events 1970-2008 Source: Swiss Re *sigma* no. 2/2009





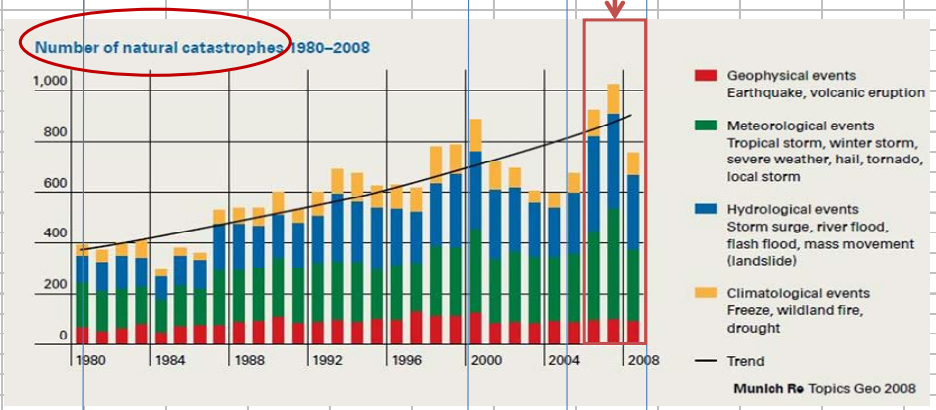


Chart at page 35

Great natural catastrophes are Category 6 catastrophes, according to Munich Re classification criteria

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This **Table** represents a comparison between Swiss Re's and Munich Re's definition of 'catastrophic event' on a chart showing the absolute number of catastrophic events occurred in the selected period (1980-2008). Notwithstanding the difficulty to compare two graphical representations without access to raw data, the gross result appears to be the same: upward sloping trends, but only apparently overlapping.

Swiss Re's chart divides perils in 'natural catastrophes' and 'man-made disasters', and represents them in a two-trend-shaped chart: a histogram could facilitate the comparison with Munich Re's data.

Munich Re's charts, on the other end, shows two hybrid-histograms in which each column is divided in colours. Each colour represents a particular type of peril. As the perils contemplated are the same, the reason for any divergence seems to be only the adoption of a different definition of catastrophe and the adoption of a different threshold to consider an event as 'catastrophic'.

Swiss Re's trend of Natural Catastrophes (blue line) is traced on a scale of 50, 100, 150, 200, 250, 300 whilst Munich Re's histogram of Natural Catastrophes is on a 200, 400, 600, 800, 1000 scale. The difference on the scale adopted shows that Swiss Re's criteria to define a 'catastrophic event' are fairly different from those adopted by Munich Re (thresholds, geographic area covered by insurance, definitions, etc.).

The timeframe considered by Swiss Re is 1970-2008 (even though it is difficult to define if the trend stops at 2008 simply by comparing the charts without data), whilst Munich Re's charts represents the 1950-2008 and the 1980-2008 situation. We should therefore not consider the first part of the Swiss Re's chart (blue shaded area). The trends are hard to compare: see e.g. the red squared areas representing reporting years 2006, 2007 and 2008. It is worth nothing that trends are hard to compare also between the two presented Munich Re's data elaboration: the definition of '*Great Natural Catastrophe*' differs from the simple '*Natural Catastrophe*'. This terminological distinction, adopted by Munich Re, leads to different trends (see the two charts in **Table 3**).

In light of the above, we can affirm that the adoption of non-homogeneous and discretional parameters in the choice of classifications, adjustments, geographic areas, etc. may greatly affect the presentation of data concerning natural disasters, giving rise to inconsistencies and difficulties in the comparison of different elaborations and statistics.

9. Conclusions

Based on the survey conducted and on the comparative observations illustrated above, to improve the current situation in terms of quality and reliability of data collection and dissemination initiatives, which in turn could facilitate better catastrophe risk management strategies, as well as the further development of effective disaster risk transfer and financing tools, we suggest the opportunity to consider the adoption of the following policy measures:

- The promotion of standardised definitions and terminology (e.g., insured losses, total economic losses);
- The development of consistent relevance and classification criteria for disaster events, which would allow easier comparison of data and statistics;
- The development of a consistent methodology to collect and elaborate data on CAT risks and losses, which would lead to greater transparency and reliability;
- For very large-scale disaster events affecting vast geographical areas, the establishment of an international platform that would allow the collection and dissemination of reliable data on the economic effects on a global scale (i.e., across political regions);
- The coordinated involvement of governmental authorities in the process of collecting and disseminating information on total economic losses (insured and uninsured) caused by disaster events.

While these are certainly very difficult tasks, the OECD could play a role in the standardisation and/or harmonisation of definitions and terminology, data collection processes involving public and private sector representatives, and methodologies to elaborate data on economic losses. It could also contribute to the establishment of impartial and reliable financial indexes, such as an international insurance industry-loss index that could be used to further develop the market for CAT-linked securities.