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A Glance into General Insurance: Some Characteristics of Natural Catastrophes and Management Thereof

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Looking back, 2017 was an inauspicious year for natural catastrophes globally. In the United States alone, there were three category 4+ hurricanes—Harvey, Irma and Maria (HIM)—making landfall, followed by a series of major fire events in Northern and Southern California. Outside the United States, much of the Caribbean was heavily affected by HIM, two powerful earthquakes struck Mexico, and devastating floods impacted Southeast Asia. These were not all.

The estimated total economic loss in 2017 from natural catastrophes was US$300 billion, of which only US$131 billion were insured losses.[1]

The goal of this article is to provide a rudimentary introduction on natural catastrophes: perils, characteristics and management of such risks. It is written in a way such that actuaries with a focus on life insurance can get a high-level understanding and can explore some aspects of further interest.

PERILS AND CHARACTERISTICS OF NATURAL CATASTROPHES

Natural catastrophes are disasters resulting from natural forces of the Earth. They can be broadly categorized into three perils: geophysical (earthquake, volcanic eruption), meteorological (hurricane, winter storm, thunderstorm and tornado) and other (fire, mass movement and flood).

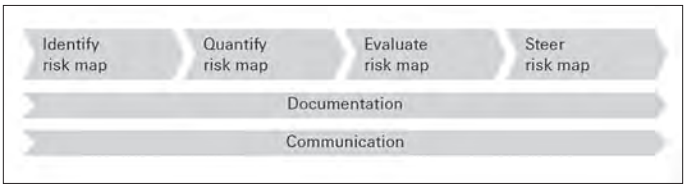
In some cases, when a single peril triggers other damage-inducing events and results in direct and indirect economic losses exceeding $50 billion, a disaster is known as mega-catastrophe. Clash losses often accompany a mega-catastrophe, impacting several areas of insurable risk simultaneously—direct losses related to property and life, and indirect losses related to liability, business interruption, workers' compensation and health.

HIM this year is a prime example. Once it made landfall on the Texas coast, Hurricane Harvey brought extreme rainfall to the densely populated Houston area, causing significant flood damage. Puerto Rico experienced extended power outages for up to two months after Hurricane Maria hit, resulting in significant liability and business interruption ramifications. Aggregate destruction from the three hurricanes is estimated at almost US$93 billion for insured loss, the bulk of the 2017 insured loss worldwide. Economic losses from the three events will be much higher, given much of the loss was uninsured.[2]

MANAGEMENT OF NATURAL CATASTROPHES

Key components of managing natural catastrophes as a critical part of risk management of general insurers (Figure 1)[3] can be characterized as follows:

Figure 1
Risk Management Process as Basis for Management of Natural Catastrophes

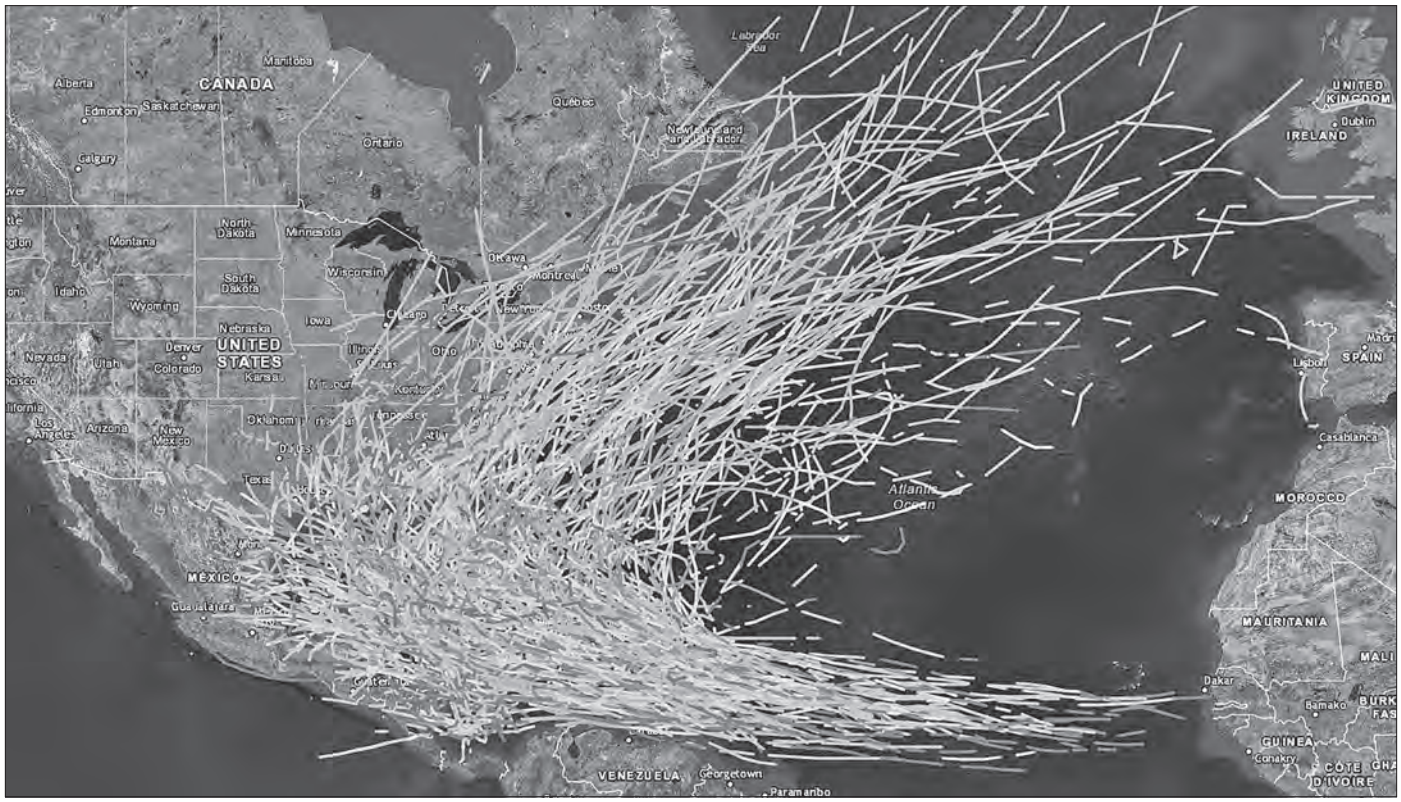


A pivotal aspect of **identifying** natural catastrophes is to enhance risk awareness, within the insurance industry and in the general public. Statistics continue to show that there is a substantial "protection gap," i.e., a major difference between the total economic loss and the insured loss. This typically triggers two consequences:

- In an event, only a portion will be covered by the insurance industry, which would have the global network to diversify local exposure to natural catastrophes. The remaining part falls back to the society, and ultimately the taxpayer.

- The protection gap offers potential for insurers to make the world more resilient. This potential could be addressed through regular insurance covers or through simpler, e.g., parametric, covers, or through a combination.

Figure 2
Historical Hurricane Tracks as Shown by NOAA (2016)



Quantification of impacts of natural catastrophes typically leverages models. RMS, AIR and EQECAT are some of the vendor tools that are used; some reinsurers use their own proprietary models. Figure 2 shows historic hurricane tracks for North America.

By ways of simulation, these models produce a probability distribution of hurricane losses of the insured portfolio in scope. This is then the quantification of the impacts of natural perils.

The next step is to **evaluate** the natural catastrophes and their impact, e.g., to financial strength. In the United States, financial strength is oftentimes measured by capital models of rating agencies like A.M. Best, Standard & Poor's, Fitch or Moody's; in other jurisdictions regulatory capital requirements may define the binding constraints. Earnings and earnings volatility, especially if they come with surprise potential, may have an impact to the franchise value of the general insurer; for listed companies this may then impact share prices, especially if it has unusual outliers in comparison to expectations or in comparison to peers.

Now, finally, it boils down to what to do with the exposure—that is, how to **steer** natural catastrophe exposure.

- **Risk could be excluded.** After 2004 and 2005, some general insurers decided not to write business in coastal areas to avoid too much hurricane exposure. Obviously for society as a whole, exclusion is not really an option.

- **Risk could be transferred**. People and municipalities leverage insurance. General insurers almost always leverage reinsurance to protect themselves. Reinsurance for general insurers works like insurance for policyholders. Since the mid-1980s capital market investors also offer protection against natural catastrophes (so called "cat bonds").

- **Diversifying risks** also plays a substantial role. Insurers may be able to diversify across client segments (personal lines,

commercial), regions (ZIP codes, states, areas, countries and continents), or perils and exposures (e.g., earthquake California and windstorm Europe).

- Complementing the above items, **holding capital** is also a tool to manage exposures to natural catastrophes; rating agencies and regulators encourage reasonable capital adequacy and address exposure to natural catastrophes specifically.[4]

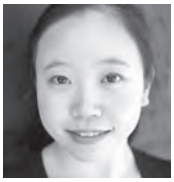
Typically it is about a smart combination of risk transfer and risk financing.

CLOSING REMARKS

Natural catastrophes are a major threat for societies. Management of natural catastrophes contributes to making our world more resilient. General insurers are a pivotal component in enhancing transparency of exposure, allocating costs for exposure in a risk-adjusted way, and providing peace of mind—plus providing protection in case a disaster strikes.

Understanding and modeling natural catastrophes is a very rich field for mathematicians and actuaries around the globe. Management of natural catastrophe exposure for general insurers in turn is pivotal in the context of capital adequacy and sustainability as well as economic capital modeling and earnings volatility.

And our understanding is probably just at the beginning. Hence, we are looking forward to shaping and enhancing our understanding further. ■



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ENDNOTES

1 Swiss Re. Preliminary sigma estimates for 2017: Global insured losses of USD 136 billion are third highest on sigma records. *SwissRe.com*, Dec. 20, 2017, *http://www.swissre.com/media/news_releases/nr20171220_sigma_estimates.html* (accessed Dec. 20, 2017).

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3 See Liebwein (2000), p. 25.

4 See stochastic capital requirements for, e.g., A.M. Best (2016). See also the upcoming changes of U.S. risk-based capital (RBC) in Brown & Garber (2017).

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