Section 2: Natural perils in the insurance context

Estimated time: 20 min

Contents

Learning objectives

- Specify the geographic hotspots and the characteristics of perils of interest in the re/insurance industry
- Explain the main differences between primary perils, secondary perils, and the sub-peril effects of primary perils in the context of re/insurance
- Discuss the Nat Cat coverage in key markets

Classification of Natural Perils

Natural perils are defined as natural processes or phenomena that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage, as defined by the United Nations Office for Disaster Risk Reduction (UNDRR, 2020). Depending on their underlying natural causes, natural perils are separated into two broad categories: weather-related and geophysical perils.

Weather-related perils include floods, storms and storm-related sub-perils, wildfires, droughts, heat /cold waves, blizzards. Storms can be further separated into a) tropical cyclones b) extratropical cyclones and c) severe convective storms.

Geophysical perils include earthquakes, mass movement processes including landslides and avalanches, volcanic eruptions, tsunamis from tectonics and landslides, subsidence, etc.

In the re/insurance context these perils are separated into two main groups.

Table 1: Natural perils separated into primary and secondary perils adapted from (Sigma 2, 2019)

Category	Definition	Examples
Primary perils	Peak-peril scenarios with known severe loss potential for the insurance industry. Traditionally well-monitored risks in developed re/insurance markets. Losses from these scenarios can arise from several effects (sub-perils) Primary effect: typically, main and best understood driver of loss.	Tropical cyclones, earthquakes, winter storms in Europe. Wind for windstorm, ground shaking for earthquake
Secondary perils	Independent secondary perils. Often not modelled and receive little monitoring by the industry. Secondary effects: other effects contributing to the loss, not always easy to separate from primary effect, often not well understood or modelled. For an individual catastrophe, loss contribution from secondary effects can be significant.	River floods, torrential rainfall, landslides, thunderstorms, winter storms outside of Europe, snow and ice storms, drought and wildfires outbreaks. Hurricane- or typhoon-induced rainfall, storm surges, tsunamis, liquification and fire following earthquake.

Most relevant natural catastrophes

The most relevant natural catastrophes for the re/insurance industry are listed below. More details about them can be found in later sections.

Earthquakes

Earthquakes are among the most destructive natural phenomena and can lead to large economic and insured losses. For example, in March 2011, Japan was hit by a massive earthquake and tsunami, which caused widespread devastation with at least USD 210 bn in economic and insured losses of USD (2011 USD) 35bn (Sigma 2, 2020) The series of 4 major earthquakes in 2010 and 2011 in Christchurch (New Zealand) added USD 31bn in insured losses and more than USD 40bn (2011 USD) in economic losses (ICNZ, 2020).

Figure 1: Effects of an earthquake

Japan is considered the 2nd largest insurance market in the world after the USA. However, in terms of insurance penetration, these two markets are well behind markets such as New Zealand. The table below compares the insurance penetration for residential and commercial sectors in Japan and New Zealand.

Table 2- Comparison of the Earthquake insurance penetration rates as the percentage of total risks in Japan and New Zealand for different sectors (adapted from (Axco, 2020).

Market	Residential	Commercial	Scope
Japan	50-60%	8-18%	The earthquake penetration is low but on a steady rising trend.
New Zealand	90%	80-90%	Homeowners: Nat Cat cover is compulsory with every fire policy (EQC Act) therefore the high penetration.

Tropical cyclones

Tropical cyclones are some of the most destructive weather-related perils and are characterised by strong wind speeds up to 320 km/h. As an example, in 2005, Hurricane

Katrina struck the US, inflicting significant loss of life and devastating damage. Hurricane Katrina remains a watershed event for re/insurance as the most expensive natural catastrophe for the global insurance industry to date. Hurricane Katrina had a remarkable impact on the reinsurance and insurance industries. Private insurance companies paid USD 41bn (2005 USD) on 1.7 million claims for residential, commercial and automotive damage in the US. On top of this, insurers paid another USD 8bn for damages to offshore energy facilities in the Gulf of Mexico.

These losses, together with USD 16.3bn in publicly insured losses to the Federal Emergency Management Agency's National Flood Insurance Program (FEMA NFIP), brought Katrina's total insured loss to more than 65bn (2005 USD). Accounting for inflation, this would be equivalent to nearly USD 86bn (2020 USD). The total economic damage from Katrina is estimated to be upward of USD 160bn (2020 USD) (SRI, 2020).

In 2017, three devastating hurricanes (Harvey, Irma, and, Maria) in the North Atlantic resulted in estimated economic damages of USD 220bn, of which USD 92bn were insured (Sigma 3, 2018).

Figure 2: Tropical cyclone, Source: (NOAA, 2020)

The scope of insurance coverage and conditions in key markets including the USA, Japan, and Australia are summarised in the table below.

Table 3- Windstorm insurance penetrations and coverage scopes in key markets adapted from (Axco, 2020).

Market	Residential	Commercial	Scope
USA	90-100%	60-70%	Standard homeowners and business property insurance policies typically provide coverage for hurricane damage from wind and wind driven rain, but do not cover losses from floods including storm surges.
Australia	80%	90%	The wind cover is typically provided under a regular property policy on a full value basis
Japan	60%	60%	The windstorm cover is automatically provided for residential and commercial risks

Extratropical cyclones

Extratropical Cyclones (ETCs) are defined as large-scale low-pressure systems that occur in the mid-latitudes (roughly between 40°-70° latitude). ETCs develop year-round but are

strongest during the winter season. The term winter storm, or winter windstorm, is also commonly used to describe ETCs. The most expensive extratropical storms to date were Lothar and Martin in 1999, which resulted in combined economic losses of approximately EUR 21bn (1999 EUR), of which more than 50% were insured losses. Before Lothar and Martin swept across Europe, cyclone Daria in 1990 was the most expensive storm to date. Lothar is not only one of the world's most expensive storms in the last 50 years with EUR 15bn (1999 EUR) economic damage but is also classified as the most severe storm in Europe since 1876 and caused the most forest damage ever recorded in Central Europe (SRG, 2019).

Figure 3: Extratropical cyclone, Source: (NASA, 2014)

The coverage and the scope of cover for winter storm in some key markets are summarized in the table below.

Table 4- Winter storm insurance penetrations and coverage scopes in key markets, adapted from (Axco, 2020).

Market	Residential	Commercial	Scope
Germany	>90%	70-80%	Coverage is included under the property fire policy at the option of the insured, although it is generally offered in combination. Consequently, the insurance penetration can be lower than in markets with automatic windstorm inclusion. (In this respect the German market differs from other European markets, where windstorm coverage follows the Fire insurance penetration).
France	100%	100%	- Property insurers in France are obliged to provide storm coverage (including hail and snow load), if fire is insured. - In principle, free to offer coverage for other natural perils, but for coverage for events, officially declared to be Nat Cat, is obligatory.
UK	95%	95%	- All UK is exposed. - WS is included in all residential and most commercial policies.

Floods

The most common natural catastrophes are floods, and although the economic damage is high compared to that caused by earthquakes and windstorms, insured losses remain smaller. As an example, in 2011, Thailand experienced its worst flooding in years with approximately 48 bn USD in economic damage. Insured losses, however, only amounted to 16 bn USD (SRI, 2015).

Figure 4: Flood

The coverage and the scope of cover for flood in some key markets are summarised in the table below.

Table 5- Flood insurance penetrations and coverage scopes in key markets adapted from (Axco, 2020).

Market	Residential	Commercial	Scope
France	100%	100%	French Cat Nat scheme, a national system of damage compensation based on an insurance super-fund.
UK	95%	95%	All homeowner policies, in accordance with the "Statement of Principles", and most commercial policies are extended to include flood. A non-profit Flood Re scheme was launched in 2016 which is financed by insurers, to cap domestic flood insurance prices and keeping insurance premiums affordable for households in high-risk areas.
Australia	70-90%	40%	Level of flood protection varies from storm water damage coverage only to full flood coverage; 90% of RES policies include it on full-value basis (ICA , 2013).
USA	10-25%	30%	The flood insurance take up rate varies by state and most flood insurance is sold through FEMA's NFIP. There are more than 5 million policyholders nationwide and the NFIP is the nation's largest single-line insurance program providing nearly $1.3 trillion in coverage against flood (FEMA, 2020).

Germany	45%	25%	Flood risk is excluded from the standard industrial, commercial and homeowner policies. Offered as an extension together with EQ and other Nat Cat risks. FL cover is common under buildings policies in the state of Baden-Wuerttemberg, with high penetration rate.

Severe Convective Storms

Severe convective storms (SCS), or strong thunderstorms, are short-lived violent weather events that are caused by a localised rapid ascent of moist air to cooler regions, leading to the formation of towering cumulus clouds. Tornadoes as a specific sub-peril of SCS are particularly frequent and destructive in the south and mid-west of the United States but can also be observed in other countries. Tornadoes can lead to local wind speeds of up to 400-450 km/h. Tornadoes are products of severe convective storms, which may also lead to heavy precipitation, hail, and straight-line winds (also known as derechos). While severe tornadoes are rare, hail is a frequent and significant contributor to insured weather-related losses. Global convective-storm-related damage topped USD30 billion (2020 USD) for the tenth consecutive year from 2010-2019 (AON, 2019).

Figure 5: Severe Convective Storm

Wildfires

Wildfires pose a serious threat to communities and human lives in many countries and are gaining importance in annual economic and insured losses.

Figure 6: Wildfire

2020 is considered as one of the costliest wildfire years on record with devastating fires in the US and Australia. In the US states of California, Oregon and Washington State, more than 800 wildfires burned close to 6 million acres, destroying thousands of structures and triggering billions in insured claims. These severe losses followed record-breaking wildfire seasons in 2017 and 2018, see also Figure 7.

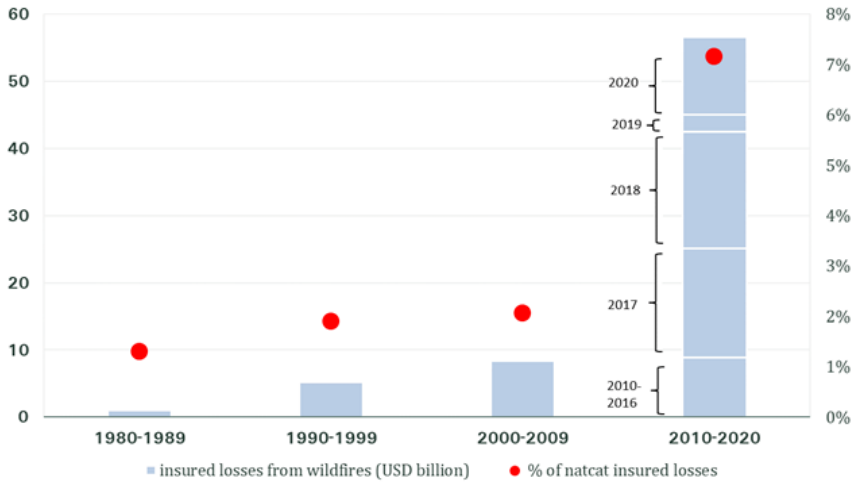

Figure 7- Global wildfire insured losses 1980-2020, Source: (Sigma database, 2021)

Other Natural Perils

The previously discussed perils included the most common and material perils for the re/insurance industry. However, other natural perils such as volcanic eruptions, landslides, subsidence, snow, freezes, blizzards, avalanches, etc. can lead to significant losses and should be considered in risk assessments if appropriate.

Figure 8: Volcano

Secondary perils gaining visibility

Primary perils are traditionally understood as those that have the greatest loss potential. However, recent years showed a strong increase in losses from secondary perils up to or even slightly above loss levels from primary perils. Losses from secondary perils have been on the rise due to rapid socio-economic development and urbanization trends in areas exposed to severe weather, as well as climate change. This trend is expected to continue. Figure 9 presents the development of annual Nat Cat insured losses from 1970 to 2020

for secondary perils, adjusted to 2020 prices, and separated into the contributions from various perils.

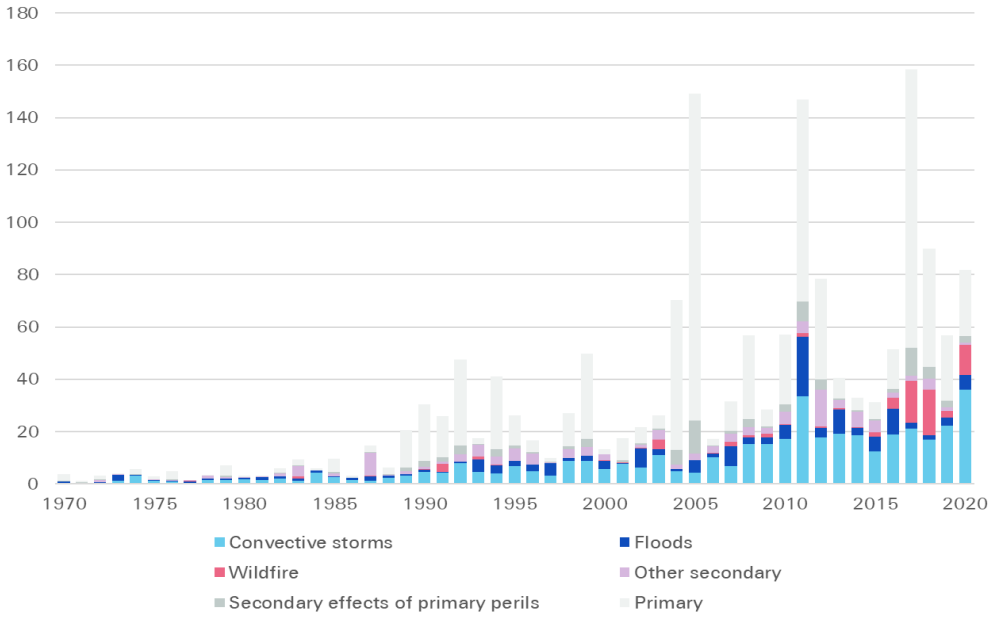

Figure 9: Nat Cat insured losses for secondary perils in billions USD from 1970-2020 (2020 USD). Source: (Sigma database, 2021)

North America has the highest share of the insured losses from secondary perils amongst all other regions globally from 1970-2020, see Figure 10.

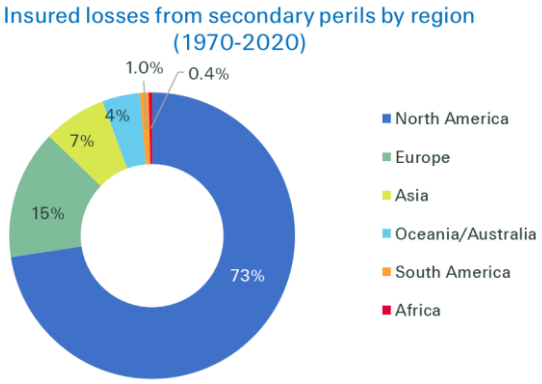

Figure 10-Insured losses from secondary perils by regions, Source: (Sigma database, 2021)

Nat Cat insurability principles

To insure Nat Cat risks in a sustainable manner, certain principles of insurability need to be fulfilled. However, covers are often written for risks that are theoretically uninsurable. Such covers are usually satisfactory only for a short period of time.

The experience gained with existing Nat Cat insurance solutions in several countries has shown that comprehensive Nat Cat insurance only works if the principles for insurability are in place. To succeed in forming an efficient risk community, policyholders must uphold the five basic principles of insurability.

Mutuality

Many people who are at risk must combine to form a risk community. The community should be large enough to allow it to even pay substantial losses efficiently, without great financial pain.

Click here to get more information about Mutuality.

Assessability

The expected loss burden must be assessable. This is an absolute requirement for pricing the risk in a way that is fair to all parties.

Click here to get more information about Assessability

Economic viability

The community organised by the insured persons must be able to cover its future, loss-related financial needs on a planned basis.

Click here to get more information about Economic viability.

Randomness

The time at which the insured event occurs must not be predictable, and the occurrence itself must be independent of the will of the insured.

Click here to get more information about Randomness.

Similarity of threat

The insured community must be exposed to the same threat, and the occurrence of the anticipated event must rise to the need for funds in the same way for all concerned.

Click here to get more information about Similarity of threat.

Section test

1. The occurrence of an insured event is independent of the will of the insured. This insurability principle is termed as:
    A. Randomness
    B. Economic Viability
    C. Similarity of threats

2. A large number of people who are at risk must combine to form a risk community. This insurability principle is termed as:
    A. Assessability
    B. Mutuality
    C. Similarity of threat
3. Which of the following perils are defined as primary perils? (Multiple answers are possible)
    A. Tsunami
    B. Winter Storm Europe
    C. Wildfire
    D. Tropical Cyclone
    E. Flood
    F. Earthquake
    G. Severe Convective Storm
4. Which of the following ones are not among the perils with the largest loss potential? (Multiple answers are possible.)
    A. Winter Storm Europe
    B. Blizzard
    C. Tropical Cyclone
    D. Severe Convective Storm
    E. Avalanche

Correct Answers;

1- A
2- B
3- B,D,F
4- B,E

References

AON, 2019. *Weather, Climate, and Catastrophe insight ,* s.l.: s.n.

Axco, 2020. *Non-Life Insurance Market Reports,* s.l.: s.n.

FEMA, 2020. *Federal Emergency Management Agency: Flood Insurance.* [Online]
Available at: https://www.fema.gov/flood-insurance
[Accessed 2020].

ICA , 2013. *Insurance Council Australia.* [Online]
Available at: http://www.insurancecouncil.com.au/industry-statistics-data/flood-cover
[Accessed 2020].

ICNZ, 2020. *Insurance Council of New Zealand.* [Online]
Available at: https://www.icnz.org.nz/natural-disasters/canterbury-earthquakes/#:~:text=One%20of%20the%20world's%20largest,of%20Christchurch%20and%20surrounding%20towns.&text=More%20than%20650%2C000%20insurance%20claims,a%20result%20of%20the%20quakes.
[Accessed 2020].

LWS, 2001. *Principal of traditional non-life reinsurance ,* s.l.: s.n.

NASA, 2014. *NASA earth observatory.* [Online]
Available at: https://earthobservatory.nasa.gov/images/83127/extratropical-cyclone-over-the-united-kingdom
[Accessed 2020].

NOAA, 2020. *National Oceanic and Atmospheric Administration.* [Online]
Available at: https://www.noaa.gov/education/resource-collections/weather-atmosphere/hurricanes
[Accessed 2020].

Sigma 2, 2019. *Secondary natural catastrophe risks on the front line,* s.l.: Swiss Re Institute.

Sigma 2, 2020. *Natural catastrophes in times of economic accumulation and climate change,* s.l.: s.n.

Sigma 3, 2018. *World insurance in 2017: solid, but mature life markets weigh on growth,* s.l.: Swiss Re Institute.

Sigma database, 2021. *Sigma Research database ,* s.l.: Swiss Re.

SRG, 2019. *Swiss Re Group Winter storms in Europe.* [Online]
Available at: https://www.swissre.com/risk-knowledge/mitigating-climate-risk/winter-storms-in-europe/storms-lothar-martin-wreak-havoc-across-europe.html#:~:text=Lothar%20resulted%20in%20economic%20losses,was%20covered%20by%20insurance%20companies.
[Accessed 2020].

721BFB9344FD%7d&file=AC_slides_for_Jerome.pptx&action=default&DefaultItemOpen=1
[Accessed 2020].

SRI, 2015. *Risky Cities: Bangkok,* s.l.: Swiss Re Institute.

SRI, 2020. *15 years after Katrina: Would we be prepared today?,* s.l.: Swiss Re Institute.

UNDRR, 2020. *United Nations Office for Desaster Risk Reduction.* [Online]
Available at: https://www.undrr.org/