New space economy: opportunities and applications in (re)insurance

New Space Economy

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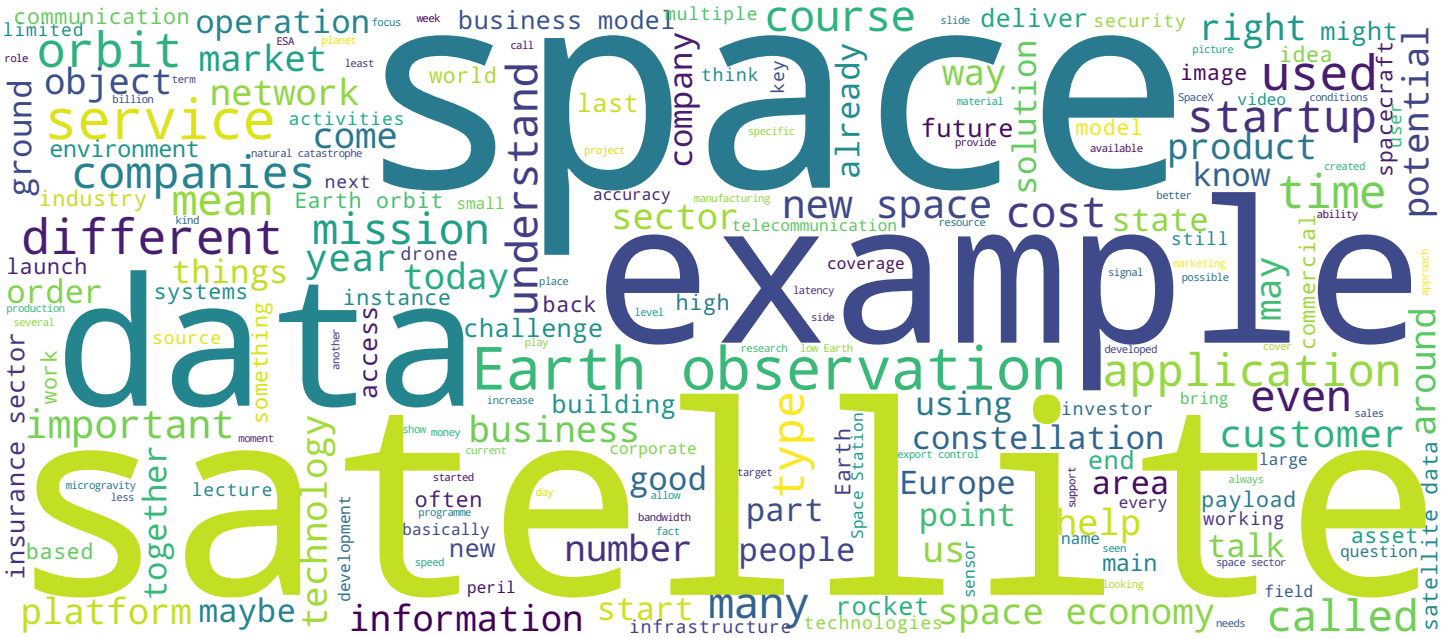

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Introduction

- Speakers
  - Rogier de Jong
    - PhD in Environmental Remote Sensing
    - Natural Hazard Specialist at Swiss Re Institute
  - Irene Garonna
    - PhD in Earth Observation
    - Property Solutions Manager at Swiss Re
- Learning goal:
  - Get familiar with key applications of EO for the insurance sector, both in terms of risk assessment and new products.

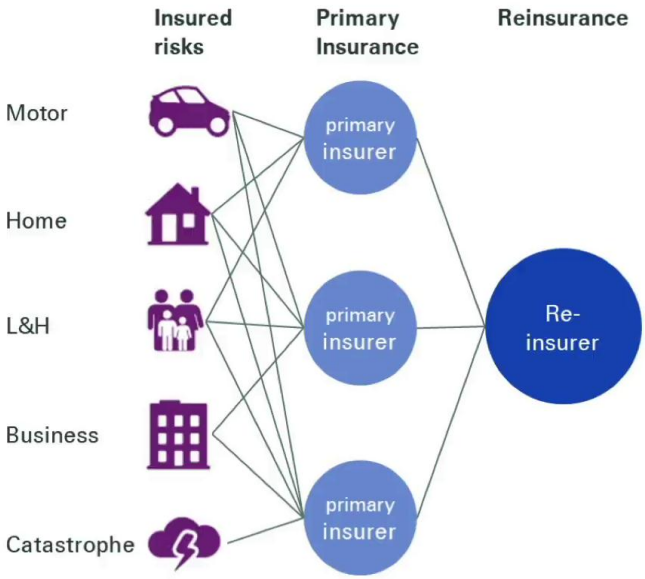
Hi, I'm Irene Garonna, and with my colleague, Rogier de Jong, we will spend the next 10 minutes or so talking about applications of the new space economy to insurance.

Notes

Summary

0m 05s

The (re)insurance sector at a glance



There is a growing number of sectors, companies, business models, and stakeholders that are involved in the insurance supply chain. Among the main players are primary insurers, brokers, but also agents, bancassurance, and reinsurers. Altogether, they play an important and widely recognised social function: that of enabling individuals, communities and companies to prepare for and recover from sudden misfortune, thereby increasing resilience in our society and promoting safer behaviours. This sector as a whole ultimately depends on the ability of these companies to quantify price, mitigate and manage risk.

Notes

Summary

0m 15s

Examples of EO applications in re/insurance

Example

Natural catastrophe modelling	Event impact assessment and response	New product design
• Generation of risk maps for various hazards • View on historic losses • Input for probabilistic models	• event monitoring, identification of most impacted areas • loss estimation	• parametric insurance (e.g. for flood, agriculture)

Large and growing potential: EO provides information across the insurance value chain.

So how does the new space economy affect this sector? For the space sector, the new space economy has created opportunities for greater efficiency upstream, and multiple and more customised applications downstream. Among these applications, those in insurance have had a promising impact on efficiency, profitability, and customer satisfaction. Earth observation already has countless applications that have been exploited, and even more that await a more pervasive use from the insurance sector. In recent years, the growing number of Earth-observing satellites in service have made data more accessible and more affordable, and this has in turn accelerated advances in some of the typical applications of Earth observation in the industry. In this presentation, we focus on three main application categories for Earth observation imagery along the insurance value chain: natural catastrophe modelling, event impact assessment and response, and the creation of new insurance products. Let us consider an example of each of these applications, starting with natural catastrophe modelling. And for this, I hand over to Rogier.

Notes

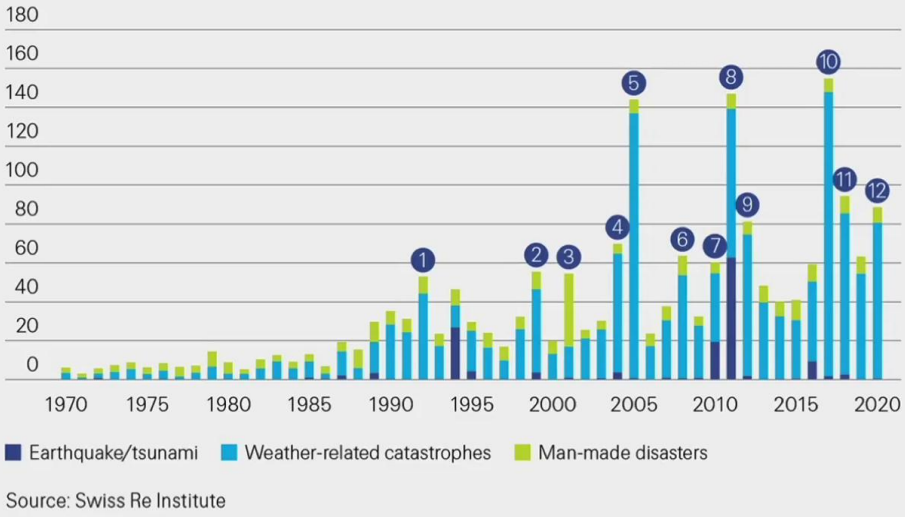
Summary

1m 03s

Natural Catastrophe Losses

Figure 15
Insured catastrophe losses, 1970–2020, in USD billion at 2020 prices

1. 1992: Hurricane Andrew
2. 1999: Winter Storm Lothar
3. 2001: 9/11 attacks
4. 2004: Hurricanes Ivan, Charley, Frances
5. 2005: Hurricanes Katrina, Rita, Wilma
6. 2008: Hurricanes Ike, Gustav
7. 2010: Chile, New Zealand earthquakes
8. 2011: Japan. NZ earthquakes, Thailand flood
9. 2012: Hurricane Sandy
10. 2017: Hurricanes Harvey, Irma, Maria
11. 2018: Camp Fire, Typhoon Jebi
12. 2020: Hurricane Laura, wildfires



Source: Swiss Re Institute

Natural catastrophes like earthquake and weather-related events form the largest risk pool of the reinsurance industry. Global economic losses from such events reached US$190 billion in 2020 only. More than 80 billion of debt was insured. In the recent history, most costly events included tropical storms like Katrina in 2005, and 2017, Harvey, Irma, and Maria season, but also Japan and New Zealand's earthquakes, recent wildfires in the USA and Australia, and various flood events, including this year in Europe.

Notes

Summary

2m 23s

Natural Catastrophe modelling: perils

Convective Storm
Pluvial Flood
Wildfire
Volcano
Drought, Subsidence

Tsunami
Storm Surge
TC-induced Rainfall
Fire following EQ
...

The peak perils for the industry are therefore tropical cyclone and earthquake, followed by flood. Winter storm is the peak peril for Europe, and while the last major event was Lothar back in 1999, the chances for such storms to occur are still equally high. Other secondary or sub-perils can also have large impacts, as we have observed with the many events that occurred over the past years. Each of these perils are studied by the reinsurance industry, and Earth observation plays a role for many of them.

Notes

Summary

3m 04s

Natural Catastrophe modelling: 4-box principle

The industry develops models to understand and cost the risk associated with natural perils. Probabilistic models start with understanding the physical hazard, and Earth observation approaches are increasingly relevant as sources of information. While application was limited to static inputs of, for instance, land cover or elevation, satellite time series can nowadays provide insight into probabilities related to some of the perils. The second box of the model is all about vulnerability. How much damage does a certain hazard intensity cause to a specific type of building or asset? Also, here, Earth observation can play a role. The third and fourth boxes determine which assets are insured, the exposure, and how coverage is provided. The financial box. Earth observation is less relevant for those, but let us give a few examples from the hazard and the vulnerability boxes.

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3m 40s

EO for Nat Cat Modelling: Convective Storms

The first example relates to convective storms. The main peril, at least in Europe, is hail. This is a very localised phenomenon that is hard to observe and therefore challenging to model. Radar observations are often the basis for calculating occurrence probabilities, so basically ground-based Earth observation. Satellite imagery is used in addition to detect overshooting clouds. Those are a good proxy for the occurrence of hailstorms.

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4m 44s

EO for Nat Cat Modelling: Vulnerability studies

Damage assessments, as we will cover in a moment, can be used to derive occupancy-specific loss estimates. Roof damage can often not be detected from space, but in this example, we see how blue tarpaulin have been used to cover roof damage after a tropical storm in Japan. Such proxies can be mapped from space and be combined with available building information to estimate what type of buildings have been affected more or less than others.

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5m 16s

EO for Nat Cat Modelling: Wildfire

Wildfire is a good example of a natural phenomenon that happens frequently, and therefore, available satellite time series give good insight into probability associated to them. And not only fire products can be used. Also, vegetation products like spectral indices can be used to estimate fuel availability. And post-event, satellite observations can help with loss estimates, especially if the insured risk is a production forest.

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5m 49s

EO for Nat Cat Modelling: Flood

The final example we would like to bring is flood modelling. The most intuitive application is probably water detection and mapping, and we'll come to that. But the models also use other remotely sensed input, for instance, land cover and topography. Hydrological models require high quality input, and state-of-the-art Earth observation products directly improve the modelling.

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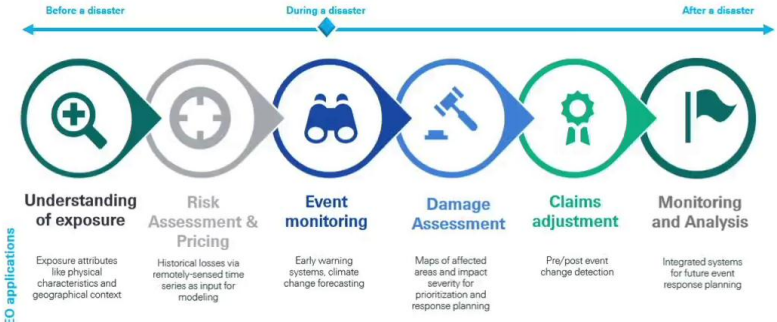
6m 18s

EO for event response



Another important application is the rapid analysis of events as they unfold. In the immediate aftermath of an event, the speed and accuracy of intervention is key to saving lives and minimising damage. Within the insurance sector, being able to rapidly assess the damage is vital for prioritising the most severely impacted areas, identifying the customers with greatest need, organising claims and loss adjuster resources to ensure the fast payment of claims, and ultimately ensuring adequate reserves are there for the company. Traditional assessment approaches may be inconsistent across countries or limited in coverage or scope, or may be very time consuming. In such cases, Earth observation may contribute fast, consistent, and objective information about an event.

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EO for event response

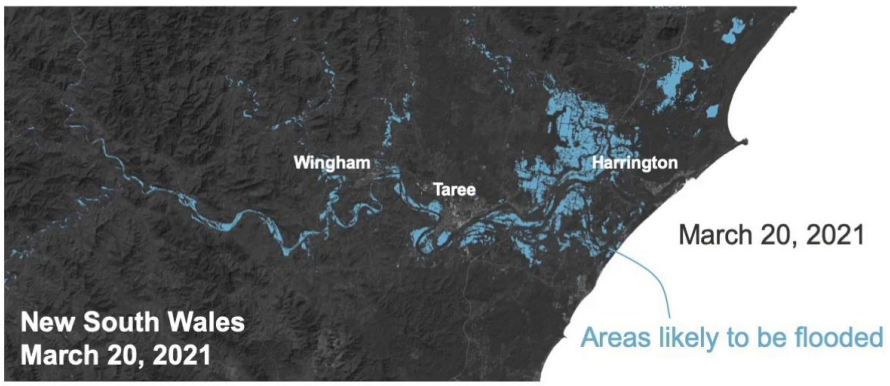

Image credits: *NASA Earth Observatory images by Lauren Dauphin, using modified Copernicus Sentinel data (2021), processed by ESA and analyzed by the National Central University of Taiwan in collaboration with NASA-JPL and Caltech.*
Link*: https://eoimages.gsfc.nasa.gov/images/imagerecords/148000/148093/austfloodingzm_aria_202179_lrg.jpg*

A concrete example of this is the rapid mapping of floods. This peril is particularly hard to monitor across the world and affects more people worldwide than any other type of natural disaster. The increasing availability and quality of satellite-derived flood footprints constitute an opportunity to make large leaps forward in the speed and accuracy of the event response. Flood footprints, like in this example, inform about the areas that are likely to be flooded and in certain cases, also about how high the water level reached.

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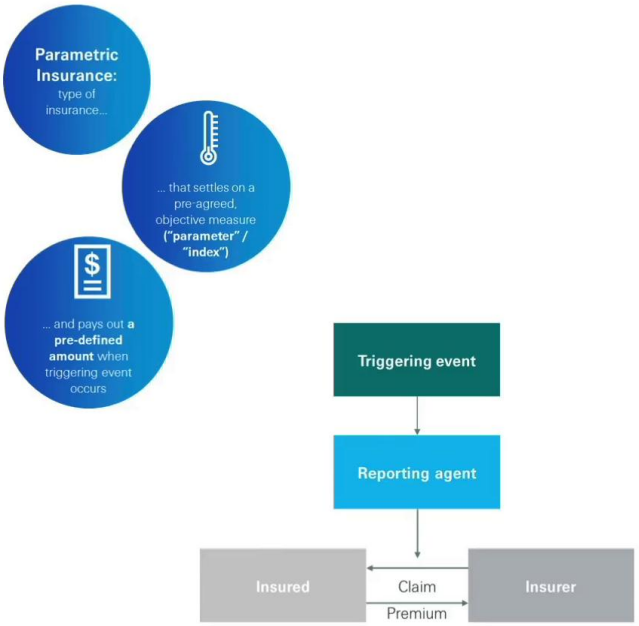
7m 35s

EO for building new, digital insurance products



Our last example is about building new digital insurance products. In our current COVID and climate change transitions, the need for social protection is increasing, and the insurance sector is putting forward new products to try and fill this growing demand.

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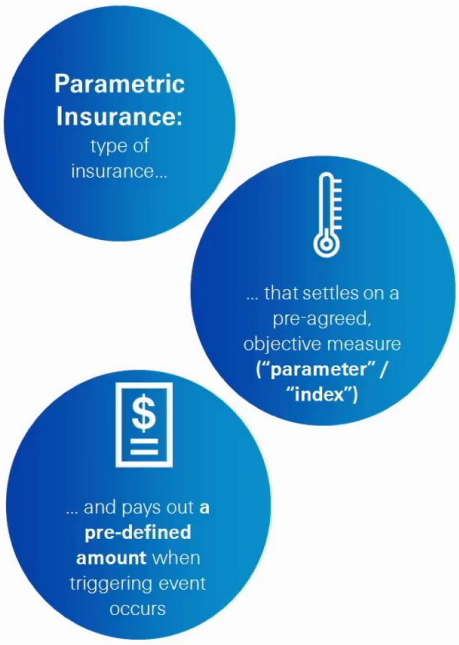
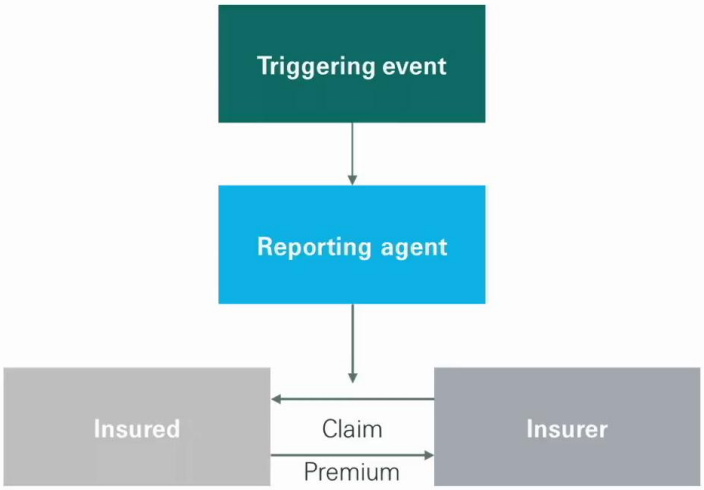
8m 14s

EO for building new, digital insurance products





An example of this is parametric insurance. This is a type of insurance that depends on a preagreed simple measure and maybe an index or a parameter. A parametric product pays out if a certain triggering event, say an earthquake above a certain intensity, for example, is reported by an independent third party, here called the reporting agent. Satellite data have very positive characteristics in that context, as they are created by independent third parties and provide consistent data across time and geography. Therefore, more and more parametric products are created in collaboration with privately-owned satellite companies. In conclusion, the new space economy offers opportunities for the insurance sector to use Earth observation data more efficiently in order to solve some of the traditional challenges in this sector. Also, it creates opportunities to ultimately better serve its customers and its social function, which is to help private households, companies, and communities rebuild and increase resilience in a world increasingly exposed to systemic hazards and uncertainty.

Notes

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8m 32s