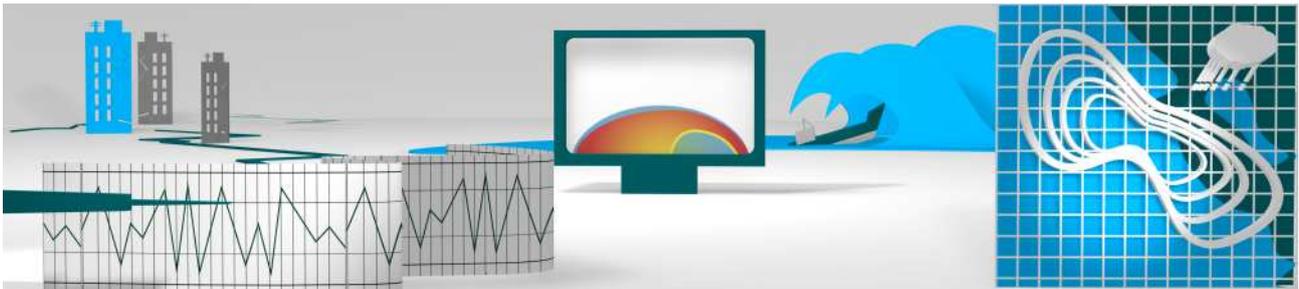


Managing Unexpected Events

The high number of catastrophe events registered across the world in 2011 has led to estimated first half losses of US\$ 70 billion for the year. The key questions are: were they unexpected, and if so, how do we manage such surprises? In order to understand this context we propose approaching it from two different angles. One relates to the chain of causes/consequences in catastrophic events, while the other one relates to the quantification of these. The conclusion will draw attention to the limitation of our knowledge of such phenomena and how to manage them.



Chain of causes/consequences in a catastrophic event



Identification of all the interactions between these 5 elements is key to understanding and managing rare or extreme events.

One way to rationalize this phenomenon is to break down the process from the source to reinsurance into five steps:

Source

The source is what generates the event, for example an earthquake. Catastrophic events occur on a very rare basis, which makes the knowledge about them more complex than for "average" phenomena. Earthquakes have been a known hazard since the origins of humanity but their relation to seismic sources was not fully accepted until the 1960's with the tectonic plate theory.

Pathway

This is the path by which the consequence of an event will impact the receptor. In the case of an earthquake, it is typically the shaking of the ground which leads to consequences for the building. However, earthquakes can also trigger other paths such as tsunamis, fires, landslides, liquefaction, dam failures. Furthermore our current complex environment/economy can generate distant impacts (for example, Contingent Business Interruption in a specialized business segment like semi-conductor manufacturing,

automotive and aviation industries can have very distant impacts).

Receptor

This represents all the potential assets that can be impacted by an event: human life, properties, public facilities. For Property insurance, receptors are essentially buildings and their contents.

Consequences

The consequences will be very different depending on the level of development in a country: for example, Haiti earthquake had enormous consequences in terms of human life when compared with the consequences of the first New Zealand earthquake. In Property insurance consequences relate essentially to building damages.

Risk transfer

This is the part of the damage which is being transferred to the insurance and reinsurance industry. The part of the risk being transferred varies widely from country to country depending on the original policy conditions, the reinsurance treaty, and the contribution of governments in a pool.



Quantification of Catastrophes

The five steps set out previously describe the interactions between the causes and consequences of natural events, however this is not enough to manage risks. Quantification of such phenomena is essential in order to be able to transfer risks. Any attempt to quantify shows how uncertainty propagates through all these components. On the other hand this system is too complex to be “modelled” to its full extent and has to be simplified.

Severity component

This part relates to the quantification of the impact (or losses for insurance/reinsurance)

given a potential source. Several components interact and make this difficult:

- Hazard intensity:** this is the description of the relationship between the sources and the receptor. In earthquake terminology, this relates to the level of ground acceleration at a particular location given a source and an attenuation relationship. Such relationships are often empiric and a wide range of factors can influence them (for example, local soil conditions).
- Vulnerability:** this relates to how a building will be impacted given a certain level

of hazard intensity (ground acceleration for earthquake, depth/duration for flood etc.). Again, several components will influence the outcome, such as the age and type of construction, the design, the compliance with building codes,...

As an example, an earthquake within the “forecasted” range and with a fully compliant seismic design code could cause minimal damage, whereas a similar earthquake in another area outside of the seismic range could lead to disastrous consequences. In other words, a catastrophe cannot be looked at purely from a hazard point of view.

Diverging impacts of 2010-2011 earthquakes

Event	Cost ⁽¹⁾		Death Toll	Chain					Comments
	Economic	Insured		Source	Pathway	Receptor	Consequence	Risk Transfer	
Haiti EQ 12/01/2010	US\$ 7.8 bn ⁽²⁾	very low (0.28% of Haitians insured)	230,000						Major human life impact essentially resulting from poor building standard.
Chile EQ 27/02/2010	US\$ 15-30 bn	US\$ 6 bn ⁽³⁾	800						Severity within range of past historical events, construction damage and consequences within “range” of the event. Lengthy loss settlement due to local regulation.
First NZ EQ 04/03/2010	n.a.	US\$ 4.5 bn	none						Unknown fault
Second NZ EQ 22/02/2011	US\$ 12 bn ⁽⁴⁾	US\$ 8 bn	more than 200						Aftershock of the first event just beneath Christchurch
Great East Japan EQ 11/03/2011	US\$ 210 bn ^{*(5)}	US\$ 25-35 bn	21,000 (including 5,000 missing)						Unexpected magnitude for this fault. As a consequence, a tsunami was triggered and caused damage to the nuclear plant cooling system.
Virginia EQ 23/08/2011	US\$ 200-300 mn ⁽⁶⁾	< US\$ 100 mn ⁽⁶⁾	none						Small earthquake far from seismic zone.

Latest available estimations
Sources: (1) AIR ; (2) United Nations ; (3) Chilean Insurance Association ; (4) NZ Government (5) Japanese Government ; (6) EQECAT
* Excluding nuclear consequences





Frequency component

The frequency component tries to evaluate the probability that a given event will occur. Frequency combined with the severity component allows us to generate a framework within which to rank/weight/prioritize the outcome of sources. Regulators, rating agencies and most risk transfer mechanisms tend to use the notion of PML (Probable Maximum Loss). In the natural catastrophe area, this translates into a return period loss (typically between 1:100 and 1:250 return period) and the severity associated with it.

In order to evaluate such extreme losses, many types of information must be considered (historical events, the physics driving the mechanism of the hazard). The historical information with accurate instrumentation data is often not complete enough to fully evaluate extreme low frequency events. The underlying physics driving the mechanism of a hazard are required to complete such

an assessment. Nevertheless better instrumentation data provide insight into the underlying physics of the phenomenon itself.

The historical seismic catalogue can often present gaps or inaccurate representations of earthquake hazards; for example in the Caribbean before seismographs were used most historical events were "assigned" to the nearest island, therefore the actual magnitude is nowadays difficult to reliably evaluate and results in some gaps or bias present the catalogue.

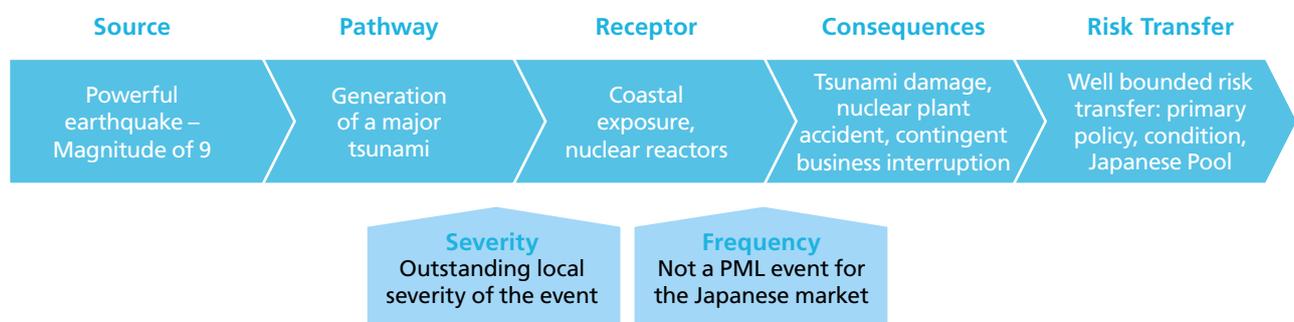
Managing extreme events

On the one hand there is a complex system to understand, whose extreme nature (rarity) makes it difficult to fully evaluate the consequences *a priori*. On the other hand, quantification/modelling of these phenomena requires dealing with uncertainty and necessarily simplifying mathematical representation of the process(es).

Severity has a broad range of uncertainty associated with all potential interactions between the source of an event and the final risk transfer from (re)insurers. The frequency component involves on-going research with a view to obtaining more accurate measurements and a better understanding of the underlying physics involved in order to refine our understanding of the relative frequency associated with extreme events.

At the present time, catastrophe models enable us to gain more insight into this area and provide a framework to help us to manage the risk, however attention shall be brought to the limitations of the models and uncertainties associated with them. Consequently, risk transfer should be adequately limited in time (event definition) and in amount (event limit) in the contracts in order to minimise the uncertainties in terms of loss outcomes of extreme natural events.

How can the chain of causes/consequences be applied to the Japanese earthquake of 11 March, 2011



The risk transfer mechanism in Japan is specific due to the existence of the Japan Earthquake Reinsurance Company (JERC) above. This scheme also explains why there is such a gap between the economic cost and the insured cost for the Great East Japan EQ.

Henry Bovy
Regional Cat Manager
SCOR Global P&C



Specifics of the earthquake (Re)Insurance System in Japan

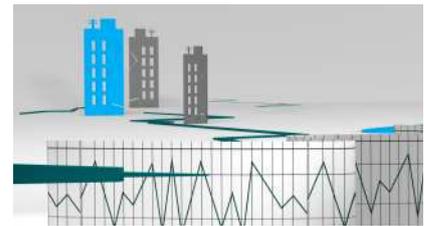
In Japan, earthquake insurance on dwelling risks has been established under a special law, with reinsurance support provided by the government, while commercial and industrial risks are covered by the private sector, mainly supported by foreign reinsurers. There is also some coverage available for earthquake risks provided by the cooperative insurance sector, mainly for dwelling risks, which is outside the scope of the law.

The Japanese earthquake reinsurance scheme is an outline of the earthquake insurance on dwelling risks provided by Non-Life insurance companies under the Earthquake Insurance Act of 1966, which plays a major role in terms of paying compensation for damage to houses/household goods in Japan in the event of a large earthquake.

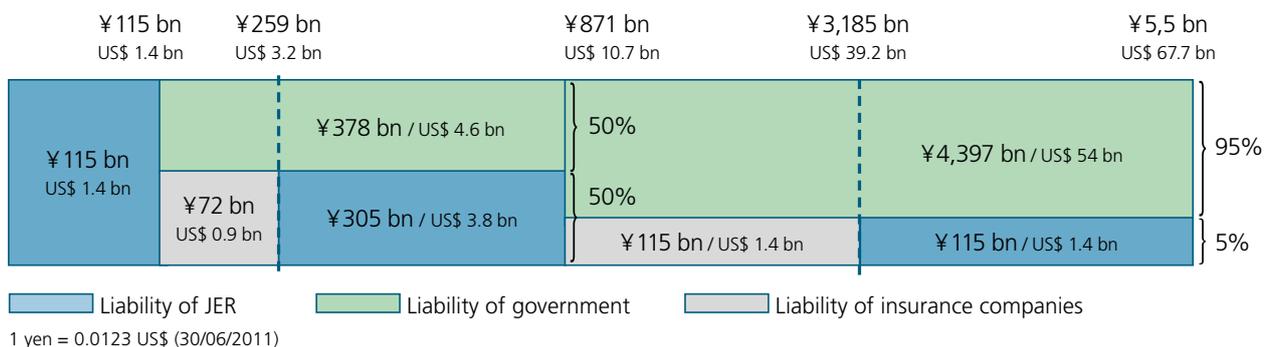
Earthquake insurance on dwelling risks covers homes and household goods. Contracts for earthquake insurance on dwelling risks can only be bought as part of a Fire insurance policy, and cannot be bought alone. These contracts pay for losses of or damage to buildings or contents caused by fire, destruction, burying or water damage, including being washed away after an earthquake or volcanic eruption, or a tsunami following an earthquake or volcanic eruption.

The insured limit is set between 30% and 50% of the insured amount for Fire insurance, subject to a maximum upper limit of JP¥50 million for houses and JP¥10 million for household goods. The Non-Life Insurance Rating Organization of Japan calculates standard premium rates. Premiums are

divided into 8 regional categories and 2 types of buildings, i.e. wooden constructions (from 1.00 o/oo to 3.13 o/oo) and non-wooden construction (from 0.50 o/oo to 1.69 o/oo). Discounts of up to 30% are applicable to houses with earthquake proof construction standards that meet the legal requirements. This insurance is designed to operate on a non-profit basis governed by the State, although it is handled by private insurance companies operating in the Japanese market.



The Japanese earthquake (Re)insurance scheme (¥/US\$ bn)



The earthquake reinsurance scheme shared by the government and the private sector operates as illustrated in the table above; all direct insurance companies cede 100% of their acceptance to the scheme operated by the government and the Japan Earthquake Reinsurance Company (JER), which is owned by Japanese domestic Non-Life insurance companies. The indemnity limit of the scheme is JP¥ 5,500 billion per event. For the Great East Japan EQ of 11 March, 2011, the scheme had paid out a total amount of JP¥ 1,121 billion as of August.

Yuji Kawamura
Deputy General Manager
SCOR Global P&C, Japan



Following on from this technical overview of an unexpected Nat Cat event that can occur at any time, and the description of the Japanese earthquake (re)insurance scheme, we felt it was extremely important to focus on the human aspect of the 11 March Great East Japan EQ tragedy and its dramatic consequences, given that this event brought about another tragic catastrophe in the form of a tsunami.

We extend our sincere thanks to our Japanese partners Mitsui Sumitomo Insurance, Sompo Japan and Tokio Marine & Nichido Fire for their testimonials, which have been essential in terms of helping us to understand the way in which Japanese insurers have acted to manage this exceptional situation, both internally and externally.

It was a Friday afternoon in March, in the midst of our April 2011 Renewal Placements, when the Great East Japan EQ and the devastating Tsunami occurred. We all knew that, unlike typhoons or hurricanes, earthquakes can occur at any time of the year. Nevertheless, it's just a nightmare to be struck by an earthquake of this magnitude during the renewal period! In the aftermath of this catastrophe, all of our colleagues in Japan, including those in the non-affected areas, made extensive efforts to provide quality services to our customers. While our Reinsurance Department was exempted so that we could devote

ourselves to the renewal placements, other departments at our Tokyo Head Office were requested to temporarily assign a number of their employees to help the claims handling. By the end of August we have closed over 98% of all the claims under our policies for Dwelling Risks. We are very proud of this achievement, which we believe eloquently proves our quality of operation, all the more because we were ranked by Nikkei as The Most Reliable Non-Life Insurer during this extraordinary adversity. Having started our renewal placements in February, as usual, we had already obtained renewal commitment for property

proportional treaties from most reinsurers before the 3.11 event. Although we were faced with unprecedented uncertainties and anxieties right after the event, as the reinsurance market seemed to fall into a temporary disruption, we successfully completed our renewal of the whole reinsurance program by the end of March. We believe it could never have been achieved without the great supports of our *true partners* like SCOR. We will never ever forget this experience, which reminded us once again of the essential feature of reinsurance; "A friend in need is a friend in deed."

Mitsui Sumitomo Insurance

The March 11 disaster - the tragic event occurred so sudden and reminded all us Japanese that we live in the country where abundance of nature and beauty exists but also with divine potential which may in an instance totally change life of tens of thousands of people. Although eighteen offices suffered some physical damage, we Sompo Japan were able to confirm safety of all employees shortly after the quake. Then our activities as direct insurer immediately started by delivering our fullest efforts to our customers whose houses were damaged or swept away - quite unexpectedly and abruptly. In order to prompt progress of investigation

and payment process, employees normally working outside the affected areas were dispatched in turns during 4 months following the event and the overall workforce at peak times was at the level of about 3000 staff. The efforts could bring significant fruit in our being able to respond to our customers by achieving claims settlement of about 94% of received claims at the end of this period. The mission for those dispatched was rather tough - they say that it was quite shocking to see how powerful the tsunami was when seeing the site. Yet they felt moved in many occasions when they received thankful words from our customers for visiting them, listening to them and

offering to make payment quickly. Six months have passed since the event. The reported loss of life and missing people is some 20,000 and still 75,000 evacuees and dislocated continue to be in quite inconvenient situation. It truly was the most tragic event in recent years but it reminded us of ties of people and spirit of helping. "All our thoughts and actions are for our customers" is the slogan which Sompo people have in our mind when assisting claims settlement at the areas. As restoration and reconstruction after the quake will speed up, we intend to fulfill our conscientious role as insurer.

Sompo Japan

The Group's first priority was to ensure the safety of employees and agents, no easy task given the scale of the human tragedy that affected so many. Alongside the immediate human response, within an hour of the event we had also established a Disaster Management Task Force at Head Office, followed by Local Task Forces across the affected regions later that day.

The following day, the first advance teams were dispatched to the affected area, while special measures for policyholders were also announced, giving priority to the prompt payment of claims and recovery support. As well as claims advice and payment information, a counseling service

was established to provide assistance for those who need mental recovery.

On Monday 14th March, two four ton trucks were sent to the affected areas with food and other relief supplies. These were the first of 23 truckloads to be sent over the next 3 weeks carrying supplies ranging from food and clothing to much needed fuel, batteries and communication equipment. This relief project, alongside claims services, involved more than 2000 employees across the disaster area, including over 200 employees engaged as volunteers in affected areas to assist with cleaning homes and the disposal of debris. Alongside the physical response, we launched a charitable donation drive

on 14th March in order to collect funds to aid those affected. By the end of June, Group donations had reached JP¥ 230M. Additionally 4 separate events were organized to support Fukushima, Tohigiki & Ibaraki by encouraging people to buy local produce.

We continuously assisted our customers and the local communities wherever possible. This includes the publication of a recovery guide for our customers, to help local businesses get back on their feet by providing advice on resuming business operations and mitigating further loss.

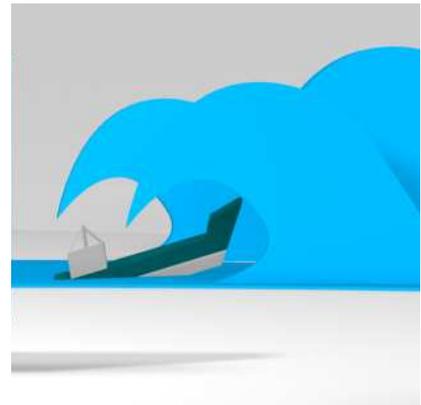
Tokio Marine & Nichido Fire

Conclusion

Experts and professionals from the (re)insurance industry agree that there has been an acceleration in the frequency of natural catastrophes, as well an increase in their intensity: 2010 and 2011 saw four major earthquakes, with varying damage levels and costs for each event. The 11 March Great East Japan EQ is the latest example, and we have attempted to shed our own light on this tragic event, which had two dramatic consequences: a tsunami and a nuclear accident. We have deliberately left the nuclear accident to

one side in this short publication, in order to focus on the testimonies of the people who experienced these dramatic events first hand.

This newsletter is the first part of an overview of recent earthquakes; it will be followed in November by a second part entitled "Lessons for insurance Risk Management and Engineering in the Major Earthquakes of 2010-2011". This upcoming issue will be also available in both digital and paper format.



SCOR Global P&C

1, avenue du Général De Gaulle - 92074 Paris La Défense Cedex France

Editor: **Dominique Dionnet**

Tel.: +33 (0)1 46 98 74 00 - Fax: +33 (0)1 46 98 84 49 - ddionnet@scor.com

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