Agenda

- Nat Cat Risk in Asia & India
- Overview of Nat Cat Modeling
- Lessons Learnt from Recent Events in Asia
- Nat Cat Capacity Management
Nat Cat Risk in Asia
Natural Perils across Asia

Source: Swiss Re

Cyclone Haiyan (2013)

Cyclone Phailin (2013)

North Indian Ocean 2013

Pacific Ocean 2013

Insured catastrophe losses 1970–2012

USD bn, at 2012 prices

- 1992: Hurricane Andrew
- 1994: Northridge EQ
- 1999: Winter storm Lothar
- 2004: Hurricanes Ivan, Charley, Frances
- 2001: 9/11 attacks
- 2005: Hurricanes Katrina, Rita, Wilma
- 2008: Hurricanes Ike, Gustav
- 2011: Japan, NZ EQs, Thailand flood

Source: Swiss Re, Sigma
## Catastrophes and losses in 2012 by region

<table>
<thead>
<tr>
<th>Region</th>
<th>Number</th>
<th>Victims</th>
<th>in %</th>
<th>Insured loss in USD bn</th>
<th>Total loss in %</th>
<th>Total loss in USD bn</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>43</td>
<td>560</td>
<td>4.0%</td>
<td>64.6</td>
<td>83.6%</td>
<td>118.5</td>
</tr>
<tr>
<td>Latin America &amp; Caribbean</td>
<td>30</td>
<td>1167</td>
<td>8.4%</td>
<td>0.9</td>
<td>1.2%</td>
<td>4.2</td>
</tr>
<tr>
<td>Europe</td>
<td>33</td>
<td>1480</td>
<td>10.7%</td>
<td>5.5</td>
<td>7.1%</td>
<td>26.8</td>
</tr>
<tr>
<td>Africa</td>
<td>53</td>
<td>2300</td>
<td>16.5%</td>
<td>0.2</td>
<td>0.3%</td>
<td>1.5</td>
</tr>
<tr>
<td>Asia</td>
<td>115</td>
<td>7177</td>
<td>51.5%</td>
<td>3.4</td>
<td>4.4%</td>
<td>30.5</td>
</tr>
<tr>
<td>Oceania/Australia</td>
<td>7</td>
<td>97</td>
<td>0.7%</td>
<td>0.3</td>
<td>0.4%</td>
<td>1.1</td>
</tr>
<tr>
<td>Seas/Space</td>
<td>37</td>
<td>1148</td>
<td>8.2%</td>
<td>2.4</td>
<td>3.1%</td>
<td>3.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>318</strong></td>
<td><strong>13929</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>77.2</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>185.7</strong></td>
</tr>
</tbody>
</table>

Source: Swiss Re, Sigma
Metropolitan Areas at Risk from Nat Cats

- 616 metropolitan areas are globally analyzed with Swiss Re CatNet® tool
  - in terms of people potentially affected
  - value of working days lost (proxy for GDP lost) absolutely and relative to country

Source: Swiss Re, *Mind the risk: A global ranking of cities under threat from natural disasters*
Indian cities at risk from Nat Cats (Earthquake, River Flood, Storm, Storm Surge, and Tsunami)

- **Kolkata** (Population: 19.1 m)
  - Rank 7th for the people potentially affected (PPA) aggregated for all perils (17.9 m)
  - Rank 3rd for the PPA by river flood (10.5 m)
  - Rank 8th for the PPA by storm surge (1.4 m)
  - Rank 5th for the PPA by tsunami (0.6 m)

- **Mumbai** (Population: 20.6 m)
  - Rank 8th for the PPA by storm (4.3 m)
  - Rank 3rd for the PPA by storm surge (2.6 m)

- **Chennai** (Population: 8.5 m)
  - Rank 9th for the PPA by storm (4.0 m)
  - Rank 10th for the PPA by Tsunami (0.2 m)

- **Delhi** (Population: 21.9 m)
  - Rank 5th for the PPA by river flood (8.9 m)

Source: Swiss Re, Cat Net®
Why we need Nat Cat models
Massive gap between economic and insured losses

Natural catastrophe losses 1982-2012, in USD billion (2012 prices)

*2012 Loss numbers are a preliminary estimate

Note: Insured losses: property and business interruption, excluding liability and life insurance losses

Source: Swiss Re sigma
Growth of values is the main driver of increasing natural catastrophe losses

Mumbai, 1900s*  
Mumbai, 2000s*

Flora Fountain, Mumbai (1900s)*  
Flora Fountain, Mumbai (2000s)*

 Reasons
Increasing values
Concentration of values in exposed areas
Increasing vulnerability
Growing insurance penetration
Changing hazard (climate variability, climate change)

Loss history is not a good guide for risk, models are an indispensable tool.

*Source/Photo Credit: Himansu Kamdar and Discover India Team <http://discoverindiabyroad.blogspot.ch/p/lost-mumbai.html>
Nat Cat risk assessment: Premium income vs. losses

Fire:

Natural catastrophes:
Nat Cat modeling landscape

- Vendor models
  - AIR
  - EQECAT
  - RMS

- Broker models

- Company proprietary models
Research driven NatCat underwriting
Think tank "Cat Perils"

**In-house models as key source for accurate Underwriting at reasonable cost**
- Taylor-made, state-of-the-art models to allow efficient Underwriting process, incl. hot line
- No black box approach
- Option to react swiftly on new findings e.g. EQ Chile & BI, Japan EQ aftershocks

**Team of experts to develop custom made solutions and train Underwriters**
- Value proposition and client centric approach as key drivers
- Structure and rate complex cases due to available R&D data set e.g. ILS
- Educated Underwriters to go beyond simple tool usage, strong link to Universities

**Valuable client services, value proposition and branding**
- Own R&D and natcat risk awareness brings added value to clients and builds SR reputation
- Client tools e.g. CatNet
- Support communication activities of Swiss Re with sound expertise

**Integrated & transparent risk management**
- All relevant lines of business included, automatic process
- Successful portfolio steering thanks to transparent figures and sound hazard assessment
- No big surprises as long as “mother nature behaves”
Natural catastrophe models
Four elements to model losses

- Risk: How often? How strong?
- Loss resistance: How well built and protected?
- Value distribution: What is covered? Where?
- Coverage conditions: How?
Simplest catastrophe model
Calculating a loss scenario

Hurricane Katrina 2005
Tropical cyclones in the north Atlantic historical tracks

Even 100 years worth of historical events are not enough to fully reflect risk.
Creating additional events based on physical correlation

Hurricane Katrina with daughter events
Tropical cyclones in the north Atlantic - historical and probabilistic tracks

Probabilistic event set aims at reflecting full range of possible storms.
Example: Loss modeling process

Loss Frequency Curve

Source: Swiss Re, Natural Catastrophes and Reinsurance
Nat Cat potential losses

Growth in emerging markets with high insurance penetration over time will significantly increase the Nat Cat potential losses
Learning from events
Recent earthquakes in Chile, New Zealand and Japan

<table>
<thead>
<tr>
<th></th>
<th>Chile 27 February 2010</th>
<th>New Zealand 22 February 2011</th>
<th>Japan 11 March 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnitude</td>
<td>8.8</td>
<td>6.3</td>
<td>9.0</td>
</tr>
<tr>
<td>Energy released</td>
<td>5 600</td>
<td>1</td>
<td>&gt;11 000</td>
</tr>
<tr>
<td>(compared to NZ)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fatalities/missing</td>
<td>562</td>
<td>&gt;160</td>
<td>&gt;20 000</td>
</tr>
<tr>
<td>Economic loss, USD bn</td>
<td>30</td>
<td>25</td>
<td>210</td>
</tr>
<tr>
<td>Insurance loss, USD bn</td>
<td>8</td>
<td>9-12</td>
<td>30</td>
</tr>
</tbody>
</table>

- **Chile**: Significant losses from industrial facilities, mainly due to business interruption
- **New Zealand**: Back to back, relatively small events on a relatively low hazard zone, generating significant insurance losses, mainly due to liquefaction-related damage
- **Japan**: Major damage and losses from tsunami; complications due to failure of nuclear power plants

Each of the earthquakes surprised us with a larger than anticipated loss.
Model blind spots revealed by recent earthquakes
Model vendors

<table>
<thead>
<tr>
<th>Loss Driver</th>
<th>Modelled?</th>
<th>Pass?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tsunami</td>
<td>Not as such. A few models/markets have a slight loading on the shock rates for coastal locations.</td>
<td>✗</td>
</tr>
<tr>
<td>Increased seismicity after large event</td>
<td>Not modelled.</td>
<td>✗</td>
</tr>
<tr>
<td>Liquefaction</td>
<td>Some models/markets consider liquefaction. However, all models by far underestimated impact in Christchurch.</td>
<td>✗</td>
</tr>
<tr>
<td>Business interruption</td>
<td>Included in most models. However, impact for BI-sensitive industries generally underestimated.</td>
<td>✗</td>
</tr>
<tr>
<td>Contingent business interruption</td>
<td>Not modelled. Exposure not fully understood.</td>
<td>✗</td>
</tr>
<tr>
<td>Next surprise?</td>
<td>?</td>
<td></td>
</tr>
</tbody>
</table>

Many vendor models have not yet taken into account experience from recent events.
Model blind spots revealed by recent earthquakes
Swiss Re model

<table>
<thead>
<tr>
<th>Loss Driver</th>
<th>Modelled?</th>
<th>Pass?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tsunami</td>
<td>Tsunami model for Japan in operation. Global model under development.</td>
<td>✔</td>
</tr>
<tr>
<td>Increased seismicity after large event</td>
<td>Models are updated within weeks.</td>
<td>✔</td>
</tr>
<tr>
<td>Liquefaction</td>
<td>Soil quality is part of all new earthquake models.</td>
<td>✔</td>
</tr>
<tr>
<td>Business interruption</td>
<td>Vulnerabilities in earthquake adjusted globally.</td>
<td>✔</td>
</tr>
<tr>
<td>Contingent business interruption</td>
<td>Not modelled. Addressed with underwriting measures.</td>
<td>✗</td>
</tr>
<tr>
<td>Next surprise?</td>
<td>?</td>
<td></td>
</tr>
</tbody>
</table>

Swiss Re is able to quickly learn from events and update models.
Nat Cat Capacity Management
Use of event loss sets from Nat Cat models

- Expected Loss
- Loading
- Pricing
- Risk Management
- Capacity

Event Loss Set

Pre/Post Event Loss Estimate
What is Capacity?

The Group scenario Short Fall (SF) can only be calculated with the entire portfolio at hand.

Capacity is an approximation of each deal's contribution to the Group scenario SF. The capacity can be calculated on a deal-by-deal basis.

Group Capacity is the sum of the capacities of the individual deals.

Capacity is used to make sure we are not overstepping the solvency limit, as well as to control growth and market share.
Event set based group portfolio aggregation

... event based

E1 | E2 | E3 | E4 | E5 | E6 | E7 | E8 | E9

Client A

Event frequency

Client B

Event frequency

Client C

Event frequency

Swiss Re group

Event frequency
Capacity Calculation
Comparing Client Exposure to Swiss Re’s

- Expected loss of both client portfolios identical
- Client 1 strongly correlates with Swiss Re portfolio

Expected loss of both client portfolios identical

Portfolio event losses

Capacity intensity

Client 1: High Capacity

Client 2: Low Capacity
How much Tropical Cyclone North Atlantic Capacity is Consumed with the Same Expected Losses?

Exposures in Chilhowie, VA diversify well

Illustrative only
Conclusion
Summary

- Massive gap between economic and insured losses in Asia
- Growth of values is the main driver of increase in losses over time
- Natural catastrophe model framework (four elements) is essential for the robust estimation of Nat Cat potential losses
- Recent events have indicated that vendor models had missed some key loss drivers (secondary perils) in the loss estimation
- Nat cat modelling can be integrated in the risk management framework for capacity and capital management
Thank you
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