Lessons from a decade of major earthquakes

Lucia Bevere
Senior Catastrophe Data Analyst
Key take aways

1. A decade of major EQs
2. Building codes work
3. Yet losses are still large
A decade of major EQs
A decade of unprecedented destructive earthquakes...

- 9.0 in 2011
- 8.8 in 2010
- 7.8 in 2015
- 7.0 in 2010
- 6.1 in 2011
...yet global seismic hazard has not increased

Number of EQs per year

Number of large earthquakes observed in recent years are in line with long term statistics

Analysis of global seismic data is inconclusive in terms of clustering of (large) EQs in time

Major earthquakes, greater than magnitude 7, happen more than once per month

“Great earthquakes”, magnitude 8 and higher, occur about once a year.
Largest earthquakes in the last decade

Swiss Re Geo Services | 27.9.2019 | S6UKJ8

Sources: Esri, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, and other contributors. Pseudo spectral acceleration in units of g at a period of 0.3s for a return period of 475 years. 0.5g=MMI VIII, 1.0g=MMI IX.

Source: GSHAP/SHARE/USGS/SR
Building codes work
Select major earthquakes 2010 – 2018

<table>
<thead>
<tr>
<th>Location</th>
<th>Year</th>
<th>Magnitude</th>
<th>Number of Victims</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Zealand</td>
<td>2011</td>
<td>6.1</td>
<td>185</td>
</tr>
<tr>
<td>New Zealand</td>
<td>2010</td>
<td>7.0</td>
<td>0</td>
</tr>
<tr>
<td>Haiti</td>
<td>2010</td>
<td>7.0</td>
<td>222,570</td>
</tr>
<tr>
<td>Nepal</td>
<td>2015</td>
<td>7.8</td>
<td>8,960</td>
</tr>
<tr>
<td>Chile</td>
<td>2010</td>
<td>8.8</td>
<td>562</td>
</tr>
<tr>
<td>Japan</td>
<td>2011</td>
<td>9.0</td>
<td>18,432</td>
</tr>
</tbody>
</table>

* = 2,225 victims
Building codes protect lives!
Yet losses are still large.
Costliest earthquakes (by insured losses)

4 out of 5 of the costliest earthquakes* happened in the time period 2010-2011

65% of all insured losses were originated in the last decade*

* on sigma records. Losses at 2019 prices.
Select major earthquakes, 2010-2018

Each of these EQs represents the costliest natcat on record for the respective countries.
What did science miss?

Before March 11, 2011

- Maximum magnitude 8.5
- Hence limited Tsunami potential

On March 11, 2011

- M 9.0
- Multisegment rupture
- >400km rupture
- Max slip > 30m
- Large Tsunami reaching 40.5m height
Record breaking tsunami waves in Japan

Record breaking wave heights along the East Coast of Japan.

Tsunami waves flooded 500 Km2 of the Japanese Pacific Coast – more than any tsunami on record.
Record breaking liquefaction-induced ground deformation in the Canterbury seismic events, NZ
Non-structural damage: primary driver of losses

Numerous modern buildings that suffered no critical structural failure, experienced costly damage to architectural elements

Severe damage to equipment in all types of structures and industrial facilities
Share of non-residential insured losses by earthquakes

**Non-structural damage partially explains the high share of non-residential as % of total insured losses in Chile!**

**Share of non-residential insured losses by earthquakes**

<table>
<thead>
<tr>
<th></th>
<th>Chile 2010</th>
<th>Italy 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Magnitude</strong></td>
<td>8.8</td>
<td>5.5 to 6.1</td>
</tr>
<tr>
<td><strong>Non-residential as % of total insured losses</strong></td>
<td>78%</td>
<td>98%</td>
</tr>
<tr>
<td><strong>BI as % of non-residential insured losses</strong></td>
<td>50%</td>
<td>40%</td>
</tr>
</tbody>
</table>
Building codes protect lives!

...less so properties
Easy solutions do exist!

L-shaped angle

Stiffener plate

Two or more bolts

...and relatively inexpensive!
Modelling of earthquake-related industrial/commercial risks

High uncertainty of the impact of the ground shaking at a given site (intra-event uncertainty)

High uncertainty around the vulnerability of the asset/location
Situation awareness

Preparing for an earthquake before the event occurs can dramatically decrease the level of damage and BI

A checklist can help identify property loss preventive measures
There are always surprises
... about the earthquakes that actually occur
... around unprecedented loss drivers

Non-structural damage
... particularly important for industrial/commercial risks
... relatively more difficult to model

Being well prepared is key
... to dramatically reduce damage and losses
... organisational resilience is a strategic advantage
Any questions?
Thank you!

Contact us

Jeroen Weurdung
Head of Benelux & Nordics
Corporate Solutions

Stefan Wunderlich
Head Nat Cat
Corporate Solutions

Lucia Bevere
Senior Catastrophe Data Analyst
Swiss Re Institute

Follow us
Legal notice

©2019 Swiss Re. All rights reserved. You may use this presentation for private or internal purposes but note that any copyright or other proprietary notices must not be removed. You are not permitted to create any modifications or derivative works of this presentation, or to use it for commercial or other public purposes, without the prior written permission of Swiss Re.

The information and opinions contained in the presentation are provided as at the date of the presentation and may change. Although the information used was taken from reliable sources, Swiss Re does not accept any responsibility for its accuracy or comprehensiveness or its updating. All liability for the accuracy and completeness of the information or for any damage or loss resulting from its use is expressly excluded.