2011 Thai Floods: Impact and Lessons Learned for Japanese Non-Life Insurers

The Institute of Actuaries of Japan

Agenda

• Japan and Natural Catastrophe
  – Tomohiro Yokota, Nipponkoa Insurance Co., Ltd.

• The Thai Floods
  – Tomomi Kawakami, The Fuji Fire and Marine Insurance Co., Ltd.

• The lessons learned from the Thai Floods
  – Ken’ichi Horie, Mitsui Sumitomo Insurance Co., Ltd.
Japan and Natural Catastrophe

Review of Tohoku Earthquake

- On March 11, 2011 14:46 JST
- Magnitude: 9.0
  - The largest EQ in Japan
- Epicenter: 130km off the Pacific coast of Tohoku region, 24km depth
- Seismic Intensity: 7 (Max) at Kurihara City, Miyagi Prefecture
  - (Japan Meteorological Agency)
- Insured Loss: USD27 bn *1
- Economic Loss: USD169 bn *2

*1: Estimated by Financial Services Agency, on July 19, 2011
*2: Estimated by Cabinet Office, on June 2011
FX rate of 1USD = 100JPY is assumed for both
Impact for Japanese insurance industry and its reaction

- Gross claims paid: USD12.4 bn
  - As at March 31, 2013
  - Households EQ insurance
- Framework for Identifying Insurer
  - Non-life companies structured a way to identify the policy for a policyholder in case of loss
- Damage survey
  - Automatic full amount settlement in fully damaged areas
- Special measures for policy holders
  - Grace period for renewal of a policy or premium payment
- Support to the affected areas
  - Volunteer activities for reconstruction
  - Donation

Impact for Japanese insurance industry and its reaction

- # of policies of EQ insurance on households: 6.8% up YoY
  - About 15 millions at the end of March 2013
  - Has been increasing after the EQ, especially in the affected and neighboring prefectures
- EQ insurance premiums on households to rise 15.5%
  - Due to growing risk of another major earthquake
  - To be effective from July 2014
- New products and services for Nankai-trough mega EQ launched by major insurance companies
  - Loss estimate for Nankai-trough mega EQ is USD 2.2 trillion at most
**Project Team for EQ insurance framework**

- "Project Team for EQ insurance framework" set up under Ministry of Finance
  - The report published on November 30, 2012
- Reconfirmed that EQ insurance is "government-private sector joint insurance"
- Issues were categorized/prioritized as follows:
  - Urgent issues:
    - To improve the robustness of the system: actions to be taken as a countermeasure against the extreme decrease of the EQ reserve of insurers
  - Issues to be tackled ASAP:
    - To revise products or premium rate
  - Issues to be discussed continuously
    - To revise insured amount or reflection of the risk’s location to premium rate

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**World EQ map**

- Majority of earthquakes happened in Pacific Rim

*Seismicity of the World*

Source: University of Tokyo, Earthquake Research Institute, Earthquake and Volcano Information Center
“Cartogram” shows global risks

- The area of each country proportional to its risk
- Green and Blue reflect EQ and Wind risk, respectively

Source: Aon Benfield "Insurance Risk Study, 7th Edition"

Natural Hazard Risk Index

- “Risk Index” of Tokyo is quite big compared to other areas

<table>
<thead>
<tr>
<th>City</th>
<th>Index as a whole</th>
<th>Hazard</th>
<th>Susceptibility to Loss</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tokyo</td>
<td>710</td>
<td>10.0</td>
<td>7.1</td>
<td>10.0</td>
</tr>
<tr>
<td>San Francisco</td>
<td>167</td>
<td>6.7</td>
<td>8.3</td>
<td>3.0</td>
</tr>
<tr>
<td>Los Angeles</td>
<td>100</td>
<td>2.7</td>
<td>8.2</td>
<td>4.5</td>
</tr>
<tr>
<td>Osaka</td>
<td>92</td>
<td>3.6</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Miami</td>
<td>45</td>
<td>2.7</td>
<td>7.7</td>
<td>2.2</td>
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<tr>
<td>New York</td>
<td>42</td>
<td>0.9</td>
<td>5.5</td>
<td>8.3</td>
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<tr>
<td>Hong Kong</td>
<td>41</td>
<td>2.8</td>
<td>6.6</td>
<td>1.9</td>
</tr>
<tr>
<td>Manila</td>
<td>31</td>
<td>4.8</td>
<td>9.5</td>
<td>0.7</td>
</tr>
<tr>
<td>London</td>
<td>30</td>
<td>0.9</td>
<td>7.1</td>
<td>4.8</td>
</tr>
<tr>
<td>Paris</td>
<td>25</td>
<td>0.8</td>
<td>6.6</td>
<td>4.6</td>
</tr>
</tbody>
</table>

1) Risk = Hazard * Loss susceptibility * Values
2) Total material loss, not the insured share
* Normated to max. value 10

Source: Munich Re "Megazilies - Megarisks", 2005
Flood risk in Japan

- Japan is exposed to not only EQ risk, but also Flood risk followed by typhoon
- Isewan Typhoon (Typhoon Vera)
  - Landed Japan on September 26, 1959
  - The strongest typhoon to hit Japan
  - 5,000 people killed and 39,000 people injured

Flood Risk around Metropolitan Area

- In 2006, the Cabinet office set up Investigation Committees regarding flood risk management
  - In light of the circumstances that the frequencies of global flooding and domestic heavy rain had been increasing
- In the report submitted in 2010, potential flood risks in the metropolitan area were estimated:
  - Tonegawa river flooding might cause 53 km² of flooded area, 2,600 of people killed, and 860,000 of flooded houses
  - Arakawa river flooding might cause 110 km² of flooded area, 2,000 of people killed, and 510,000 of flooded houses
Historic Global Natural Disaster Events

- Top 10 Fatality Events (1980-2011)
  - Many of them are Asian events

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Country/Region</th>
<th>Economic Loss (USD Millions)</th>
<th>Insured Loss (USD Millions)</th>
<th>Fatalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan. 12, 2010</td>
<td>Earthquake</td>
<td>Haiti</td>
<td>8,000</td>
<td>200</td>
<td>250,000</td>
</tr>
<tr>
<td>Dec. 26, 2004</td>
<td>EQ/Tsunami</td>
<td>Southeast Asia</td>
<td>15,000</td>
<td>2,000</td>
<td>227,998</td>
</tr>
<tr>
<td>Apr. 29-30, 1991</td>
<td>Tropical Cyclone</td>
<td>Bangladesh</td>
<td>1,700</td>
<td>100</td>
<td>138,865</td>
</tr>
<tr>
<td>May 2-3, 2004</td>
<td>Cyclone Nargis</td>
<td>Myanmar</td>
<td>10,000</td>
<td>N/A</td>
<td>138,365</td>
</tr>
<tr>
<td>Oct. 8, 2005</td>
<td>Earthquake</td>
<td>Pakistan, India, Afghanistan</td>
<td>5,200</td>
<td>5</td>
<td>88,000</td>
</tr>
<tr>
<td>May 12, 2008</td>
<td>Earthquake</td>
<td>China</td>
<td>85,000</td>
<td>425</td>
<td>87,000</td>
</tr>
<tr>
<td>Jul-Aug 2005</td>
<td>Heat Wave</td>
<td>Western and Northern Europe</td>
<td>15,800</td>
<td>20</td>
<td>70,000</td>
</tr>
<tr>
<td>Jul-Sep 2010</td>
<td>Heat Wave</td>
<td>Russia</td>
<td>15,000</td>
<td>20</td>
<td>56,000</td>
</tr>
<tr>
<td>Jan 6, 1990</td>
<td>Earthquake</td>
<td>Iran</td>
<td>7,100</td>
<td>100</td>
<td>40,000</td>
</tr>
<tr>
<td>Dec 8-19, 1999</td>
<td>Floods</td>
<td>Venezuela, Colombia</td>
<td>3,200</td>
<td>220</td>
<td>30,000</td>
</tr>
</tbody>
</table>

Source: Aon Benfield "Annual Global Climate and Catastrophe Report – Impact Forecasting 2011"

Historic Global Natural Disaster Events

- Top 10 Economic Loss Events (1980-2011)
  - Many of them are Asian events
  - Three events in 2011 among top 10 (Tohoku Earthquake ranked no.1)

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<th>Economic Loss (USD Millions)</th>
<th>Insured Loss (USD Millions)</th>
<th>Fatalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar 11, 2011</td>
<td>EQ/Tsunami</td>
<td>Japan</td>
<td>210,000</td>
<td>35,000</td>
<td>15,644</td>
</tr>
<tr>
<td>Aug 23-30, 2005</td>
<td>Hurricane Katrina</td>
<td>United States</td>
<td>125,000</td>
<td>66,900</td>
<td>1,835</td>
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<tr>
<td>Jan 17, 1995</td>
<td>Earthquake</td>
<td>Japan</td>
<td>102,300</td>
<td>3,075</td>
<td>6,434</td>
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<tr>
<td>May 12, 2006</td>
<td>Earthquake</td>
<td>China</td>
<td>81,000</td>
<td>425</td>
<td>87,000</td>
</tr>
<tr>
<td>Jul-Nov 2011</td>
<td>Flooding</td>
<td>Thailand</td>
<td>45,000</td>
<td>10,789</td>
<td>790</td>
</tr>
<tr>
<td>Jan 17, 1994</td>
<td>Earthquake</td>
<td>United States</td>
<td>41,800</td>
<td>11,300</td>
<td>57</td>
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<tr>
<td>Sep 6-14, 2008</td>
<td>Hurricane Ike</td>
<td>U.S., Caribbean Islands</td>
<td>37,600</td>
<td>15,000</td>
<td>195</td>
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<tr>
<td>May-Sep 1998</td>
<td>Floods</td>
<td>China</td>
<td>32,000</td>
<td>1,000</td>
<td>3,656</td>
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<tr>
<td>Feb 27, 2010</td>
<td>EQ/Tsunami</td>
<td>Chile</td>
<td>50,000</td>
<td>8,500</td>
<td>525</td>
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<tr>
<td>Dec 8-19, 1999</td>
<td>Floods</td>
<td>Australia (Queensland)</td>
<td>30,000</td>
<td>2,420</td>
<td>36</td>
</tr>
</tbody>
</table>

Source: Aon Benfield "Annual Global Climate and Catastrophe Report – Impact Forecasting 2011"
Historic Global Natural Disaster Events

- **Top 10 Insured Loss Events (1980-2011)**
  - Three events in 2011 among top 10 (Tohoku EQ ranked no.2)
  - Many of them are US events

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Country/Region</th>
<th>Economic Loss (USD Millions)</th>
<th>Insured Loss (USD Millions)</th>
<th>Fatalities</th>
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</thead>
<tbody>
<tr>
<td>Aug. 25-30, 2005</td>
<td>Hurricane Katrina</td>
<td>United States</td>
<td>525,000</td>
<td>66,900</td>
<td>1,833</td>
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<tr>
<td>Mar. 11, 2011</td>
<td>EQ/Tsunami</td>
<td>Japan</td>
<td>210,000</td>
<td>35,000</td>
<td>15,444</td>
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<tr>
<td>Aug. 25-27, 1992</td>
<td>Hurricane Andrew</td>
<td>United States</td>
<td>26,750</td>
<td>17,000</td>
<td>60</td>
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<tr>
<td>Sep. 6-14, 2008</td>
<td>Hurricane Ike</td>
<td>United States, Caribbean</td>
<td>37,400</td>
<td>15,000</td>
<td>195</td>
</tr>
<tr>
<td>Jan. 17, 1994</td>
<td>Earthquake</td>
<td>United States</td>
<td>41,800</td>
<td>15,300</td>
<td>57</td>
</tr>
<tr>
<td>Sep. 7-21, 2004</td>
<td>Hurricane Ivan</td>
<td>U.S., Caribbean</td>
<td>18,800</td>
<td>13,800</td>
<td>130</td>
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<tr>
<td>Feb. 22, 2011</td>
<td>Earthquake</td>
<td>New Zealand</td>
<td>30,000</td>
<td>12,500</td>
<td>182</td>
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<tr>
<td>Oct. 19-24, 2005</td>
<td>Hurricane Wilma</td>
<td>U.S., Mexico, Bahamas, Caribbean</td>
<td>21,000</td>
<td>12,500</td>
<td>40</td>
</tr>
<tr>
<td>July-Nov. 2011</td>
<td>Flooding</td>
<td>Thailand</td>
<td>45,000</td>
<td>10,789</td>
<td>716</td>
</tr>
<tr>
<td>Sep. 20-24, 2005</td>
<td>Hurricane Rita</td>
<td>United States</td>
<td>12,097</td>
<td>10,200</td>
<td>10</td>
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</tbody>
</table>

Source: Aon Benfield “Annual Global Climate and Catastrophe Report – Impact Forecasting 2011”

Global Economic & Insured Losses by Peril

Source: Aon Benfield “Annual Global Climate and Catastrophe Report – Impact Forecasting 2012”
Global Economic Loss Events by Region

- Global Billion-Dollar-Plus Economic Loss Events by Region
  - Economic Losses in Asia were second to the U.S.

Source: Aon Benfield “Annual Global Climate and Catastrophe Report – Impact Forecasting 2012”

Global Insured Loss Events by Region

- Global Billion-Dollar-Plus Insured Loss Events by Region
  - Whereas Insured Losses in Asia were small

Source: Aon Benfield “Annual Global Climate and Catastrophe Report – Impact Forecasting 2012”
Global Natural Disaster Events in 2011

- Top 10 Human Fatality Events in 2011

<table>
<thead>
<tr>
<th>Event Date</th>
<th>Event Name Or Type</th>
<th>Event Location</th>
<th># Of Deaths</th>
<th># Of Structures/ Claims</th>
<th>Economic Loss Estimates (USD)</th>
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</thead>
<tbody>
<tr>
<td>3/11</td>
<td>Earthquake</td>
<td>Japan</td>
<td>15,844</td>
<td>1,100,000</td>
<td>210.0 billion</td>
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<tr>
<td>12/16-12/17</td>
<td>TS Wash</td>
<td>Philippines</td>
<td>1,237</td>
<td>46,499</td>
<td>31.70 million</td>
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<td>1/10-1/14</td>
<td>Flooding</td>
<td>Brazil</td>
<td>903</td>
<td>21,500</td>
<td>1.20 billion</td>
</tr>
<tr>
<td>7/29-7/30</td>
<td>Flooding</td>
<td>Thailand</td>
<td>790</td>
<td>4,000,000</td>
<td>45.00 billion</td>
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<tr>
<td>10/23</td>
<td>Earthquake</td>
<td>Turkey</td>
<td>804</td>
<td>15,000</td>
<td>750.00 million</td>
</tr>
<tr>
<td>8/12-8/30</td>
<td>Flooding</td>
<td>Pakistan</td>
<td>520</td>
<td>1,600,000</td>
<td>2.90 billion</td>
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<tr>
<td>4/22-4/28</td>
<td>Severe Weather</td>
<td>SouthEast, Plains, Midwest</td>
<td>544</td>
<td>700,000</td>
<td>10.20 billion</td>
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<tr>
<td>9/10-10/31</td>
<td>Flooding</td>
<td>Cambodia</td>
<td>250</td>
<td>230,000</td>
<td>3.21 billion</td>
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<tr>
<td>6/1-6/24</td>
<td>Flooding</td>
<td>China</td>
<td>219</td>
<td>500,000</td>
<td>6.65 billion</td>
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<td>10/19-10/21</td>
<td>TS 02B</td>
<td>Myanmar</td>
<td>215</td>
<td>6,000</td>
<td>1.75 million</td>
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</tbody>
</table>

Source: Aon Benfield “Annual Global Climate and Catastrophe Report – Impact Forecasting 2011”

Global Natural Disaster Events in 2011

- Top 10 Structural Damage and Filed Claim Events in 2011

<table>
<thead>
<tr>
<th>Event Date</th>
<th>Event Name Or Type</th>
<th>Event Location</th>
<th># Of Deaths</th>
<th># Of Structures/ Claims</th>
<th>Economic Loss Estimates (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/29-11/30</td>
<td>Flooding</td>
<td>Thailand</td>
<td>790</td>
<td>4,000,000</td>
<td>45.00 billion</td>
</tr>
<tr>
<td>8/12-8/30</td>
<td>Flooding</td>
<td>Pakistan</td>
<td>520</td>
<td>1,400,000</td>
<td>2.00 billion</td>
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<td>Japan</td>
<td>15,844</td>
<td>1,100,000</td>
<td>210.0 billion</td>
</tr>
<tr>
<td>8/22-8/30</td>
<td>Mw Hene</td>
<td>U.S., Bahamas, Caribbean Isl.</td>
<td>46</td>
<td>833,000</td>
<td>8.55 billion</td>
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<tr>
<td>5/21-5/27</td>
<td>Severe Weather</td>
<td>Plains, Midwest, SouthEast</td>
<td>183</td>
<td>750,000</td>
<td>9.10 billion</td>
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<tr>
<td>4/32-4/38</td>
<td>Severe Weather</td>
<td>SouthEast, Plains, Midwest</td>
<td>344</td>
<td>700,000</td>
<td>10.20 billion</td>
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<tr>
<td>3/21-4/18</td>
<td>Flooding</td>
<td>Thailand</td>
<td>61</td>
<td>609,967</td>
<td>880.00 million</td>
</tr>
<tr>
<td>6/7-6/24</td>
<td>Flooding</td>
<td>China</td>
<td>219</td>
<td>500,000</td>
<td>6.65 billion</td>
</tr>
<tr>
<td>1/15-3/31</td>
<td>Flooding</td>
<td>Colombia</td>
<td>116</td>
<td>375,000</td>
<td>5.85 billion</td>
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<tr>
<td>7/27-7/30</td>
<td>Tyf Nock ten</td>
<td>Philippines, China, Vietnam</td>
<td>94</td>
<td>340,000</td>
<td>126.00 million</td>
</tr>
</tbody>
</table>

Source: Aon Benfield “Annual Global Climate and Catastrophe Report – Impact Forecasting 2011”
Global Natural Disaster Events in 2011

- Top 10 Insured Loss Events in 2011

<table>
<thead>
<tr>
<th>Event Date</th>
<th>Event Name Or Type</th>
<th>Event Location</th>
<th># Of Deaths</th>
<th># Of Structures Claims</th>
<th>Economic Loss Estimates (USD)</th>
<th>Insured Loss Estimates (USD)</th>
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</thead>
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<tr>
<td>3/11</td>
<td>Earthquake</td>
<td>Japan</td>
<td>15,844</td>
<td>1,100,000</td>
<td>290.00 billion</td>
<td>35.00 billion</td>
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<tr>
<td>2/22</td>
<td>Earthquake</td>
<td>New Zealand</td>
<td>182</td>
<td>156,313</td>
<td>*30.00 billion</td>
<td>13.50 billion</td>
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<td>7/25-11/30</td>
<td>Flooding</td>
<td>Thailand</td>
<td>790</td>
<td>4,000,000</td>
<td>45.00 billion</td>
<td>10.78 billion</td>
</tr>
<tr>
<td>4/22-9/28</td>
<td>Severe Weather</td>
<td>U.S. (Southeast, Plains, Midwest)</td>
<td>344</td>
<td>700,000</td>
<td>10.20 billion</td>
<td>7.50 billion</td>
</tr>
<tr>
<td>5/21-5/27</td>
<td>Severe Weather</td>
<td>U.S. (Plains, Midwest, Southeast)</td>
<td>181</td>
<td>750,000</td>
<td>9.10 billion</td>
<td>6.75 billion</td>
</tr>
<tr>
<td>8/22-9/30</td>
<td>Hurricane</td>
<td>U.S., Bahamas, Caribbean Is.</td>
<td>46</td>
<td>850,000</td>
<td>8.55 billion</td>
<td>5.00 billion</td>
</tr>
<tr>
<td>12/21-1/14</td>
<td>Flooding</td>
<td>Australia (Queensland)</td>
<td>36</td>
<td>58,463</td>
<td>30.00 billion</td>
<td>2.42 billion</td>
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<tr>
<td>4/3-4/7</td>
<td>Severe Weather</td>
<td>U.S. (Midwest, Southwest, Plains)</td>
<td>9</td>
<td>225,000</td>
<td>2.80 billion</td>
<td>2.00 billion</td>
</tr>
<tr>
<td>6/13</td>
<td>Earthquake</td>
<td>New Zealand</td>
<td>1</td>
<td>53,963</td>
<td>*30.00 billion</td>
<td>1.80 billion</td>
</tr>
<tr>
<td>4/11-4/16</td>
<td>Severe Weather</td>
<td>U.S. (Plains, Southeast, Midwest)</td>
<td>48</td>
<td>150,000</td>
<td>2.50 billion</td>
<td>1.70 billion</td>
</tr>
</tbody>
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Source: Aon Benfield “Annual Global Climate and Catastrophe Report – Impact Forecasting 2011”

Household EQ Insurance System

- Established in 1966 with Niigata EQ in 1964 as a turning point
- For contribution to the stabilization of the lives of the suffered people
- Operated jointly by Government and companies
  - Premium rates are required to be as low as possible while maintaining equilibrium between income and expenses
  - Reinsurance contracts are underwritten by Government
  - The total amount of paid premiums, excluding necessary expenses for contracts, is accrued as fund reserved

Source: The Institute of Actuaries of Japan “The Great Tohoku Earthquake”
Net claims paid for Tohoku EQ and Thai Flood

- Gross claims of Households EQ insurance paid for Tohoku EQ were USD 12.4bn, but actual financial impact was quite small
  - Almost half of that is ceded to the Government
  - It’s neutral to P/L, due to compensation with the release of EQ reserve
- Net claims of commercial insurance
  - Tohoku EQ: USD 2.0bn < Thai flood: USD 4.2bn

The Thai Floods

Overview of the Floods
Overview of the Thai Floods

- Duration: July - December, 2011
- Fatalities: Over 800 people
- Economic Loss: USD45.7 bn (approx. 13% of Thai GDP)

Major causes

- Why was the damage so significant?
  - Amount of rainfall
  - Flooded area
  - Duration of the floods
  - Concentration of major factories
  - Disruption of world wide supply chains
Major causes

- Why was the damage so significant?
  - Amount of rainfall
  - Flooded area
  - Duration of the floods
  - Concentration of major factories
  - Disruption of world wide supply chains

Amount of rainfall

- Once in 50 years heavy rainfall

Source: Thai Meteorological Department
Major causes

- Why was the damage so significant?
  - Amount of rainfall
  - Flooded area
  - Duration of the floods
  - Concentration of major factories
  - Disruption of world wide supply chains

Flooded area

- Flooded area
  - Highlighted provinces of the map

Source: JETRO
Major causes

• Why was the damage so significant?
  – Amount of rainfall
  – Flooded area
  – Duration of the floods
  – Concentration of major factories
  – Disruption of world wide supply chains

Cause of flood and long duration

• Cause of the flood
  – Levee collapsed on the upstream Chao Phraya river

• Cause of long duration
  – Flat landscape
  – A slope of 1.5m per 100km from Bangkok to Ayutthaya

Source: Ministry of Land, Infrastructure, Transport and Tourism
Major causes

- Why was the damage so significant?
  - Amount of rainfall
  - Flooded area
  - Duration of the floods
  - Concentration of major factories
  - Disruption of world wide supply chains

The economy of Thailand

- Thailand is the 2nd largest country in ASEAN (Association of Southeast Asian Nations) in terms of Nominal GDP
- Thailand is a major automobile manufacturer
  - Thailand is called ‘Detroit in Asia’

<table>
<thead>
<tr>
<th>Economic Comparison</th>
<th>Year 2011</th>
<th>Thailand</th>
<th>Indonesia</th>
<th>Malaysia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (x 1000)</td>
<td>64,080</td>
<td>241,030</td>
<td>28,730</td>
<td></td>
</tr>
<tr>
<td>Nominal GDP (USD billion)</td>
<td>145.6</td>
<td>845.7</td>
<td>238.7</td>
<td></td>
</tr>
<tr>
<td>Nominal GDP Mix</td>
<td>Agriculture, forestry, and fisheries</td>
<td>9%</td>
<td>11%</td>
<td>8%</td>
</tr>
<tr>
<td>Mining</td>
<td>2%</td>
<td>8%</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>39%</td>
<td>26%</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td>2%</td>
<td>6%</td>
<td>3%</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>45%</td>
<td>47%</td>
<td>53%</td>
<td></td>
</tr>
</tbody>
</table>

Automobile Production

- Thailand
- Malaysia
- Indonesia
Automobile industry in Thailand

- Many car related companies and their employees in Thailand
- Much more than Indonesia, the largest in ASEAN in terms of Nominal GDP

Automobile industry in Thailand

- Car maker: 13 companies, 100,000 employees
- 1st-tier Supplier: 635 companies, 250,000 employees
- 2nd,3rd-tier Supplier: 1,700 companies, 175,000 employees
- Total: 2,348 companies, 525,000 employees

Automobile industry in Indonesia

- Car maker: 20 companies, 27,000 employees
- 1st-tier Supplier: 250 companies, 42,000 employees
- 2nd,3rd-tier Supplier: 550 companies, 28,000 employees
- Total: 820 companies, 97,000 employees

Source: Bank of Tokyo-Mitsubishi UFJ, Economic Review No.2013-1

HDD industry in Thailand

- Thailand is the world’s #1 producer of HDD (Hard Disk Drive)
- 43% share of world market

Market Share of HDD Production in the World (2010)

- Thailand, 43%
- China, 25%
- Malaysia, 19%
- Philippines, 7%
- Singapore, 4%
- South Korea, 3%

Source: Development Bank of Japan Inc.
Japanese affiliated companies operating in Thailand

- Over 1,400 Japanese affiliated companies are operating in Thailand
- Manufacturing makes up about half

Number of Japanese affiliated companies operating in Thailand (2013)

- Manufacturing: 712
- Engineering/Construction: 78
- Aviation/Transport: 85
- Commerce/Trade: 274
- Others: 309

* Companies which are members of Japanese Chamber of Commerce, Bangkok

Concentration of major factories

- Many industrial parks concentrated along Chao Phraya River
- 7 industrial parks and over 800 factories were flooded

Source: Derived from Tokyo Development Consultants
Major causes

- Why was the damage so significant?
  - Amount of rainfall
  - Flooded area
  - Duration of the floods
  - Concentration of major factories
  - Disruption of worldwide supply chains

Disruption of worldwide supply chains

- Concentration of major factories and the floods’ duration caused disruption of worldwide supply chains

- This affected the productivity of manufacturers not only in Thailand but also in other countries
  - In the case of Nidec, a hard disc motor maker
  - In the case of Honda, a car manufacturer
The Thai Floods

The impact for insurers by the Floods

Ranking of costliest natural disaster event

- The 9th costliest event in terms of insured losses since 1980

**Top 10 Insured Loss Events (1980-2011)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Country/Region</th>
<th>Economic Loss (USD Millions)</th>
<th>Insured Loss (USD Millions)</th>
<th>Fatalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 25-30, 2005</td>
<td>Hurricane Katrina</td>
<td>United States</td>
<td>125,000</td>
<td>66,900</td>
<td>1,833</td>
</tr>
<tr>
<td>Mar. 11, 2011</td>
<td>EQ/Tsunami</td>
<td>Japan</td>
<td>270,000</td>
<td>35,000</td>
<td>13,844</td>
</tr>
<tr>
<td>Aug. 23-27, 1992</td>
<td>Hurricane Andrew</td>
<td>United States</td>
<td>26,750</td>
<td>17,000</td>
<td>60</td>
</tr>
<tr>
<td>Sep. 6-14, 2008</td>
<td>Hurricane Ike</td>
<td>United States, Caribbean</td>
<td>37,600</td>
<td>15,000</td>
<td>195</td>
</tr>
<tr>
<td>Jan. 17, 1994</td>
<td>Earthquake</td>
<td>United States</td>
<td>45,800</td>
<td>13,300</td>
<td>57</td>
</tr>
<tr>
<td>Sep. 7-21, 2004</td>
<td>Hurricane Ivan</td>
<td>United States, Caribbean</td>
<td>18,800</td>
<td>13,800</td>
<td>130</td>
</tr>
<tr>
<td>Feb. 22, 2011</td>
<td>Earthquake</td>
<td>New Zealand</td>
<td>*50,000</td>
<td>13,500</td>
<td>182</td>
</tr>
<tr>
<td>Oct. 19-24, 2005</td>
<td>Hurricane Wilma</td>
<td>U.S., Mexico, Bahamas, Caribbean</td>
<td>21,000</td>
<td>12,500</td>
<td>40</td>
</tr>
<tr>
<td>July-Nov. 2011</td>
<td>Flooding</td>
<td>Thailand</td>
<td>41,000</td>
<td>10,789</td>
<td>790</td>
</tr>
<tr>
<td>Sep. 20-24, 2005</td>
<td>Hurricane Rita</td>
<td>United States</td>
<td>12,037</td>
<td>10,200</td>
<td>10</td>
</tr>
</tbody>
</table>

*The New Zealand earthquake has only released a combined USD10 billion economic loss total for the Sept., 2010, Feb., 2011 and June 2011 EQ events.

Source: Aon Benfield
The losses for each insurer

- The amount of losses for foreign (outside of Thailand) insurers were significant.
- Particularly, the amount of losses for Japanese insurers topped the list.

**Japanese insurers**

**Estimated Losses**

<table>
<thead>
<tr>
<th>Insurer</th>
<th>Estimated Losses (USD millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MHI</td>
<td>2,242</td>
</tr>
<tr>
<td>Tokio Marine</td>
<td>1,371</td>
</tr>
<tr>
<td>MSU Holdings</td>
<td>1,300</td>
</tr>
<tr>
<td>Mizuho</td>
<td>1,260</td>
</tr>
<tr>
<td>Swiss Re</td>
<td>642</td>
</tr>
<tr>
<td>Swiss Re</td>
<td>540</td>
</tr>
<tr>
<td>Zurich Financial*</td>
<td>375</td>
</tr>
<tr>
<td>SICOR</td>
<td>140</td>
</tr>
<tr>
<td>AIG Group*</td>
<td>144</td>
</tr>
<tr>
<td>Everest Re</td>
<td>120</td>
</tr>
<tr>
<td>Everest Re</td>
<td>145</td>
</tr>
<tr>
<td>1st Re</td>
<td>120</td>
</tr>
<tr>
<td>Prudential</td>
<td>28</td>
</tr>
</tbody>
</table>
| Source: Thailand Flood: A Case Study (Hong Kong 2012)

Financial impact on Japanese insurers

- Financial impact on Japanese insurers*
  - Net Loss for The Year of FY 2011 (Actual) caused by Thai Flood reached USD 1.8 billion (= around 4% of their Total Net Asset)

**Financial Impact Breakdown (USD billions)**

- Net Claims (Caused by Thai Flood): USD 4.2 billion
- Release of Cat Loss Reserve: USD 1.5 billion
- Tax Deduction: USD 0.9 billion
- Net Loss for The Year: USD 1.8 billion

* The top 5 insurers which were damaged by Thai Flood
* 1USD = 100 JPY

Estimated based on the companies' financial reports.
The Change of Net Profit for The Year

- The impact on Japanese insurers *1
  - Went into the red in FY 2011

The Change in Net Profit (unit: USD bn)

<table>
<thead>
<tr>
<th>Year</th>
<th>Change in Net Profit (USD bn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY2007</td>
<td>2.3</td>
</tr>
<tr>
<td>FY2008</td>
<td>0.4</td>
</tr>
<tr>
<td>FY2009</td>
<td>2.0</td>
</tr>
<tr>
<td>FY2010</td>
<td>1.2</td>
</tr>
<tr>
<td>FY2011</td>
<td>-2.1</td>
</tr>
</tbody>
</table>

*1 The top 5 insurers which were damaged by the Thai Flood
*2 The Tohoku Earthquake occurred in the 4th Quarter of FY2010.

The Thai Floods

National Catastrophe Insurance Fund in Thailand
Foundational National Catastrophe Insurance Fund

- Problem of purchasing flood cover
- Foundation of National Catastrophe Insurance Fund

Catastrophe Insurance Policy

The definition of “catastrophe”
Accident which meets either of the following criteria
- Upon the advice given by the Department of Disaster Prevention and Mitigation, declaration of the Cabinet of Ministers that a particular event has escalated to a ‘Catastrophe’
- The total claim for catastrophe damages exceeds 5 billion baht per event that is within a 60-day duration and with a minimum of 2 claimers
  - Earthquake with the magnitude at least 7 on the Richter scale
  - Windstorm with the wind speed at least 120 kilometers per hour

<table>
<thead>
<tr>
<th>Insured Type</th>
<th>Coverage</th>
<th>Claim</th>
<th>Deductible</th>
<th>Premium (Per Annum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household</td>
<td>&quot;Fire and Catastrophe Insurance Policy for Household&quot; will provide automatic coverage to catastrophe with a sublimit of 100,000 baht</td>
<td>- Water reaches the floor of the household: 30% of sublimit&lt;br&gt;- Water reaches 50 cm: 50% of sublimit&lt;br&gt;- Water reaches 75 cm: 75% of sublimit&lt;br&gt;- Water reaches 100 cm: 100% of sublimit</td>
<td>None</td>
<td>0.50%</td>
</tr>
<tr>
<td>SME (Sum Insured not exceeding 50 million baht)</td>
<td>SME will be entitled to buy catastrophe’s protection with a sublimit of 50% of the sum insured</td>
<td>Loss adjuster / Surveyor will determine the actual loss and the business operators will be paid accordingly</td>
<td>5% of sublimit</td>
<td>1.00%</td>
</tr>
<tr>
<td>Industrial Sector</td>
<td>Industrial operators will be entitled to buy catastrophe’s protection with a sublimit of 30% of the sum insured</td>
<td>Loss adjuster / Surveyor will determine the actual loss and the business operators will be paid accordingly</td>
<td>5% of sublimit</td>
<td>1.25%</td>
</tr>
</tbody>
</table>

Sources: Office of Insurance Commission
The lessons learned from the Thai Floods

The lessons learned and the actions based on the Floods

- Why did Japanese non-life insurers suffer a heavy impact?
- What did they learn from the event?
- What kind of actions should they take?
The issues (summary)

1) Risk identification
   – Insufficient identification of flood risk in Thailand
2) Data adequacy and sufficiency
3) CBI (Contingency Business Interruption)
   – Difficulty of grasping location and quantity of exposure in CBI
4) Risk quantification by CAT Model
   – Appropriateness of CAT model (Model risk)
   – Risk management of non-modeled perils

The issues and the actions (1)

Risk identification

- The issues
  – Insufficient identification of flood risk in Thailand
    - Improper Risk accumulation management
    - No major vendor model for flood risk

- The actions
  – Identification of significant CAT risk
    - To cover all the significant CAT risk comprehensively
      - flood, Hail, Tsunami...
    - To grasp exposures and risk amount by area and peril
      - Making information into data and improving the accuracy
The issues and the actions (2)

Data adequacy and sufficiency

• The issues
  – Data adequacy and sufficiency

• The actions
  – Improvement of the data accuracy and the acquisition of more detailed information
  – It is important to consider both accumulation risk management and risk quantification

The issues and the actions (3)

CBI

• The issues
  – Difficulty of grasping location and quantity of exposure in CBI (Contingency Business Interruption)

• The actions
  – Seeking to acquire more detailed information of exposure even in case of unnamed insured
  – Revision of policy (riders) conditions
    • unnamed insured → named insured
  – Improvement of underwriting
    • adoption of Sub-Limit, Rating up, etc.
The issues and the actions (4)

Risk quantification by CAT model (Validation)

• The issues
  – Validation of CAT model (Model risk)

• The actions
  – Improvement of the accuracy of CAT model
    • Improvement of the accuracy of data used by model
    • Comparison with some models
    • Upgrading of validation of model
      – Back test, etc.

The issues and the actions (4)

Risk quantification by CAT model (non-modeled perils)

• The issues
  – Risk management of non-modeled perils

• The actions
  – Identification of availability of CAT model
  – Seeking to develop CAT model
  – Scenario analysis by on-site survey
    • Considering of the importance of non-modeled perils (total amount, general statistics, etc.)
The issues and the actions (4)

Risk quantification by CAT model (non-modeled perils)

- Model Coverage: Earthquake

- Model Coverage: Windstorm

* This information is based on our investigation. It may differ from the latest status.
The issues and the actions (4)

Risk quantification by CAT model (non-modeled perils)
• Model Coverage: Flood

The other issues and the actions

Liquidity and credit risk management
• The issues
  – Preparation of adequate liquidity assets
    • Importance of quantifying CAT risk
    • Asset Liability Management in Japanese insurers
    • Preparation of foreign currency
    • Currency risk management
  – Credit risk management about reinsurers
• The actions
  – Review of necessary amount of liquidity assets
  – Systematic foreign currency financing
  – Making use of Forward Exchange Contract
  – Reinforcement of monitoring of reinsurers

* This information is based on our investigation. It may differ from the latest status.
Conclusion

• Dealing with risk beyond expectations
  – Analyzing CAT risk closely through improving data accuracy and acquiring more detailed information

• Proactive Risk Management

• Speedy actions
  – Considering the priority

• A role of actuaries
  – Evaluating process and result of risk quantification appropriately as experts for various risks

Thank you!

ありがとうございます！
Appendix: Reference for Section 2

- Thai Meteorological Department
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- Ministry of Land, Infrastructure, Transport and Tourism
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