Flood Insurance

From Clients to Global Financial Markets

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Topics

Recent flood disasters and disaster statistics
Disaster risk management
Flood insurance
Cat bonds
Micro-insurance
Final remarks
Recent flood disasters and disaster statistics

The costliest floods in the 21st century

(Original values in US$ million, not adjusted for inflation)

<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
<th>Total Losses</th>
<th>Insured Losses</th>
<th>% Insured</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>Japan: Typhoon Saomai</td>
<td>1,400</td>
<td>1,050</td>
<td>75</td>
</tr>
<tr>
<td>2002</td>
<td>China</td>
<td>8,200</td>
<td>&lt;1</td>
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<tr>
<td>2003</td>
<td>China (Yangtze, Huai)</td>
<td>7,890</td>
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<tr>
<td>2004</td>
<td>China (Yangtze, Yellow, Huai)</td>
<td>7,800</td>
<td>&lt;1</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>India, Bangladesh, Nepal</td>
<td>5,000</td>
<td>&lt;1</td>
<td></td>
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<tr>
<td>2005</td>
<td>China (Pearl)</td>
<td>5,000</td>
<td>&lt;1</td>
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<tr>
<td>2005</td>
<td>India (Mumbai)</td>
<td>5,000</td>
<td>770</td>
<td>15</td>
</tr>
<tr>
<td>2006</td>
<td>India (Gujarat, Orissa)</td>
<td>5,300</td>
<td>400</td>
<td>8</td>
</tr>
<tr>
<td>2007</td>
<td>Indonesia (Jakarta)</td>
<td>1,700</td>
<td>410</td>
<td>24</td>
</tr>
<tr>
<td>2007</td>
<td>Tajikistan</td>
<td>1,000</td>
<td>&lt;1</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>India</td>
<td>2,600</td>
<td>&lt;1</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>Oman: Tropical Cyclone Gonu</td>
<td>3,900</td>
<td>650</td>
<td>17</td>
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<tr>
<td>2007</td>
<td>China (Huai)</td>
<td>6,800</td>
<td>&lt;1</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>Pakistan: Tropical Cyclone Yemyin</td>
<td>990</td>
<td>&lt;1</td>
<td></td>
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<tr>
<td>2007</td>
<td>Bangladesh: Tropical Cyclone Sidr</td>
<td>* 3,775</td>
<td>&lt;1</td>
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<tr>
<td>2000</td>
<td>Italy (north), Switzerland (south)</td>
<td>8,500</td>
<td>470</td>
<td>6</td>
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<tr>
<td>2000</td>
<td>United Kingdom</td>
<td>1,500</td>
<td>1,100</td>
<td>73</td>
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<tr>
<td>2002</td>
<td>Central Europe (Elbe, Danube)</td>
<td>21,500</td>
<td>3,400</td>
<td>16</td>
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<tr>
<td>2003</td>
<td>France (Rhone)</td>
<td>1,600</td>
<td>900</td>
<td>56</td>
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<tr>
<td>2005</td>
<td>Romania, Bulgaria</td>
<td>2,440</td>
<td>15</td>
<td>&lt;1</td>
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<tr>
<td>2005</td>
<td>Switzerland, Austria, Germany (Bavaria)</td>
<td>3,300</td>
<td>1,760</td>
<td>53</td>
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<tr>
<td>2007</td>
<td>United Kingdom</td>
<td>8,000</td>
<td>6,000</td>
<td>75</td>
</tr>
<tr>
<td>2001</td>
<td>USA: Tropical Storm Allison (Houston,TX)</td>
<td>6,000</td>
<td>3,500</td>
<td>58</td>
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<tr>
<td>2001</td>
<td>Argentina</td>
<td>750</td>
<td>&lt;1</td>
<td></td>
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<tr>
<td>2005</td>
<td>Canada (Alberta)</td>
<td>860</td>
<td>190</td>
<td>22</td>
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<tr>
<td>2005</td>
<td>USA: Hurricane Katrina (Gulf Coast)</td>
<td>* 125,000</td>
<td>61,600</td>
<td>49</td>
</tr>
<tr>
<td>2007</td>
<td>Mexico (Tabasco)</td>
<td>2,500</td>
<td>350</td>
<td>14</td>
</tr>
<tr>
<td>2007</td>
<td>Australia (East Coast)</td>
<td>* 1,300</td>
<td>680</td>
<td>52</td>
</tr>
<tr>
<td>2008</td>
<td>Australia (Queensland)</td>
<td>? 2,000</td>
<td>1,600</td>
<td>&gt;80</td>
</tr>
<tr>
<td>2000</td>
<td>Mozambique, Zimbabwe, South Africa</td>
<td>715</td>
<td>50</td>
<td>7</td>
</tr>
<tr>
<td>2007</td>
<td>Madagascar</td>
<td>* 240</td>
<td>&lt;1</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>Sudan</td>
<td>300</td>
<td>&lt;1</td>
<td></td>
</tr>
</tbody>
</table>

* Including wind-storm losses
Topics Geo - Annual review of natural catastrophes

First edition in 1994

Now available in 5 languages:
- German
- English
- French
- Italian
- Spanish

Flood losses in Europe

Total losses [US$ bn]

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As at: February 2008
Flood losses in Europe

<table>
<thead>
<tr>
<th>Year</th>
<th>Insured Losses [US$ bn]</th>
<th>10-year Running Mean</th>
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<tbody>
<tr>
<td>1980</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>1982</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>1984</td>
<td>0.8</td>
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<tr>
<td>1986</td>
<td>0.4</td>
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<tr>
<td>1988</td>
<td>0.6</td>
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<tr>
<td>2004</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>5.0</td>
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</tr>
</tbody>
</table>

Great Flood Disasters 1950 – 2006

Overall and insured losses

<table>
<thead>
<tr>
<th>Year</th>
<th>Economic Losses [US$ bn]</th>
<th>Insured Losses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>5.0</td>
<td>2.0</td>
</tr>
<tr>
<td>1955</td>
<td>6.0</td>
<td>3.0</td>
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<td>1960</td>
<td>7.0</td>
<td>4.0</td>
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<tr>
<td>1965</td>
<td>8.0</td>
<td>5.0</td>
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<tr>
<td>1970</td>
<td>9.0</td>
<td>6.0</td>
</tr>
<tr>
<td>1975</td>
<td>10.0</td>
<td>7.0</td>
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<td>11.0</td>
<td>8.0</td>
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<td>1985</td>
<td>12.0</td>
<td>9.0</td>
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<td>1990</td>
<td>13.0</td>
<td>10.0</td>
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<td>1995</td>
<td>14.0</td>
<td>11.0</td>
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<tr>
<td>2000</td>
<td>15.0</td>
<td>12.0</td>
</tr>
<tr>
<td>2005</td>
<td>16.0</td>
<td>13.0</td>
</tr>
<tr>
<td>2006</td>
<td>17.0</td>
<td>14.0</td>
</tr>
</tbody>
</table>

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As at: February 2008
What are “great natural catastrophes“?

The affected region's ability to help itself is distinctly overtaxed
- Interregional or international assistance is necessary
- Thousands are killed
- Hundreds of thousands are made homeless
- Substantial economic losses
- Considerable insured losses

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Why only “great natural catastrophes“?

... because neglecting the development in worldwide communication activity during the past decades extremely biases the statistics of ALL loss events.

It may even lead to wrong trends.
Disaster risk management

Risk reduction

Risk = \( f(\text{Hazard}, \text{Values at risk}, \text{Vulnerability}) \)

How can we reduce the risk?

by reducing one or more of these influencing factors
Risk reduction requires a risk partnership between Public authorities, People concerned, and Insurance industry.

Main tasks of the partners:

**Public authorities/organisations**

→ basic prevention measures:
  - avoiding frequent losses
  - mitigation during rare events

- land-use regulations
- technical flood control
- observation networks
- forecasting and warning
- flood retention
- providing information
People concerned/affected

→ actions during rare events: loss prevention/reduction/limitation

- proper construction
- spot protection
- appropriate behaviour (alarm plan, checklist)
- seeking/receiving information
- maintaining risk awareness

Insurance industry

→ securing existence, prevention of ruinous consequences for personal/business property

- assuming part of the risk
- proper risk assessment
- adequate contracts
- providing information
- accumulation control

→ Make sure that the commitments towards the insureds can be fulfilled.
Risk partnership

in a more holistic way . . .

The international risk spreading system

Insurance clients

Primary insurers

Re-insurers

Capital market

Retrocession
Example of reinsured losses

**Hurricane Gilbert (Jamaica 1988)**

- **Economic loss:** 2 000 mio US$
- **Insured loss:** 700 mio US$
- **Reinsured loss:** 690 mio US$ (99%)

Typical percentages of reinsured losses:
- Weak markets: >90%
- Strong markets: <50%
Flood insurance

General problems

- large loss potential
- linear rather than area impacts
- high variation of exposure within short distance
- high influence of local factors
- flood control structures (e.g. dykes) make floods rare, but have almost no effect during extreme events
- loss of awareness and feeling of security
- anti- or adverse selection
Flood insurance

Principle of the insurance

\[
\text{sum of premiums from all clients} = \text{sum of payments to the affected clients}
\]

\[ (+ \text{ yields}) \quad ( + \text{ administrative costs + profits}) \]

Adverse selection

A Only those, who subjectively feel threatened by a flood, have interest in insurance cover; a large portion of them is in fact exposed to a high risk and experiences losses more or less regularly.

B The others feel safe and do not want to get insured.

If the portfolio mainly consists of members of group A, the spatial and temporal risk compensation is not guaranteed anymore.

Flood insurance

Approaches to a solution

- information about the individual exposure
- definition of zones according to exposure level (country-wide for all areas)
- exclusion of particularly exposed areas
- insurance package including coverage for other natural hazards (geographical spread of risk)
- adequately structured insurance contracts including deductibles and limits
- encouragement of measures for individual loss reduction
Flood insurance

Hazard zonation: Flood risk classes in the Austrian system HORA

Frequency of flooding:
- on average once in >200 years: GK 1
- 50-200 years: GK 2
- 10-50 years: GK 3
- <10 years: GK 4
Flood insurance

**Insurance packages including:**

- earthquake
- volcanic eruption
- landslide
- subsidence
- flooding
- storm surge
- backwater
- groundwater infiltration
- avalanche
- snow pressure

**are often separated from the others**

Examples:

**East Asia:** STF (Storm-Tempest-Flood) covers

**United Kingdom:** All-Natural-Peril covers

**France:** Catastrophe pool
Who pays when?
(simplified, classical approach)

- The insured bears a part of the loss, e.g.
  - a fixed amount
  - a percentage of the loss
  - a percentage of the sum insured
**Forms of loss participation**

Co-insurance, Deductible, Liability limit

<table>
<thead>
<tr>
<th>Loss ratio (in %)</th>
<th>Co-insurance 20% (of loss)</th>
<th>Deductible 5% (of TSI)</th>
<th>Liability limit 30% (of TSI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss: 40%</td>
<td>Loss: 10%</td>
<td>Loss: 10%</td>
<td>Loss: 10%</td>
</tr>
<tr>
<td>100</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>

- **Deductibles**

  example: Windstorm “Lothar” 1999 - Germany

  Percentage of the total number of losses (buildings)

  - deductible: 500 €

  ⇒ Reduction of the number of losses by 51%
Deductibles

example: Windstorm “Lothar” 1999 - Germany

Percentage of the total losses amount (buildings)

⇒ Reduction of the total loss amount by: 35%

Natural peril insurance

Effect of deductibles

- The insured pays a portion of the loss himself.
- The number of minor losses and the administrative costs will be drastically reduced.
- The total effort of the insurers will be reduced.
- Premiums can be kept at a low level or be reduced.
- Insureds are motivated to loss reduction measures in order to keep their own losses low.
- The total loss/costs are reduced.
How much does a large flood cost?

e.g., an event as in August 2002 in the Elbe and Danube catchments in Germany?

Or an even bigger one?

WANTED:

The **Probable** Maximum Losses (PML) that a portfolio, i.e. a company may face

* “Probable” depends on the company’s risk policy, but also on legal requirements (e.g. Solvency II)
Calculation of a PML curve

To obtain (estimate) the loss of a single event, we have to combine:

- **liability distribution**
- **vulnerability**
- **event scenario**

1. **loss ratio (in % of s.i.)**
2. **water depth**
3. **event scenario**

| Values at risk | Vulnerability | Hazard |

from historic events, we have some loss experience

but as we have only a VERY limited number of historic events, we need to generate more events stochastically
loss “experience” from a stochastic event set

1 10 100 1000 10000 100000

empirical PML curve

How high is 200-year loss?
What is the return period of losses for a given historic event?

empirical PML curve

Cat bonds
Cat bonds

We have

potential of record losses from single natural catastrophes

huge amounts of money in the international financial markets

Alternative Risk Transfer (ART):
Catastrophe bonds (Cat bonds)

→ new financial instruments, which supplement the classical distribution of risk via the reinsurance market.
→ geared to very large potential losses
→ exclusively used in developed countries

How does it work?

A specified risk (e.g. losses from a hurricane in Florida) is transferred from a risk carrier (sponsor) reinsurers, large companies such as a national railroad company to investors hedge funds, specialised catastrophe-oriented funds, asset managers, life insurers, reinsurers, banks, pension funds

The investor buys a share of the cat bond.

If the catastrophic event for which the bond is issued does
- not occur: the invested capital plus high interest is paid back to the investor at maturity.
- occur: the investor loses its principal or a portion of it.
Cat bonds

How is “occurrence” (triggering of the cat bond) defined?

- by a certain loss to the sponsor (indemnity trigger)
- by a market loss (industry loss index trigger)
- if a set of certain defined physical threshold values (e.g. wind speeds at certain points or discharges) are exceeded (parametric trigger).

Current situation:

- only one cat bond has been triggered so far (by hurricane Katrina),

- trigger points still quite high,
  (Example: Munich Re issued a cat bond in 2007; it covers
  ▪ trigger: market loss (total insured losses) > US$ 35bn)

- increasing experience will probably reduce prices and enhance the competitiveness of cat bonds,

- diversity of cat bonds in terms of expected loss levels, trigger types, and underlying perils will grow.
Micro-insurance

Flood insurance penetration in developed countries is low.

Reasons:

- lack of risk awareness
- lack of financial means
- insurance cover is not available
Micro-insurance

For whom is it meant?

- for low-income people,
- for people ignored by mainstream commercial and social insurance schemes,
- for people who do not have access to regular products.

For what is it meant?

- to provide cover against specific perils in exchange for regular premium payments,
- to help people to manage their risk better,
- to help people to maintain their standard of living.

How does it work?

basically, like any other insurance scheme, but some aspects make a difference:

- MI does not cover a single client but rather thousands of clients under one contract.

- MI requires an intermediary between the client and the insurance company (e.g. a local non-governmental organisation or a rural bank that can handle the distribution and administration).
Micro-insurance

What are the problems?

- low premiums and high transaction costs per client,
- lack of infrastructure,
- lack of insurance knowledge,
- insurance illiteracy (clients do not understand the concept of insurance),
- low and irregular income,
- lack of data.

Most important:

Raising awareness and educating the people concerned.

Current situation:

- Micro-insurance covers for risks related to natural disasters are still hardly available.
- As fewer than 100 million people (or 3%) of the world's poor have access to insurance, the MI market has a huge development potential.
- Helping people to develop a stable life situation will also allow them to eventually become normal clients of the insurance industry.
- A scheme underprivileged residents of Jakarta, Indonesia, who suffer from flooding practically every year, is currently being set up.
- In Colombia (and soon in other Latin American countries) a micro-insurance is developed for low-income groups and microentrepreneurs for protection against the impacts of natural disasters.
Final Remarks

- Weather catastrophes have increased in number and intensity.

- Losses have increased and reached new dimensions.

- Public authorities, affected people and enterprises, and the insurance industry must work together in a risk partnership.

- The insurance industry can considerably contribute to risk reduction and loss reduction.

- It must protect its own business by accumulation control.

- New instruments have been developed for insuring the poor and for coping with extremely large single losses.

- It is of crucial importance to create – and constantly maintain – proper risk awareness on all levels of the society.