

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

The Institute of Actuaries of Japan



Agenda

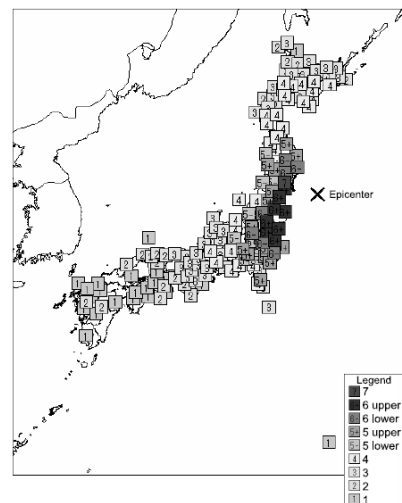
- Japan and Natural Catastrophe
 - Tomohiro Yokota, Nipponkoa Insurance Co., Ltd.
- The Thai Floods
 - Tomomi Kawakami, The Fuji Fire and Marine Insurance Co., Ltd.
- The lessons learned from the Thai Floods
 - Ken'ichi Horie, Mitsui Sumitomo Insurance Co., Ltd.



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

World EQ map

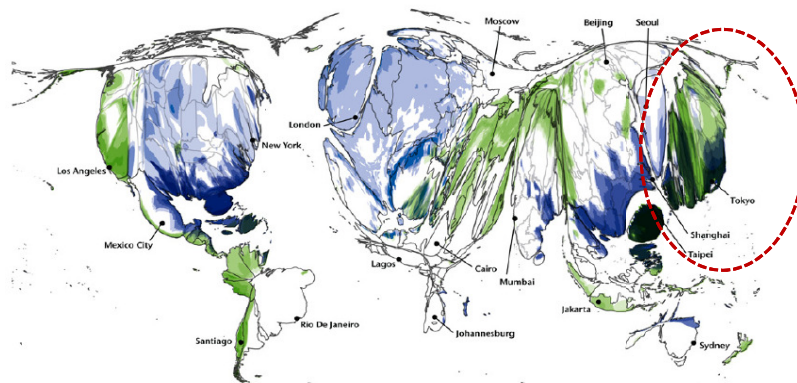
- Majority of earthquakes happened in Pacific Rim



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

City	Index as a whole ¹⁾²⁾	Hazard ^{*)}	Susceptibility to Loss ^{*)}	Values ^{*)}
Tokyo	710	10.0	7.1	10.0
San Francisco	167	6.7	8.3	3.0
Los Angeles	100	2.7	8.2	4.5
Osaka	92	3.6	5.0	5.0
Miami	45	2.7	7.7	2.2
New York	42	0.9	5.5	8.3
Hong Kong	41	2.8	6.6	1.9
Manila	31	4.8	9.5	0.7
London	30	0.9	7.1	4.8
Paris	25	0.8	6.6	4.6

1) Risk = Hazard * Loss susceptibility * Values

2) Total material loss, not the insured share

*) Normated to max. value 10

Source: Munich Re “Megacities - Megarisks”, 2005

Historic Global Natural Disaster Events

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

Date	Event	Country/Region	Economic Loss (USD Millions)	Insured Loss (USD Millions)	Fatalities
Jan. 12, 2010	Earthquake	Haiti	8,000	200	230,000
Dec. 26, 2004	EQ/Tsunami	Southeast Asia	15,000	2,000	227,898
Apr. 29-30, 1991	Tropical Cyclone	Bangladesh	1,700	100	138,866
May 2-5, 2008	Cyclone Nargis	Myanmar	10,000	N/A	138,366
Oct. 8, 2005	Earthquake	Pakistan; India; Afghanistan	5,200	5	88,000
May 12, 2008	Earthquake	China	85,000	425	87,000
Jul.-Aug. 2003	Heat Wave	Western and Northern Europe	13,800	20	70,000
Jul.-Sep. 2010	Heat Wave	Russia	15,000	20	56,000
Jun. 6, 1990	Earthquake	Iran	7,100	100	40,000
Dec. 8-19, 1999	Floods	Venezuela; Colombia	3,200	220	30,000

Sources: Impact Forecasting, Insurance Information Institute, National Hurricane Center, National Climatic Data Center, USGS

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)

Date	Event	Country/Region	Economic Loss (USD Millions)	Insured Loss (USD Millions)	Fatalities
Mar. 11, 2011	EQ/Tsunami	Japan	210,000	35,000	15,844
Aug. 25-30, 2005	Hurricane Katrina	United States	125,000	66,900	1,833
Jan. 17, 1995	Earthquake	Japan	102,500	3,075	6,434
May 12, 2008	Earthquake	China	85,000	425	87,000
Jul-Nov. 2011	Flooding	Thailand	45,000	10,789	790
Jan. 17, 1994	Earthquake	United States	41,800	15,300	57
Sep. 6-14, 2008	Hurricane Ike	U.S.; Caribbean Islands	37,600	15,000	195
May-Sep. 1998	Floods	China	32,000	1,000	3,656
Feb. 27, 2010	EQ/Tsunami	Chile	30,000	8,500	525
Dec. 2010 - Jan. 2011	Floods	Australia (Queensland)	30,000	2,420	36

Sources: Impact Forecasting, Insurance Information Institute, National Hurricane Center, National Climatic Data Center, USGS

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

Date	Event	Country/Region	Economic Loss (USD Millions)	Insured Loss (USD Millions)	Fatalities
Aug. 25-30, 2005	Hurricane Katrina	United States	125,000	66,900	1,833
Mar. 11, 2011	EQ/Tsunami	Japan	210,000	35,000	15,844
Aug. 23-27, 1992	Hurricane Andrew	United States	26,750	17,000	60
Sep. 6-14, 2008	Hurricane Ike	United States; Caribbean	37,600	15,000	195
Jan. 17, 1994	Earthquake	United States	41,800	15,300	57
Sep. 7-21, 2004	Hurricane Ivan	U.S.; Caribbean	18,800	13,800	130
Feb. 22, 2011	Earthquake	New Zealand	*30,000	13,500	182
Oct. 19-24, 2005	Hurricane Wilma	U.S.; Mexico; Bahamas; Caribbean	21,000	12,500	40
July-Nov. 2011	Flooding	Thailand	45,000	10,789	790
Sep. 20-24, 2005	Hurricane Rita	United States	12,037	10,200	10

*The New Zealand gov't has only released a combined USD30 billion economic loss total for the Sept. 2010, Feb. 2011 and June 2011 EQ events
 Sources: Impact Forecasting, Insurance Information Institute, National Hurricane Center, National Climatic Data Center, USGS

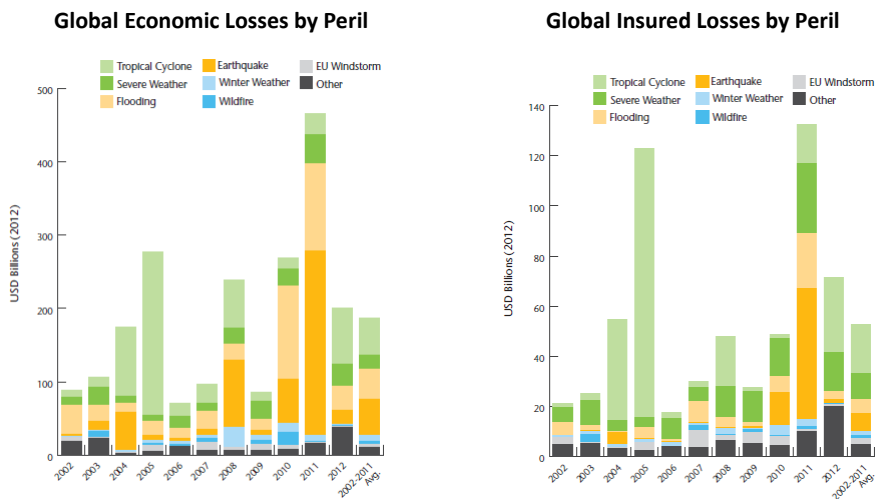
Source: Aon Benfield "Annual Global Climate and Catastrophe Report – Impact Forecasting 2011"



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Global Economic & Insured Losses by Peril

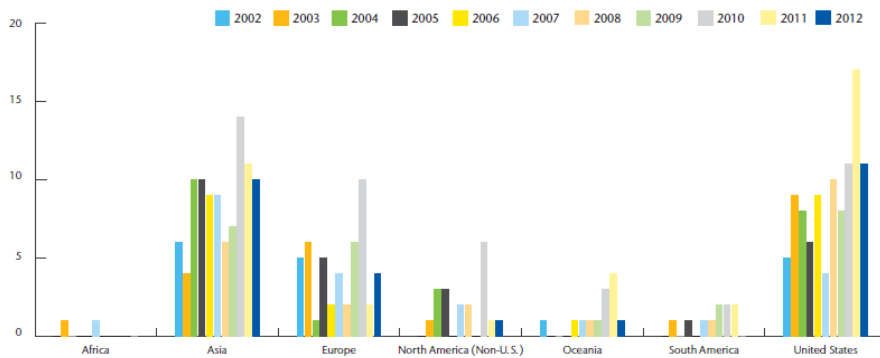


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Global Economic Loss Events by Region

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



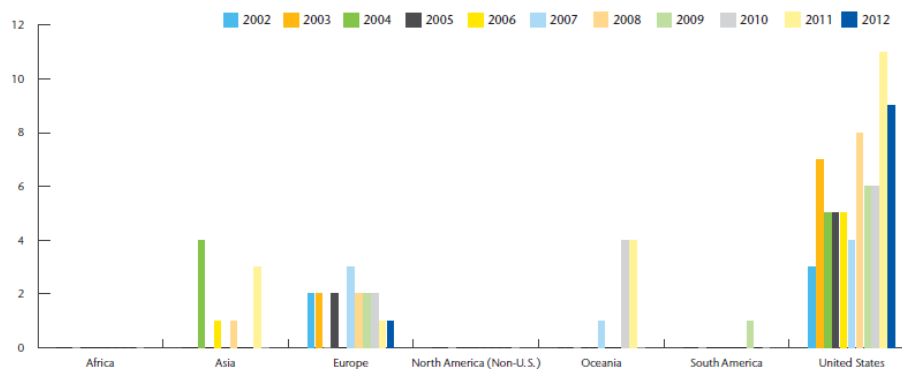
Source: Aon Benfield "Annual Global Climate and Catastrophe Report – Impact Forecasting 2012"



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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"



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Global Natural Disaster Events in 2011

- Top 10 Human Fatality Events in 2011

Event Date	Event Name Or Type	Event Location	# Of Deaths	# Of Structures/ Claims	Economic Loss Estimates (USD)
3/11	Earthquake	Japan	15,844	1,100,000	210.00 billion
12/16-12/17	TS Washi	Philippines	1,257	48,499	31.70 million
1/10-1/14	Flooding	Brazil	903	21,500	1.20 billion
7/29-11/30	Flooding	Thailand	790	4,000,000	45.00 billion
10/23	Earthquake	Turkey	604	15,000	750.00 million
8/12-9/30	Flooding	Pakistan	520	1,600,000	2.00 billion
4/22-4/28	Severe Weather	Southeast, Plains, Midwest	344	700,000	10.20 billion
9/10-10/31	Flooding	Cambodia	250	250,000	521.00 million
6/1-6/24	Flooding	China	239	500,000	6.65 billion
10/19-10/21	TS 02B	Myanmar	215	8,000	1.70 million

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



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Global Natural Disaster Events in 2011

- Top 10 Structural Damage and Filed Claim Events in 2011

Event Date	Event Name Or Type	Event Location	# Of Deaths	# Of Structures/ Claims	Economic Loss Estimates (USD)
7/29-11/30	Flooding	Thailand	790	4,000,000	45.00 billion
8/12-9/30	Flooding	Pakistan	520	1,600,000	2.00 billion
3/11	Earthquake	Japan	15,844	1,100,000	210.00 billion
8/22-8/30	HU Irene	U.S., Bahamas, Caribbean Isl.	46	835,000	8.55 billion
5/21-5/27	Severe Weather	Plains, Midwest, Southeast	181	750,000	9.10 billion
4/22-4/28	Severe Weather	Southeast, Plains, Midwest	344	700,000	10.20 billion
3/21-4/8	Flooding	Thailand	61	609,967	880.00 million
6/1-6/24	Flooding	China	239	500,000	6.65 billion
1/1-5/31	Flooding	Colombia	116	375,000	5.85 billion
7/27-7/30	TY Nock-ten	Philippines, China, Vietnam	94	340,000	126.00 million

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



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Global Natural Disaster Events in 2011

- Top 10 Insured Loss Events in 2011

Event Date	Event Name Or Type	Event Location	# Of Deaths	# Of Structures/ Claims	Economic Loss Estimates (USD)	Insured Loss Estimates (USD)	
3/11	Earthquake	Japan	15,844	1,100,000	210.00 billion	35.00 billion	
2/22	Earthquake	New Zealand	182	156,313	*30.00 billion	13.50 billion	
7/25-11/30	Flooding	Thailand	790	4,000,000	45.00 billion	10.78 billion	
4/22-4/28	Severe Weather	U.S. (Southeast, Plains, Midwest)	344	700,000	10.20 billion	7.30 billion	
5/21-5/27	Severe Weather	U.S. (Plains, Midwest, Southeast)	181	750,000	9.10 billion	6.75 billion	
8/22-8/30	HU Irene	U.S., Bahamas, Caribbean Isl.	46	835,000	8.55 billion	5.00 billion	
12/21-1/14	Flooding	Australia (Queensland)	36	58,463	30.00 billion	2.42 billion	
4/3-4/5	Severe Weather	U.S. (Midwest, Southeast, Plains)	9	225,000	2.80 billion	2.00 billion	
6/13	Earthquake	New Zealand	1	53,963	*30.00 billion	1.80 billion	
4/14-4/16	Severe Weather	U.S. (Plains, Southeast, Midwest)	48	150,000	2.50 billion	1.70 billion	
					All Other Events	86.69 billion	20.90 billion
					Totals	434.84 billion	107.15 billion

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



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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"
ANNUAL MEETING 2011 CASUALTY ACTUARIAL SOCIETY

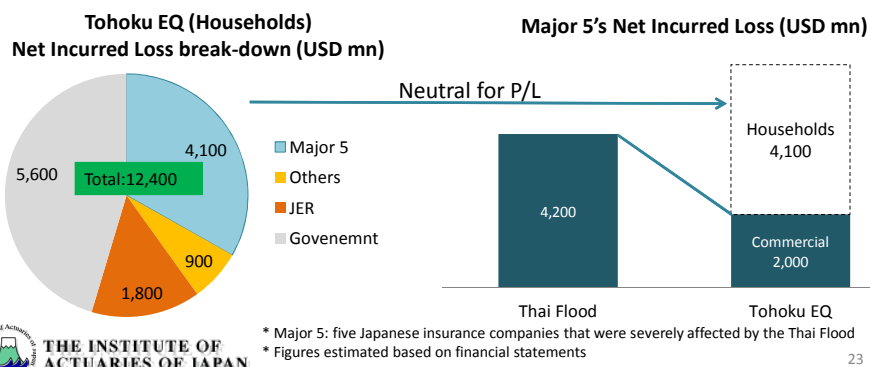


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Net claims paid for Tohoku EQ and Thai Flood

- 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

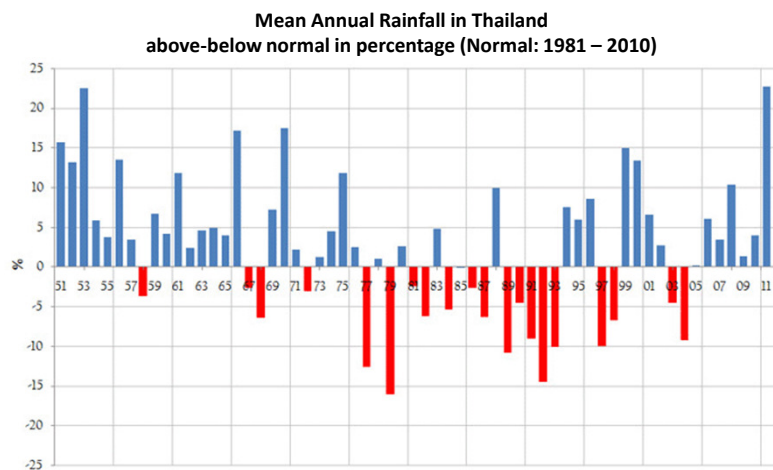
- Why was the damage so significant?
 - Amount of rainfall
 - Flooded area
 - Duration of the floods
 - Concentration of major factories
 - Disruption of world wide supply chains

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



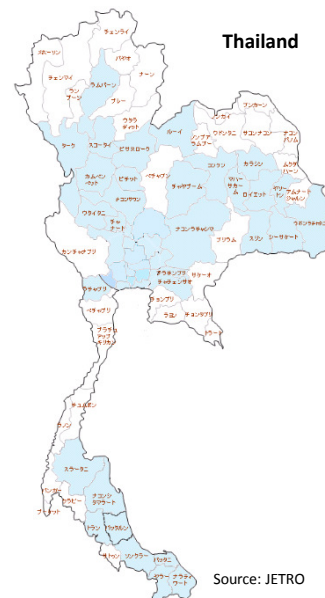
Source: Thai Meteorological Department

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



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

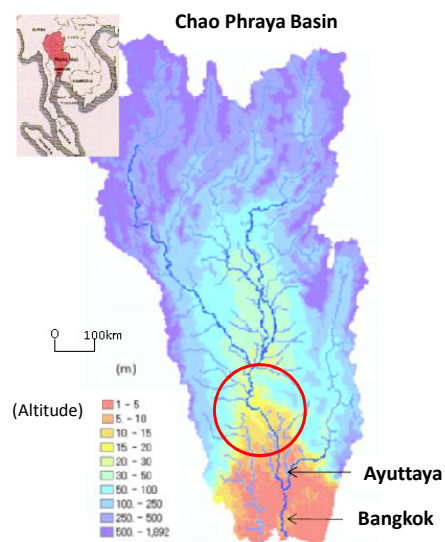


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Cause of flood and long duration

- 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 Ayuttaya



Source: Ministry of Land, Infrastructure, Transport and Tourism



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Major causes

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



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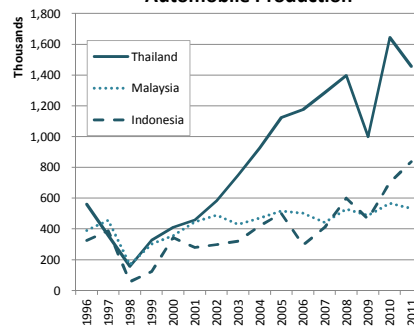
The economy of Thailand

- 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'

Economic Comparison

Year 2011	Thailand	Indonesia	Malaysia	
Population (x 1000)	64,080	241,030	28,730	
Ranking in ASEAN	4th	1st	6th	
Nominal GDP (USD billion)	345.6	845.7	278.7	
Ranking in ASEAN	2nd	1st	3rd	
Nominal GDP Mix	Agricultural forestry and fishers	9%	13%	8%
	Mining	2%	8%	9%
	Manufacturing	39%	26%	25%
	Construction	2%	6%	3%
	Others	45%	47%	53%

Automobile Production

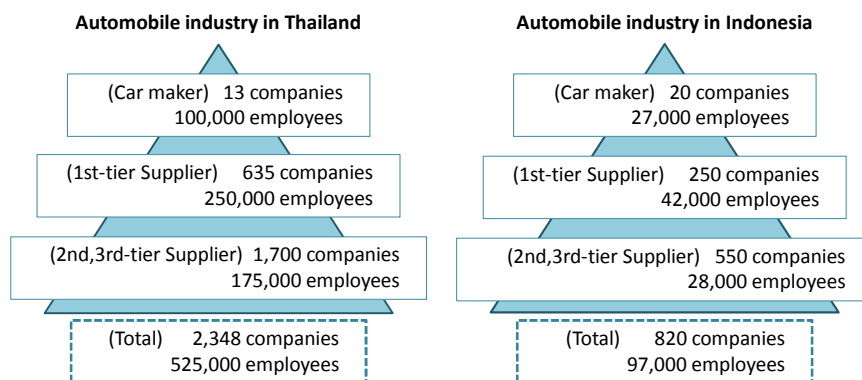


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Automobile industry in Thailand

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



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

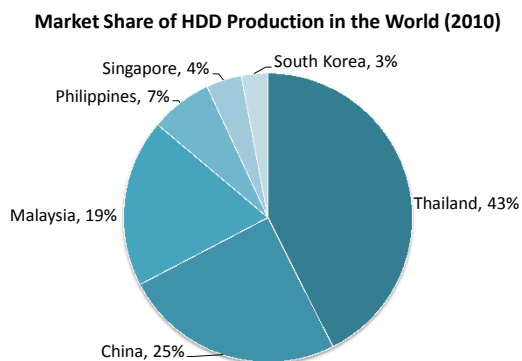


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HDD industry in Thailand

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



Source : Development Bank of Japan Inc.



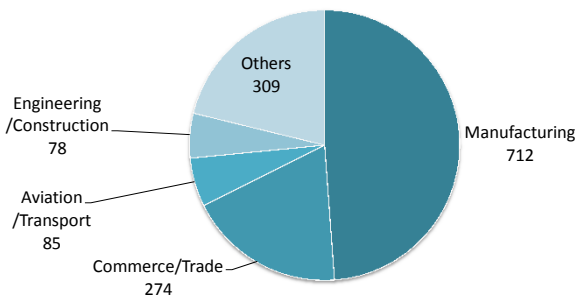
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Japanese affiliated companies operating in Thailand

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

Number of Japanese affiliated companies* operating in Thailand(2013)



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



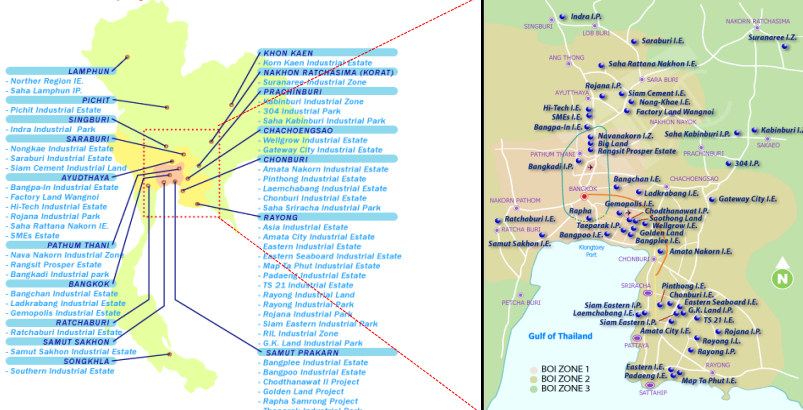
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Concentration of major factories

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

The industrial project in Thailand



Source: Derived from Tokyo Development Consultants



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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

Disruption of worldwide supply chains

- Concentration of major factories and the floods' duration caused disruption of world wide 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)

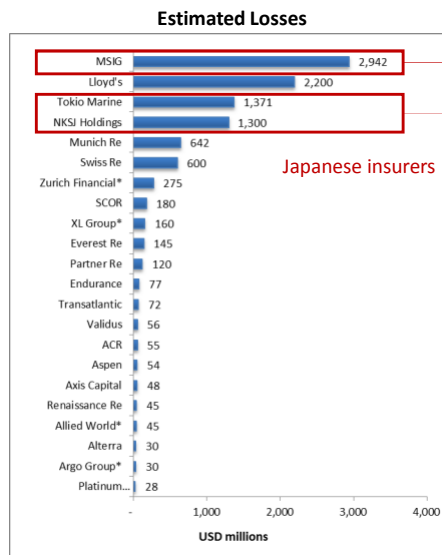
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Aug. 25-30, 2005	Hurricane Katrina	United States	125,000	66,900	1,833
Mar. 11, 2011	EQ/Tsunami	Japan	210,000	35,000	15,844
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*The New Zealand gov't has only released a combined USD30 billion economic loss total for the Sept. 2010, Feb. 2011 and June 2011 EQ events
Sources: Impact Forecasting, Insurance Information Institute, National Hurricane Center, National Climatic Data Center, USGS

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



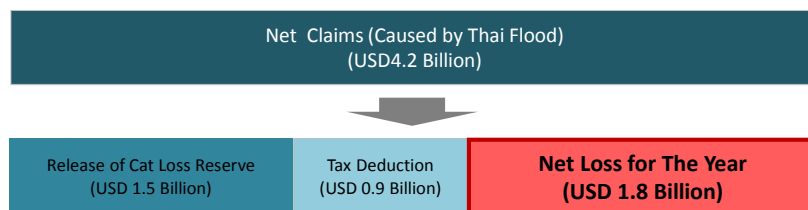
Source : Thailand Flood : A Case Study (Hong Kong 2012)



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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)



Estimated based on the companies' financial reports

* The top 5 insurers which were damaged by Thai Flood

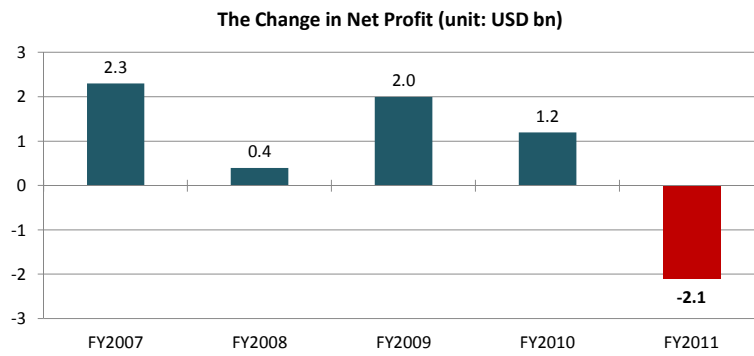
* 1USD = 100 JPY



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The Change of Net Profit for The Year

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



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



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The Thai Floods

National Catastrophe Insurance Fund in Thailand

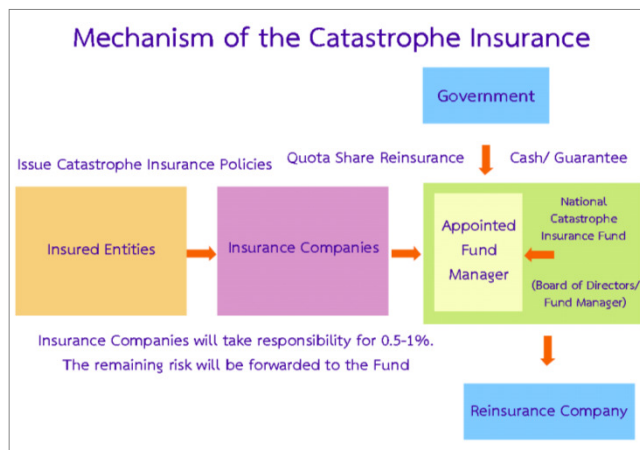


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Foundation of National Catastrophe Insurance Fund

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



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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

Insured Type	Coverage	Claim	Deductible	Premium (PerAnnun)
Household	"Fire and Catastrophe Insurance Policy for Household" will provide automatic coverage to catastrophe with a sublimit of 100,000 baht	Flood: • Water reaches the floor of the household: 30% of sublimit • Water reaches 50 cm: 50% of sublimit • Water reaches 75 cm: 75% of sublimit • Water reaches 100 cm: 100% of sublimit Windstorm/Earthquake: Loss adjuster / Surveyor will determine the actual loss and the business operators will be paid accordingly	None	0.50%
SME (Sum Insured not exceeding 50 million baht)	SME will be entitled to buy catastrophe's protection with a sublimit of 30% of the sum insured	Flood/Windstorm/Earthquake: Loss adjuster / Surveyor will determine the actual loss and the business operators will be accordingly	5% of sublimit	1.00%
Industrial Sector	Industrial operators will be entitled to buy catastrophe's protection with a sublimit of 30% of the sum insured			1.25%

Sources: Office of Insurance Commission

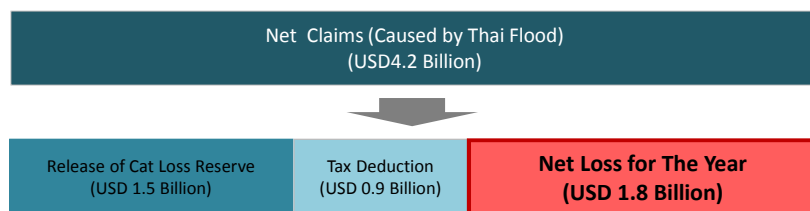


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The lessons learned from the Thai Floods

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)

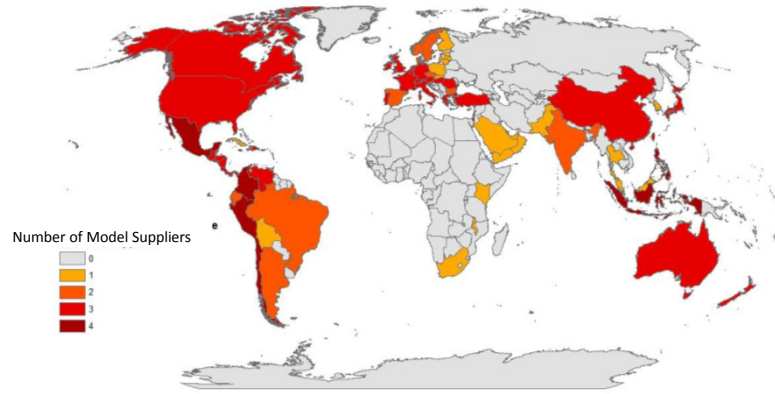
Risk quantification by CAT model (non-modeled perils)

- 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

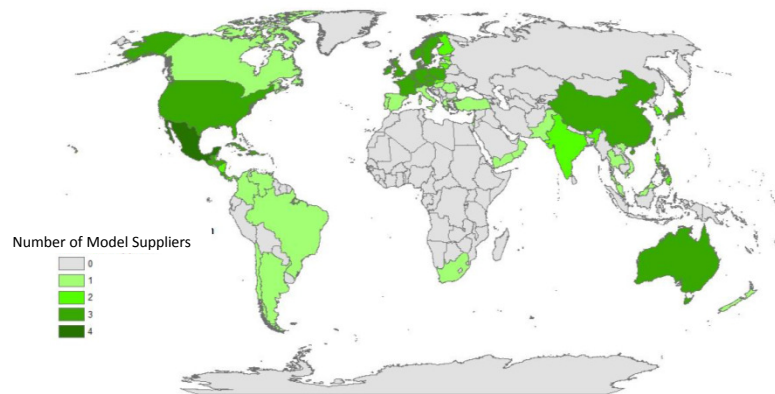


* This information is based on our investigation. It may differ from the latest status.

The issues and the actions (4)

Risk quantification by CAT model (non-modeled perils)

- Model Coverage: Windstorm

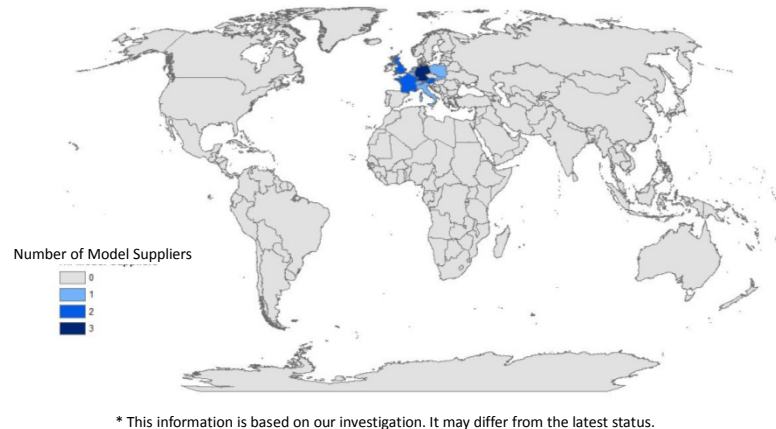


* This information is based on our investigation. It may differ from the latest status.

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

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した！

Appendix: Reference for Section 2

- Thai Meteorological Department
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 - <http://www.jetro.go.jp/world/asia/th/flood/archive/#higaiken>
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- Bank of Tokyo-Mitsubishi UFJ
 - <http://www.bk.mufg.jp/report/ecorevi2013/review20130129.pdf>
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- Aon Benfield
 - "Annual Global Climate and Catastrophe Report – Impact Forecasting 2011"
- Thailand Flood : A Case Study (Hong Kong 2012)
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