Managing the unavoidable – Natural Catastrophes

Dr. Sandra Schuster, sschuster@munichre.com
Munich Re

- Insurer of Insurances
- Founded 1880
- The world’s largest re-insurer
- Premium income ca. € 23 bn
- Leading role in insurance of natural catastrophes

Geo Risks Research of Munich Re – Analyses of natural disasters since 1974 (staff today 30)
Core business of insurance industry is quantification of risks!
2.1 Climatic Variations

Investigations into the overall trend of claims experience are indispensable, and here climatic variations become most significant. Such investigations involve a study of thermodynamic processes such as, for example, the rising temperature of the earth’s atmosphere (as a result of which glaciers and the polar caps recede, surfaces of lakes are reduced and ocean temperatures rise); changes in the earth’s atmosphere due to the large-scale increase in areas irrigated and cultivated and increases in humidity resulting therefrom; and lastly the pollution of the earth’s atmosphere, e.g. rise of the CO₂ content of the air causing a change in the absorption of solar energy.

We wish to enlarge on this complex of problems in greater detail, especially as—as far as we know—its conceivable impact on the long-range risk trend has hardly been examined to date.

Mr-Publication
Flood / Inundation (August 1973)
Weather disasters

The last years have brought records in weather disasters in respect to:

- Intensities
- Frequencies
- Damages and losses
From 1980 until today all loss events

For USA and selected countries in Europe all loss events since 1970

Retrospectively all Great Natural Catastrophes since 1950

In addition all major historical events starting from 79 AD – eruption of Mt. Vesuvio (3,000 historical data sets)

Currently more than 26,000 events documented

Natural catastrophes 2008

- Earthquake, tsunami, volcanic eruption
- Storm
- Flood
- Extreme temperature (heat wave, forest fires)

Great natural catastrophes:
- Earthquake China
- Hurricane Ike
- Cyclone Nargis
- Winter damage China
2008 was one of the most devastating years on record: TC Ike, TC Nargis, EQ Sichuan /China, winter storm
Geophysical, meteorological, hydrological events

- about 750 natural catastrophes in 2008 (950 in 2007)
Great Weather Catastrophes 1950 – 2008
Overall and insured losses with trend

2008: 3rd most expensive year on record
90% of insured losses caused by windstorms

Source: Munich Re Geo Topics 2008
Review of Natural Catastrophes in Australia

- Natural disasters such as floods, bushfires, severe storms and tropical cyclones occur regularly across the Australian continent.
- Australia, on average, experiences 8 natural disasters per year.
- Natural disasters each year, cause more than $1.14bn worth of damage to homes, business and infrastructure.
- Research indicates Australia will experience more extreme weather events in the years to come.

Source: BTE 2001
Natural catastrophes in Australia/Oceania 1980 – 2008
Geographical overview

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As at May 2009
Natural catastrophes in Australia 1980 – 2008
Number of events with trend
Munich Re’s catastrophe classification:

- **Damaging events**: < 20 deaths, up to considerable property damage.
- **Severe catastrophes**: 20 – 500 deaths, AU$ 55 – 550m overall losses.
- **Major catastrophes**: > 500 deaths, > AU$ 550m overall losses.

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As at May 2009
Local Trend
Oceania natural catastrophes

Annual losses 1980 – 2008

US$bn (in 2008 values)

Severe droughts
Bushfires VIC/SA
Newcastle EQ
Sydney hailstorm
NSW ECL hail Sydney/Canberra
Qld floods

Overall Losses
Insured Losses

NCCARF Seminar Series, Brisbane, 22nd October 2009
2009 sees the anniversary of several major natural catastrophe events in Australia:

10\textsuperscript{th} Sydney Hailstorm, April 1999
20\textsuperscript{th} Newcastle Earthquake, December 1989
35\textsuperscript{th} Brisbane Floods, January 1974 (resulting out of TC Wanda)
35\textsuperscript{th} Darwin TC Tracey, December 1974
70\textsuperscript{th} Black Friday Bushfires VIC/NSW, January 1939

... and near hit ...
TC Hamish – March 2009

- Maximum Category: 5
- Maximum sustained wind speed: 215 km/h
- Maximum wind gust: 295 km/h
- Lowest central pressure: 925 hPa

Source: Bureau of Meteorology

Source: earthobservatory
Reasons for globally increasing losses caused by natural disasters

- Rise in population
- Better standard of living
- Increasing insurance density
- Settlement in extremely exposed regions
- Increased vulnerability of modern societies and technologies to natural hazards
- Change in environmental conditions - Climate Change

In general no problem for insurance as premiums rise proportionally with risk!

Problem for insurance, if risk models are not adapted to the changes!
Concentration of people and values in large urban areas:

<table>
<thead>
<tr>
<th>City</th>
<th>2021</th>
<th>2051</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sydney</td>
<td>14-18%</td>
<td>25-49%</td>
</tr>
<tr>
<td>Brisbane</td>
<td>26-46%</td>
<td>56-136%</td>
</tr>
<tr>
<td>Darwin</td>
<td>17-50%</td>
<td>40-171%</td>
</tr>
<tr>
<td>Australia</td>
<td>14-24%</td>
<td>24-66%</td>
</tr>
</tbody>
</table>

- 1950  30% of world‘s population in urban areas
- 2005  50%
- 2030  60%
TC Tracy, Darwin scenario

- 24 December 1974
- The last “direct hit” TC in Australia
- 90% of buildings suffered major roof damage
- 9,000 houses damaged (50% total losses)

<table>
<thead>
<tr>
<th>Year</th>
<th>2006</th>
<th>2021*</th>
<th>2051*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population: 48,000</td>
<td>106,000</td>
<td>17 to 50%</td>
<td>40 to 171%</td>
</tr>
<tr>
<td>Insured loss AUD 200m,</td>
<td>Ins. loss est.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic loss AUD 800m</td>
<td>AUD 2bn to 3.6bn</td>
<td></td>
<td>???</td>
</tr>
</tbody>
</table>

*Projections compared to June 2004 population, ABS

- Values increased tenfold!
- Reduced vulnerability following reconstruction

Source MR, ICA
Example of population change & settlement in extremely exposed regions: South East Queensland (SEQ)

- SEQ: Brisbane, Gold and Sunshine Coast
  - > 2.7m residents, 66% of states population
  - Strongest population growth in Qld (71% within the last 5 years!)
  - Australia’s highest exposed values concerning TC’s, highest loss potential.

1966: population 40,000  today > 508,000

Source: Climate Change and Coastal Erosion, Prof. R. Tomlinson, ABS, Qld population update.
Munich Re’s approach to climate change
Strategic areas

**Risk assessment/underwriting**

- Changed frequencies/intensities of weather hazards in underwriting and risk management

  Examples:
  - Tropical cyclones, El Niño/La Niña, …
  - Prospective risk management
  - Holistic approach in risk models (budgets)
  - Analysis of clients portfolios, climate risks & opportunities

**Management of assets**

- Integration of sustainability criteria into investment strategies

  Examples:
  - Investments acc. to sustainability criteria
  - Development of a climate asset analysis tool
  - Retail fund investing acc. Dow Jones Sustainability
  - Transparency (CDP participation)

**New markets/new products**

- Pathway to low-carbon, hazard-adaptive economies: new business opportunities

  Examples:
  - Kyoto Multi Risk Cover (delivery of carbon credits as planned)
  - Micro insurance in developing economies
  - Covers for renewable energies
The impact of changing hazards on risk modelling

From hazard to risk: Principle of NatCat modelling, Tropical Cyclones

Hazard: historical events, probabilistic event set

Vulnerability function

Individual portfolio/liability data

Dinah, 1967

Wind speed [km/h]

- 60
- 61 - 90
- 91 - 120
- 121 - 150
- 151 - 180
- 181 - 210
- 211 - 240
- 241 - 270
- 271 - 300
- >=300

Risk curve

Losses

“Return period”
Risk assessment/underwriting

Example: changed hurricane loss expectation in the Atlantic Multidecadal Oscillation-warm phase

Warm phase in North Atlantic since 1995 on average causes higher annual losses

Changed loss distribution US-market in the current warm phase

Yellow bars: mean annual losses according to R. Pielke's loss figures; Orange bars: similar as above, but since 1954 Munich Re's annual loss figures were used
Blue triangles: number of data points per class (right-hand axis).
Source: Faust, Munich Re 2006.
Evaluating the economics of climate risks & opportunities in the insurance sector
Collaboration between Munich Re and the London School of Economics

Main areas of research activities

- quantifying the costs of a climate-related increase in natural catastrophes
- dealing with the uncertainties of climate models
- evaluating the potential and consequences of emissions trading systems and the appropriate design of such schemes
- estimating the economic impacts of climate change on the BRIC states (Brazil, Russia, India, China)

Institute: Centre for Climate Change Economics and Policy at LSE
Chair: Lord Nicholas Stern
Management: Prof. Rees (LSE), Prof. Gouldson (Leeds)
Project duration: 2008-2012
Sponsoring: £3m (~ €4m)
Munich Re’s Kyoto Multi Risk Policy

**Insured:**
Institutions engaged in projects for
generation of emissions credits

**Compensated:**
Shortfall of emissions’ reduction
compared to plan

**Advantage:**
Bundle of traditionally separated
insurance lines (physical damage,
counterparty risk, country risk, …)
Munich Climate Insurance Initiative (MCII)

**Objectives of MCII:**

Development of risk transfer solutions to support adaptation mechanisms to global warming in developing countries in the framework of the UNFCCC process (currently Copenhagen negotiations).

MCII was founded in 2005 on initiative by Munich Re together with Germanwatch, International Institute for Applied Systems Analysis (IIASA), Munich Re Foundation, Potsdam Institute for Climate Impact Research (PIK), Tyndall Centre, World Bank and independent experts.

**Microinsurance** schemes in developing countries, in particular Latin America, Indonesia, India: easy-to-understand, low-price insurance covers (life insurance, natural hazards property insurance); sold to micro entrepreneurs.
The two-tiered insurance pillar:

- Meets the principles set out by the UNFCCC
- Provides assistance (climate insurance solutions) to benefit those most vulnerable
- Includes private market participation.

The MCII Proposal

**Prevention Pillar**

- **TIER 1** Climate Insurance Pool
- **TIER 2** Support for micro and macro insurance systems

**Insurance Pillar**

- Link insurance with incentives to prevent losses

**High Layer RISK**

- Premiums paid by Assistance Facility ($5 bn)

**Middle Layer RISK**

- Support financed by AF ($2 bn)

**Low Layer RISK**

- Support financed by AF ($3 bn)

Rough estimated annual costs: $10 bn
Increasing business opportunities - ENERGY

Covers for renewable energies / energy efficient technology

- wind power: on-shore / off-shore
- Solar thermal / photovoltaic power
- coal gasification
- biomass
- geothermal power
- wave power
- low energy buildings, e.g. Green Building Council’s Green Star program
Solar power has been recognized ahead of time

„I'd put my money on the sun and solar energy. What a source of power! I hope we don't have to wait 'til oil and coal run out before we tackle that.“

Thomas Alva Edison, 1847-1931

Concentrating Solar-Thermal-Power-Plants (CSP): focusing of solar power with the aid of mirrors
Munich Re promotes the vision of a renewable energy future - DESERTEC (www.desertec.org)

The objective of this initiative is to analyse and develop the

- Technical (mostly networked solar thermal power plants)
- Economic
- Political (Middle East and North Africa)
- Social and
- Ecological framework

for carbon-free power generation in the deserts of North Africa.

The aim is to produce sufficient power to meet around 15% of Europe’s electricity requirements and a substantial portion of the power needs of the producer countries.
The role of insurance industry in partnership with society

- Provision of data on weather-related losses to science, political decision makers and the public
- Transparency of risks via risk measurement & risk adequate premiums
  - sound actions, prevention, reduced loss loads for society
- Products promoting society’s emissions reduction goals
- Products enhancing society’s hazard-adaptive capability
Natural hazards: MR has shared its knowledge for 30 years.
Globe of Natural Hazards 2009 – Products

Globe of Natural Hazards DVD

CD-ROM: 80,000 copies distributed in market – MR publication record
Globe of Natural Hazards

Earthquake
Globe of Natural Hazards

Earthquake

Probable maximum intensity (MM: modified Mercalli scale) with an exceedance probability of 10% in 50 years (equivalent to a return period of 475 years) for medium subsoil conditions.

- Zone 0: MM V and below
- Zone 1: MM VI
- Zone 2: MM VII
- Zone 3: MM VIII
- Zone 4: MM IX and above

Scale: 1,500 km
Position (Degrees): 26°19'55"S 153°57'29"E
Position (Decimal): 26.330687 E 153.960277
Globe of Natural Hazards

Tropical cyclone
Globe of Natural Hazards

Hail
Globe of Natural Hazards

Hail

Frequency and intensity of hailstones:
- Zone 1: low
- Zone 2:
- Zone 3:
- Zone 4:
- Zone 5:
- Zone 6: high

Topography

Scale: 1,500 km

Position (Degrees): 26°19'53.51"S 152°59'02.99"E

Position (Decimal): -26.3265197, 152.9839981

Globe of Natural Hazards

Münchener Rück
Munich Re Group

NCCARF Seminar Series, Brisbane, 22nd October 2009
Globe of Natural Hazards

Main impacts of climate change
Globe of Natural Hazards

Anomalies during El Niño / La Niña

El Niño / La Niña

During El Niño Phases:
- Summers warmer, heatwave risk higher
- Winter drier, drought risk higher

During La Niña Phases:
- Rainfall above average in winter

Further links:
- More information on El Niño / La Niña
- El Niño teleconnections (map)
- La Niña teleconnections (map)
Topics Geo presents the results of our annual worldwide survey of natural catastrophes, plus practice-oriented analyses and evaluations.

In this issue:

- Carbon is the currency of climate change
- A new warning system for Tonga
- Oceania natural catastrophes: Review of the year 2008
- Notable Oceania Events in 2008
- Pictures of the year 2008
How much risk do you want to assume?

Do you know how much you assume?

Do you control the risk you (want to) take?
Six Key Actions of Resilience

1. Community Understanding of Weather Related Risks
2. Risk Appropriate Land Use Planning & Zoning
3. Risk Appropriate Mitigation Measures
4. Risk Appropriate Property protection Standards
5. Financial Risk Mitigation in the Community

Climate Change: Improving Community Resilience to Extreme Weather Events, April 2008
## Improving Community Resilience to Extreme Weather Events

<table>
<thead>
<tr>
<th>General Insurance Industry Actions</th>
<th>Action by Governments</th>
<th>Actions by Individuals &amp; Businesses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong> Community Understanding of Weather Related Risks</td>
<td></td>
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</tr>
<tr>
<td>▶ Provide industry advice and research to governments and the community regarding the probabilities and costs of extreme weather events.</td>
<td>▶ Develop a concise public education campaign through an appropriate authority regarding specific climate change impacts and changes to extreme weather events for communities on a regional basis.</td>
<td>▶ Use of the presented education information to make risk appropriate decisions regarding assets and operations as part of an annual risk assessment &amp; management cycle.</td>
</tr>
</tbody>
</table>

| **2** Risk Appropriate Land Use Planning & Zoning |  |  |
| ▶ Provide industry advice and guidance to governments and the community regarding the risk implications of particular developments and projects under consideration with regard to extreme weather events. | ▶ Implement risk appropriate land use planning legislation harmonised across all states to prevent inappropriate development on land subject to inundation, specifically: | ▶ Critical assessment of each purchase of new property and the future risks to current property, then implement appropriate adaptive behaviour to lower or avoid the risks. |
| ▶ Implement a southerly expansion of cyclone and wind storm related building codes to counter the predicted southerly expansion of severe cyclones. | ▶ no residential or commercial development should occur on land currently subject or predicted to become subject to a 1 in 50yr return period for storm surges unless mitigation works have been carried out to maintain a 1 in 100yr risk exposure limit. |  |

| **3** Risk Appropriate Mitigation Measures |  |  |
| ▶ Provide industry data and event observations regarding failed or poorly performing mitigation infrastructure that has caused damage to the community. | ▶ Review current funding and approval mechanisms for disaster mitigation works, with a view to expansion of the fund to allow for implementation of mitigation works in high priority areas. |  |
| ▶ Implement a southerly expansion of cyclone and wind storm related building codes to counter the predicted southerly expansion of severe cyclones. | ▶ Expansion of the current National Disaster Mitigation Program to include upgrades and repairs to critical stormwater and drainage systems. |  |

| **4** Risk Appropriate Property Protection Standards |  |  |
| ▶ Provide best practice guidance to property owners regarding risk adaptation and mitigation steps for protecting property from extreme weather events & climate change impacts. | ▶ Expansion of the Building Code of Australia to incorporate property protection as a fundamental basis for consideration in building design and construction. | ▶ No residential or commercial development should occur on land currently subject or predicted to be subject to a 1 in 50yr return period of inland flooding unless mitigation works have been carried out to maintain a 1 in 100yr risk exposure limit. |
| ▶ Analyse and deliver pricing incentives for lower risk properties involving risk improved property. | ▶ Review current funding and approval mechanisms for disaster mitigation works, with a view to expansion of the fund to allow for implementation of mitigation works in high priority areas. | ▶ Increased fire protection and suppression. |
| ▶ Increase level of property protection for your critical assets that meet the possible extremes over the life cycle of the asset. E.g. | ▶ Increased capacity of flood and stormwater drainage. |  |

| **5** Financial Risk Mitigation in the Community |  |  |
| ▶ Develop and implement public education and financial literacy programs regarding personal financial risk mitigation. | ▶ Removal of taxes on all general insurance products, thereby encouraging greater adoption of personal financial risk mitigation. | ▶ Undertake a critical analysis of preparedness available and implement the risk predicted over the long term. |
| ▶ Undertake ongoing product development to cater to non-insured demographics parallel to any increasing demand. | ▶ Individuals & businesses in the community implement Business Continuity Planning that incorporates extreme weather initiated damage on essential assets as well as impacts on external |
| ▶ Continue insurance product innovation addressing extreme weather risks and rewarding sustainable or ‘greener’ behaviour that contributes to climate change reversal. | ▶ Stronger roofing able to withstand increased wind and hail. |  |
| ▶ Continue to perform catastrophe modelling and development of capitalisation options to maintain a healthy and stable general insurance market. | ▶ Increased fire protection and suppression. |  |
| ▶ Continue to participate in global management of the insurance market cycle to facilitate availability of competitive & appropriate levels of general insurance in Australia. | ▶ Increased capacity of flood and stormwater drainage. |  |

| **6** Community Emergency & Recovery Planning |  |  |
| ▶ Ensure that the industry’s catastrophe coordination arrangements keep pace with community needs and advancements in State recovery capabilities as climate change forces advancements in emergency response. | ▶ Continuous best practice emergency response & recovery changes and new emerging threats. |  |
Conclusions

• Natural catastrophes, especially weather related events, are increasing dramatically in number and magnitude, both globally and in Australia.

• There is more and more scientific evidence for causal links between global warming and increasing frequencies and intensities of natural catastrophes.

• We have to mitigate global warming and adapt to the changing risks in respect to the regionally specific risk patterns.

• Mitigation and adaptation measures open up great economic chances for companies and countries being on the forefront in these processes.

• With our long experience we have created unique expertise on natural catastrophe risks in the changing world and are happy to share this within our industry, with government authorities and the UNFCCC- community.
Munich Reinsurance Group in Australasia

Thank you for your attention

Dr. Sandra Schuster
sschuster@munichre.com