Geohazards: Minimizing Risk, Maximizing Awareness
The Role of the Insurance Industry

Prof. Dr. Peter Hoeppe
Head of Geo Risks Research
Munich Re

International Year of Planet Earth, Paris, 13 February 2008

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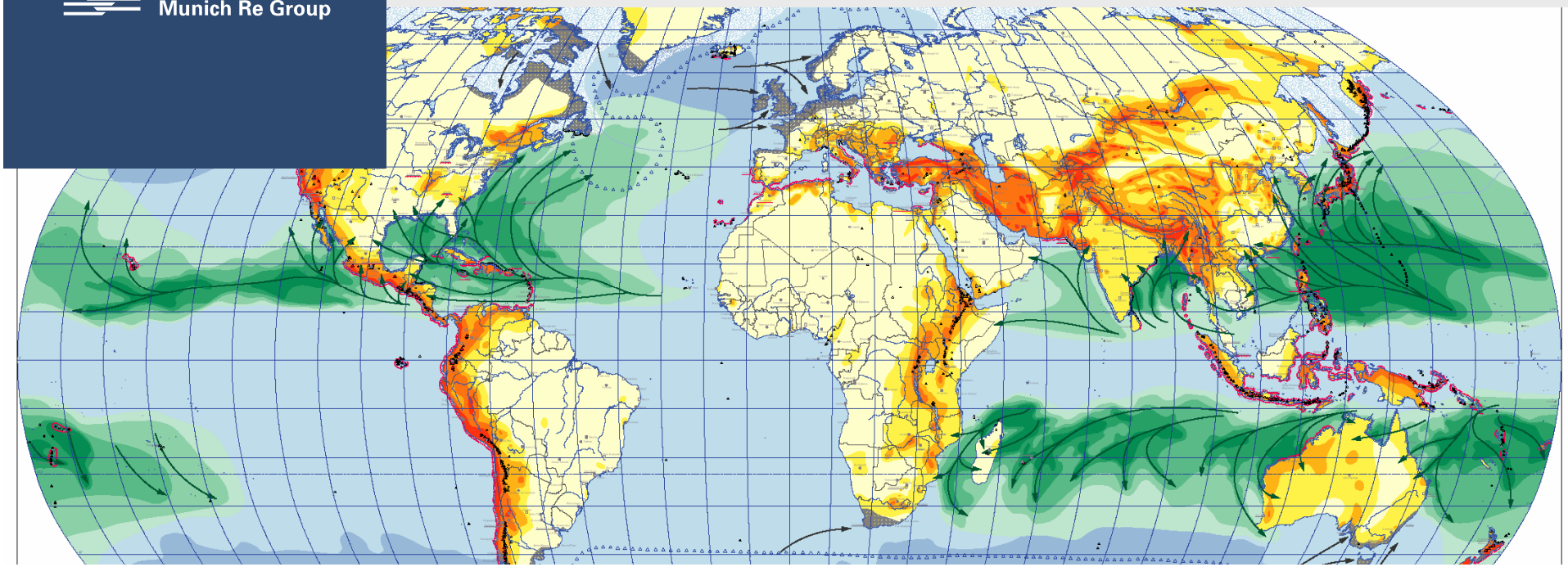

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Munich Re

- Insurer of Insurances
- Founded 1880
- One of the world‘s largest re-insurers
- Premium income ca. bn 20 €
- Leading role in insurance of natural catastrophes

Geo Risks Research Department of Munich Re –
Analyses of natural disasters since 1974

Core business of insurance industry is quantification of risks!

Trends of Natural Disasters

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

- Intensities
- Frequencies
- Damages and losses

Heat wave of 2003, with more than 70,000 fatalities the largest humanitarian natural catastrophe in Europe for centuries

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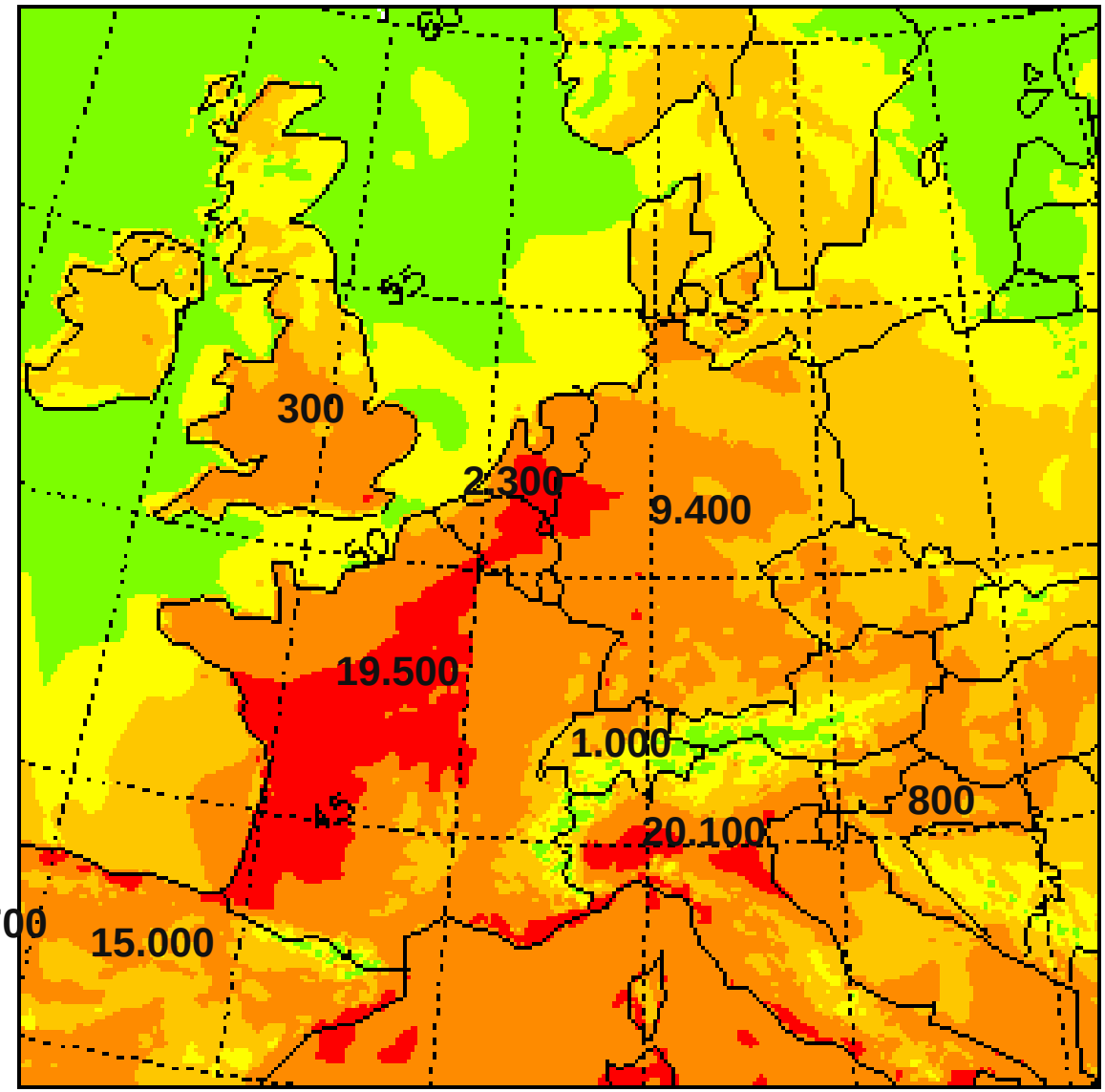
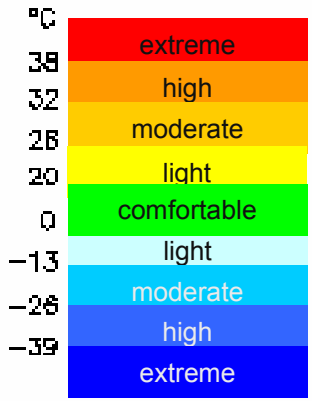


Perceived Temperature on 8 August 2003 and excess mortality

Heat stress



Cold stress

Sources: Robine et al., 2007;
German Weather Service, 2004

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The Tsunami of 26 December 2004

> 200,000 victims
ca. 2.7 million homeless
Economic loss about US$ 10 bn
Insured loss about US$ 1 bn
Largest natural catastrophe since earthquake in Tangshan 1976
Largest tsunami event in the documented history (fourth largest earth quake)

Hurricane Katrina, 25.-30.8.2005
6th strongest hurricane, largest losses of a single event

1.322 fatalities

Economic losses (US$ m):	125.000
Insured losses (US$ m):	61.000 (NFIP included)

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2004: 1st Hurricane in South Atlantic

Hurricane Catarina off the Coast of Brasil, March 2004

Hurricane Vince (9 October 2005)

Vince, a hurricane in a region without hurricane risk (easterly North Atlantic, Madeira)

Source: Image courtesy of Earth Sciences and Image Analysis Laboratory, NASA Johnson Space Center, Bild-Nummer ISS008-E-19646. http://eol.jsc.nasa.gov

MR NatCatSERVICE

One of the world‘s largest databases on natural catastrophes

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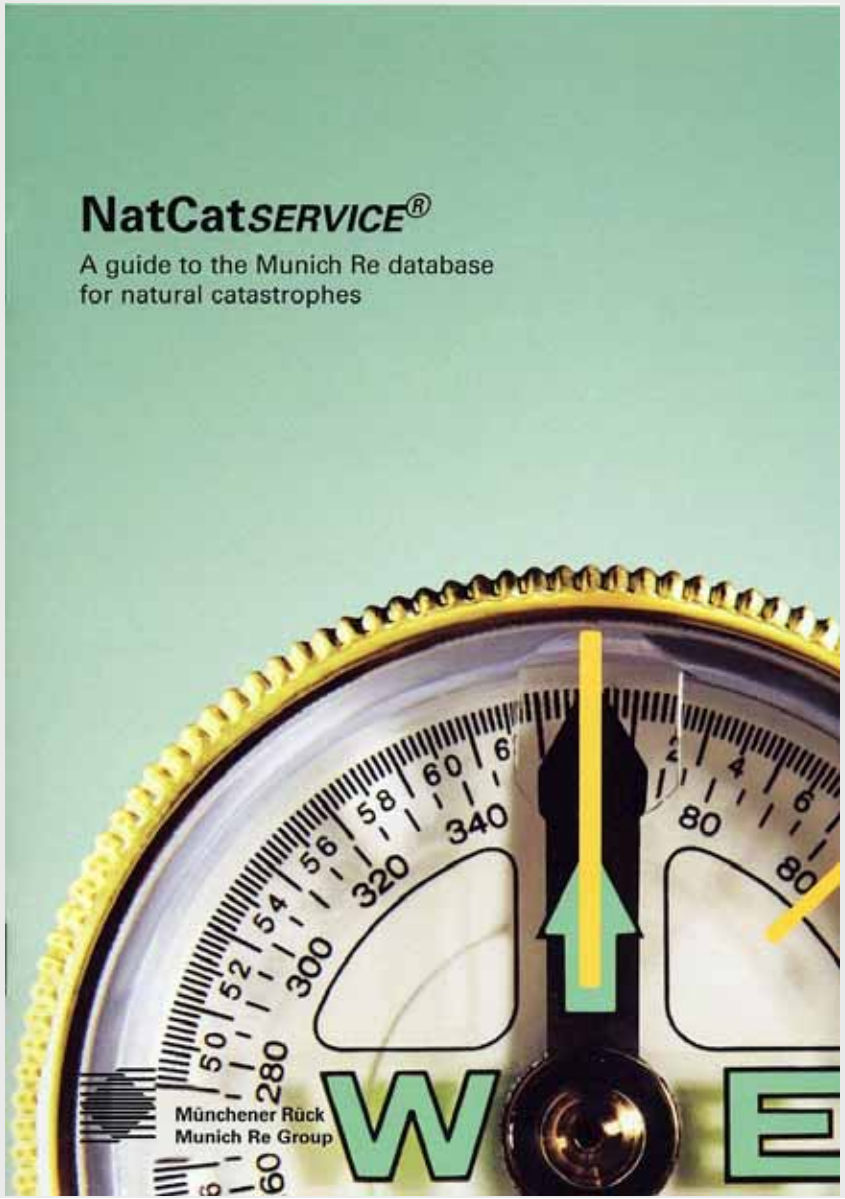

The database today:

- From 1980 until today all loss events, for USA and selected countries in Europe all loss events since 1970
- Retrospectively all Great Disasters since 1950
- In addition all major historical events starting from 79 AD – eruption of Mt. Vesuvio (3,000 historical data sets)

Currently more than 25,000 events

Great Natural Disasters 1950 - 2007

Percentage distribution worldwide

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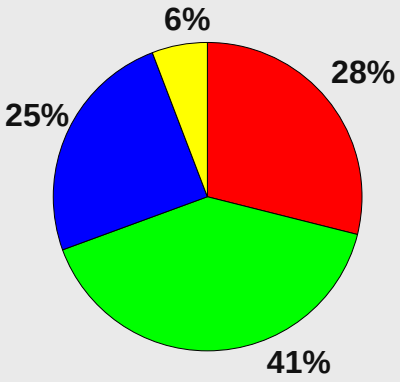
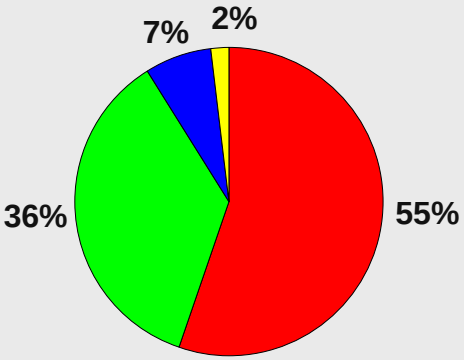
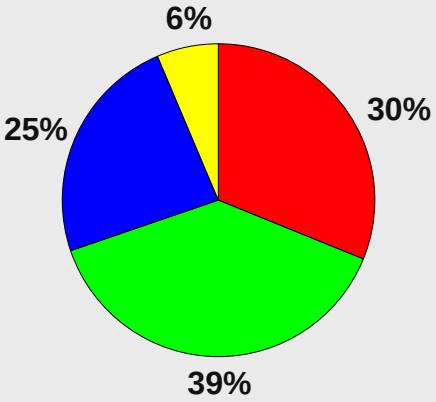
Number of events: 283



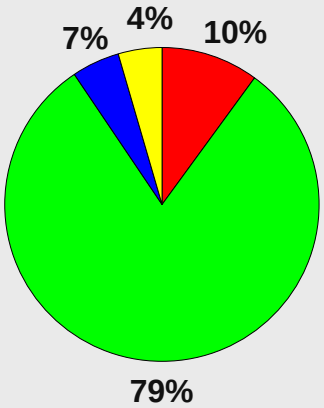
Deaths: 1.8 Million



Overall losses: US$ 1,750bn*



Insured losses: US$ 370bn*



Geological events

- Earthquake, tsunami, volcanic eruption

Weather related events

- Storm
- Flood
- Temperature extremes

*2007 values

As at January 2008

Great Natural Disasters 1950 – 2007

Number of events

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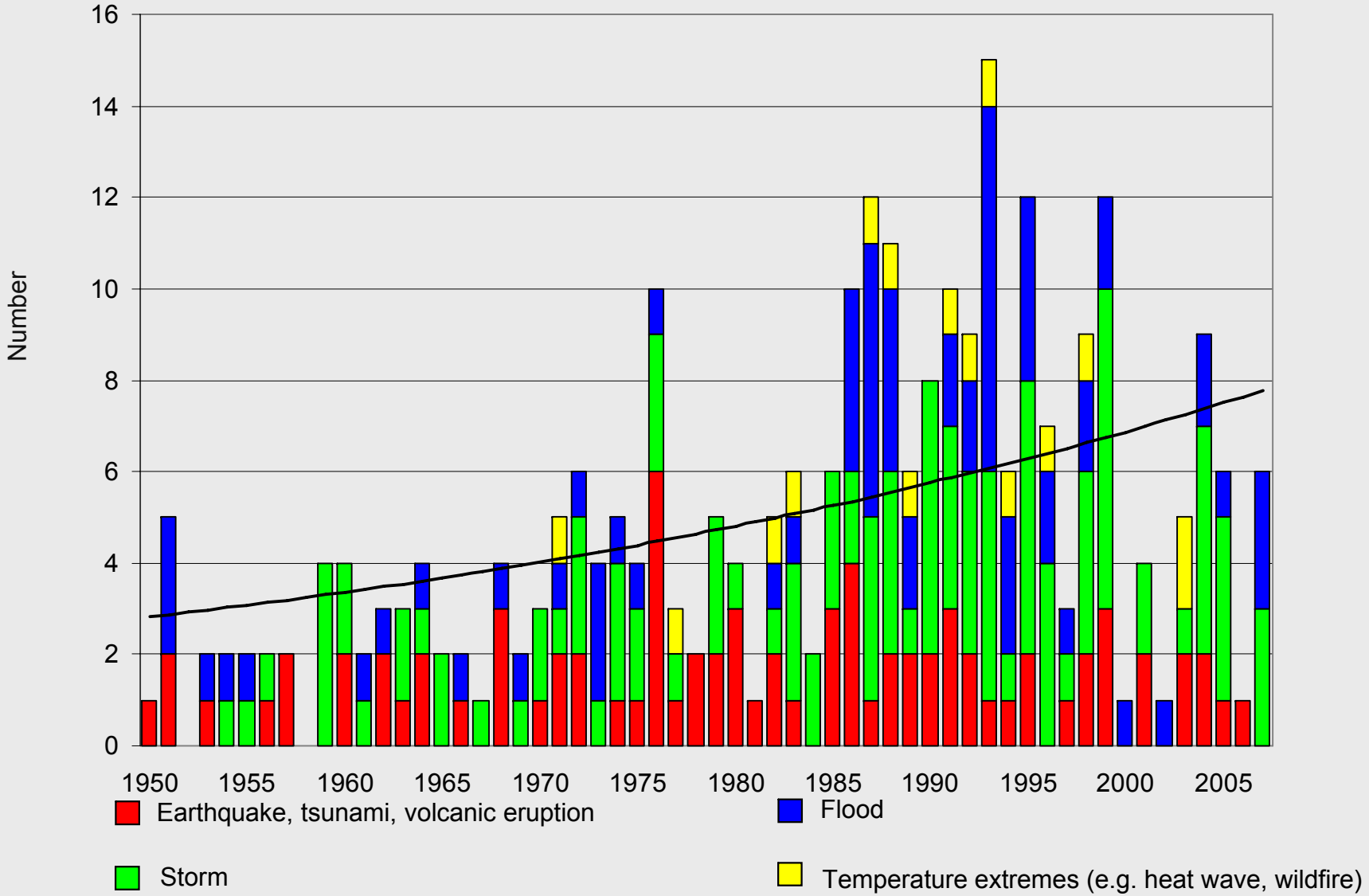

As at January 2008

Hydrological events globally 1980 – 2007
(Floods, Mass Movement)

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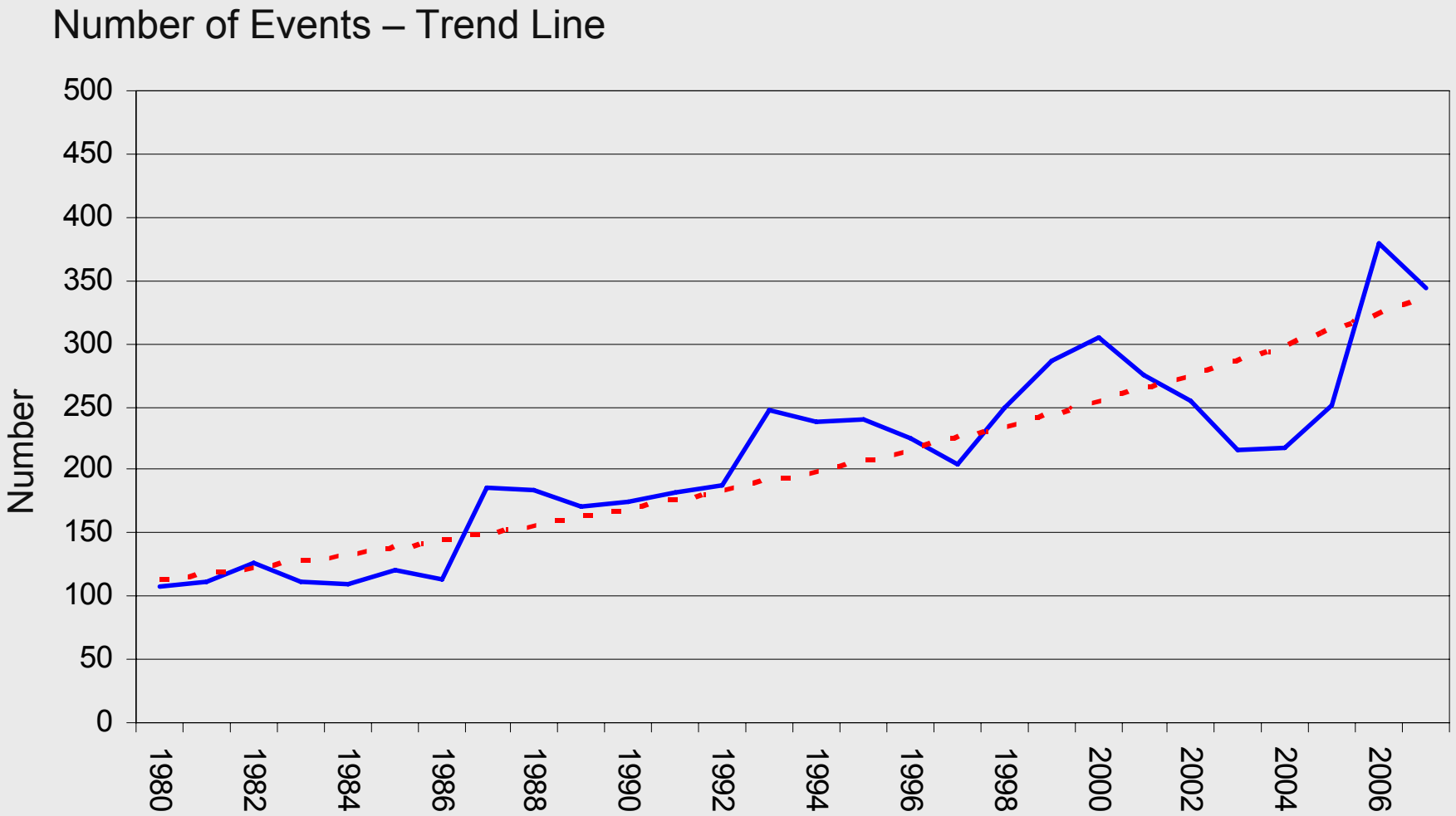

Storm events globally 1980 – 2007

(Tropical Storms, Winter Storms, Tornados, Hail)

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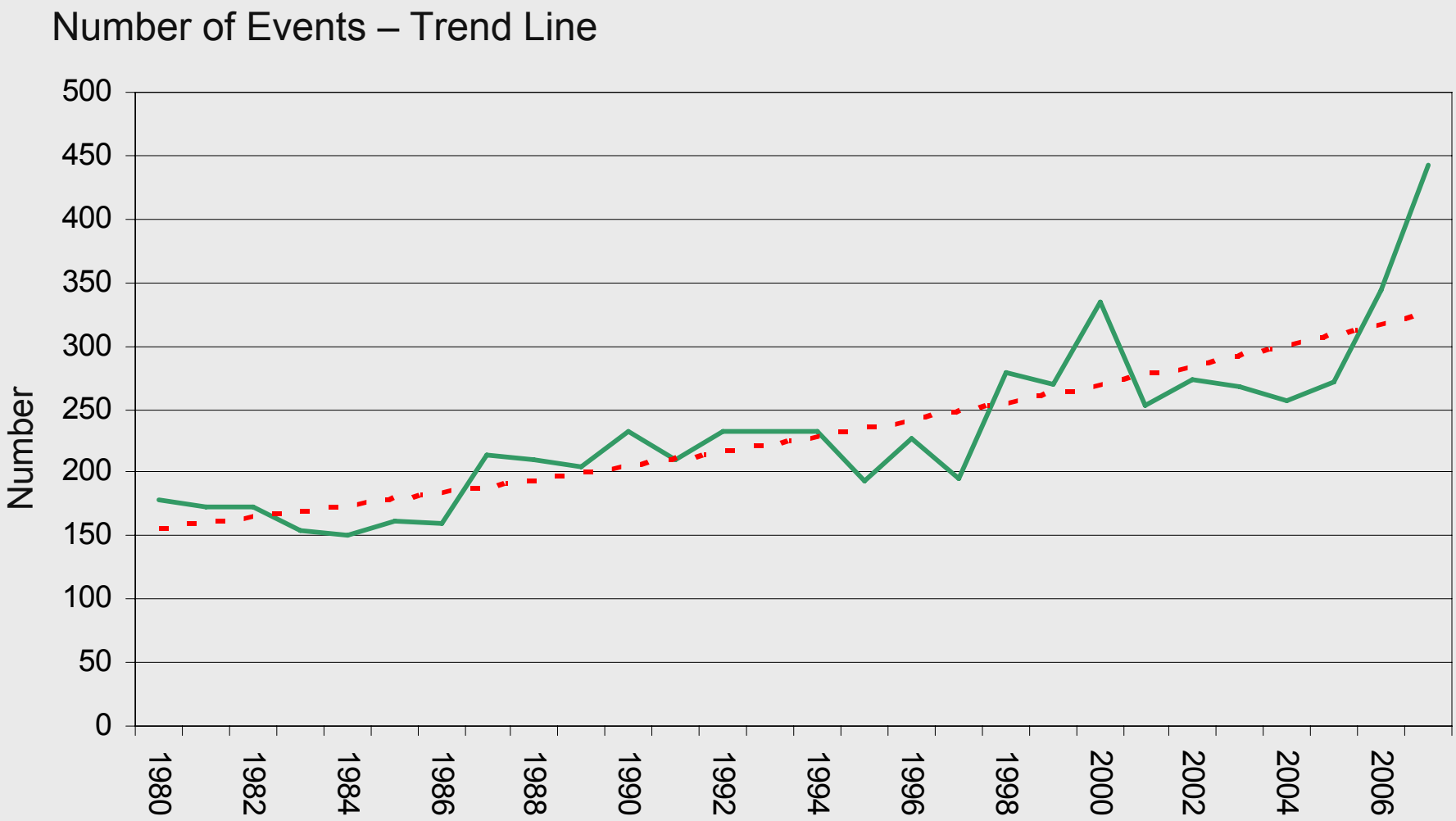

Other Weather Related Events (globally) 1980 - 2007

(Extreme temperatures, forest fires, drought)

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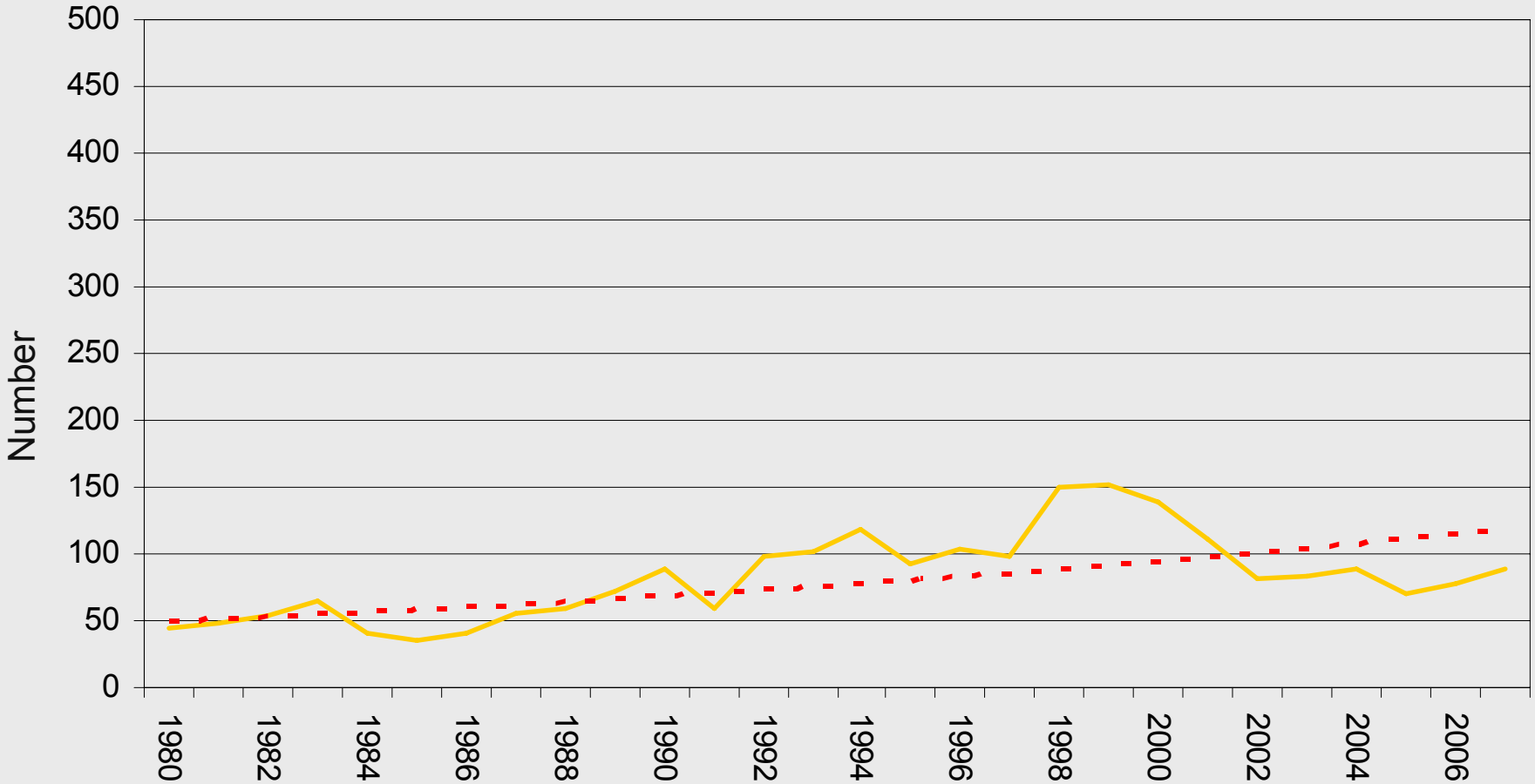
Number of Events – Trend Line



Geophysical events globally 1980 – 2007

(Earthquakes, volcano eruptions, tsunamis)

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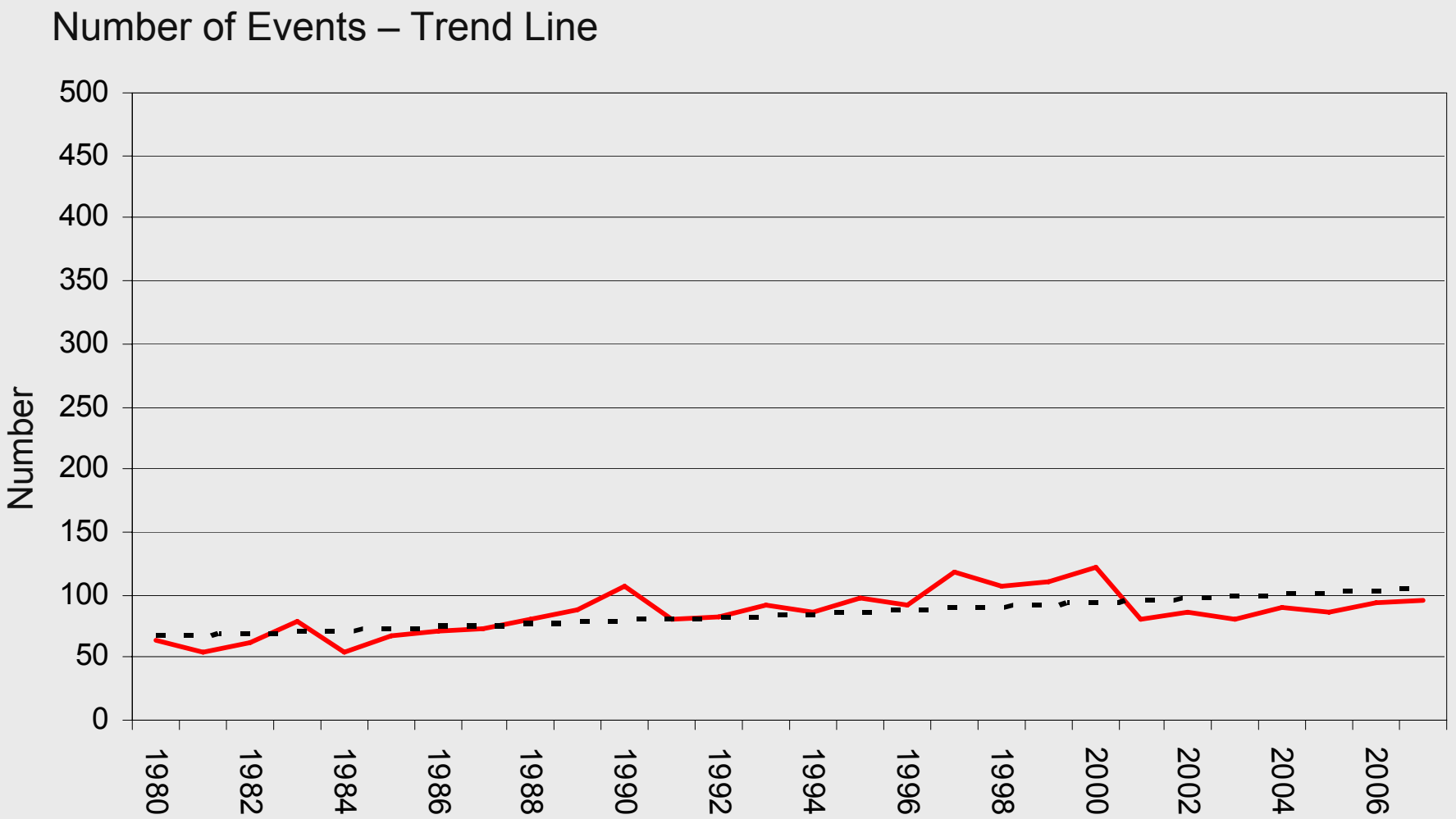

Great Natural Disasters 1950 – 2007

Overall and insured losses

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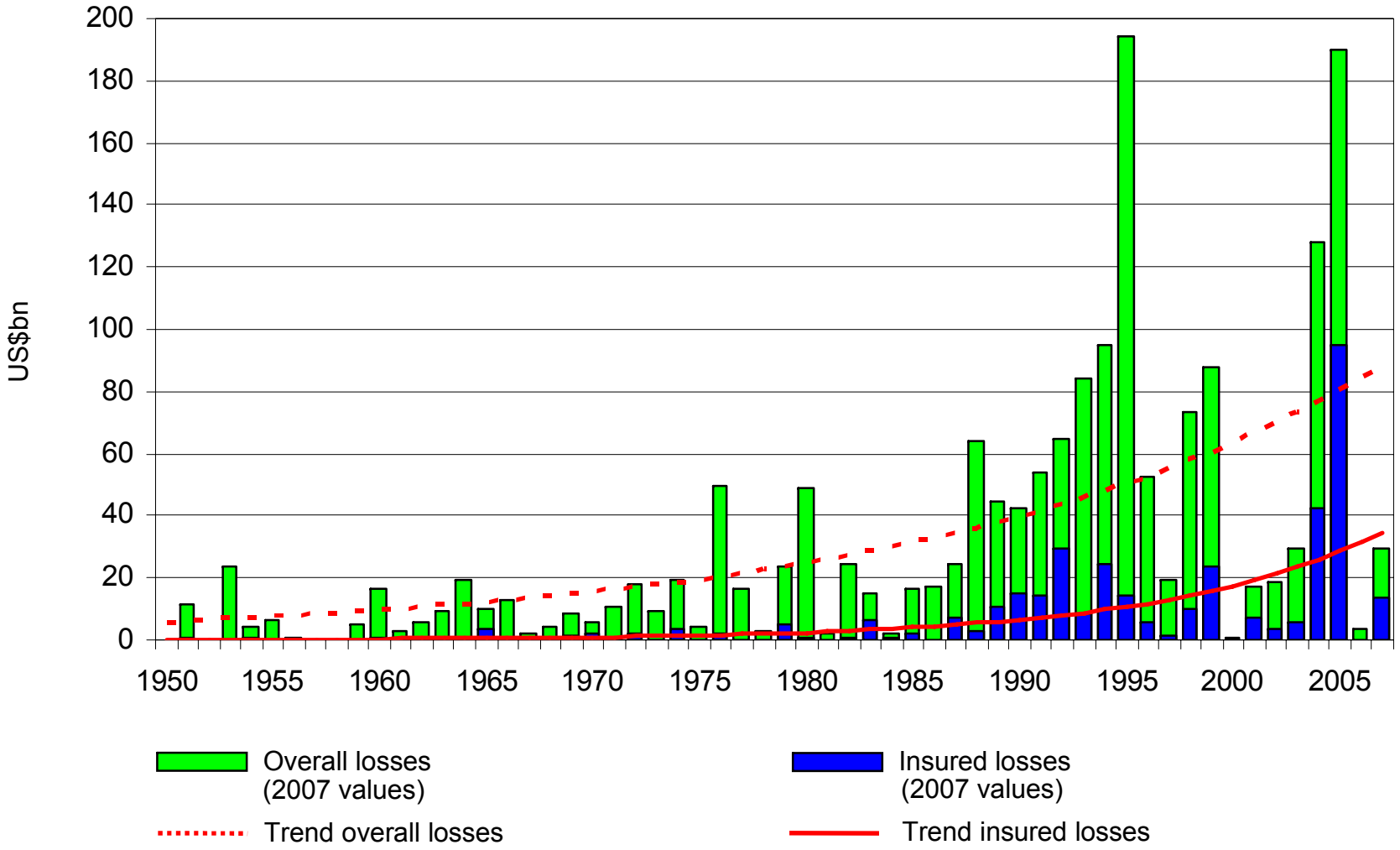

As at January 2008

Causes for increases of natural catastrophes

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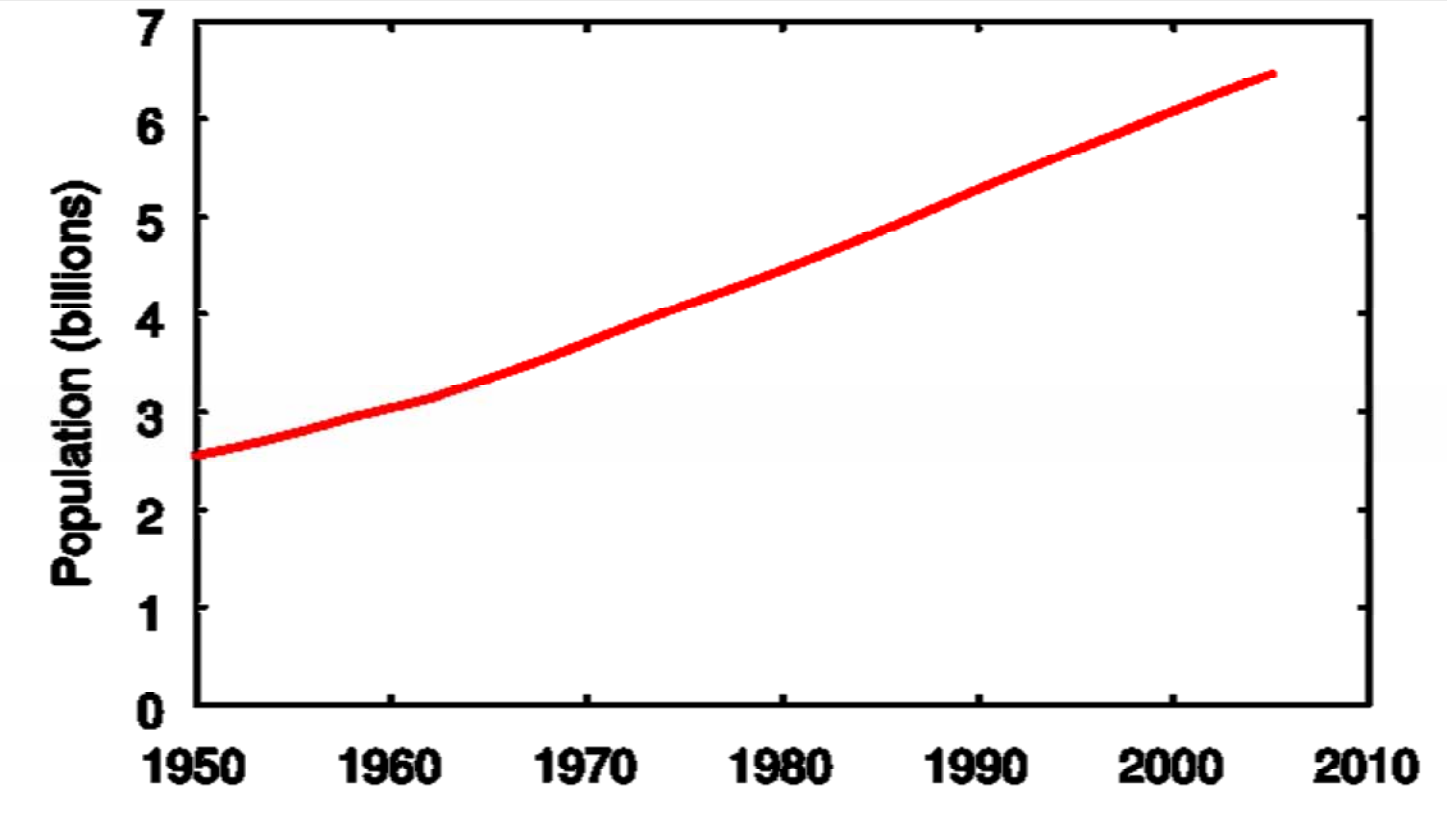
- Population growth



Causes for increases of natural catastrophes

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- Population growth
- Increasing standard of living

Causes for increases of natural catastrophes

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- Population growth
- Increasing standard of living
- Concentration of population and values in mega cities

  1950 30% of world population live in cities
  2005 50% of world population live in cities
  2030 60% of world population live in cities

Causes for increases of natural catastrophes

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- Population growth
- Increasing standard of living
- Concentration of population and values in mega cities
- More and more people settling in highly exposed regions

Causes for increases of natural catastrophes

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- Population growth
- Increasing standard of living
- Concentration of population and values in mega cities
- More and more people settling in highly exposed regions
- Increased vulnerability of modern societies

Causes for increases of natural catastrophes

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- Population growth
- Increasing standard of living
- Concentration of population and values in mega cities
- More and more people settling in highly exposed regions
- Increased vulnerability of modern societies
- Changes of environmental conditions

Global annual mean temperatures, 1856 - 2007

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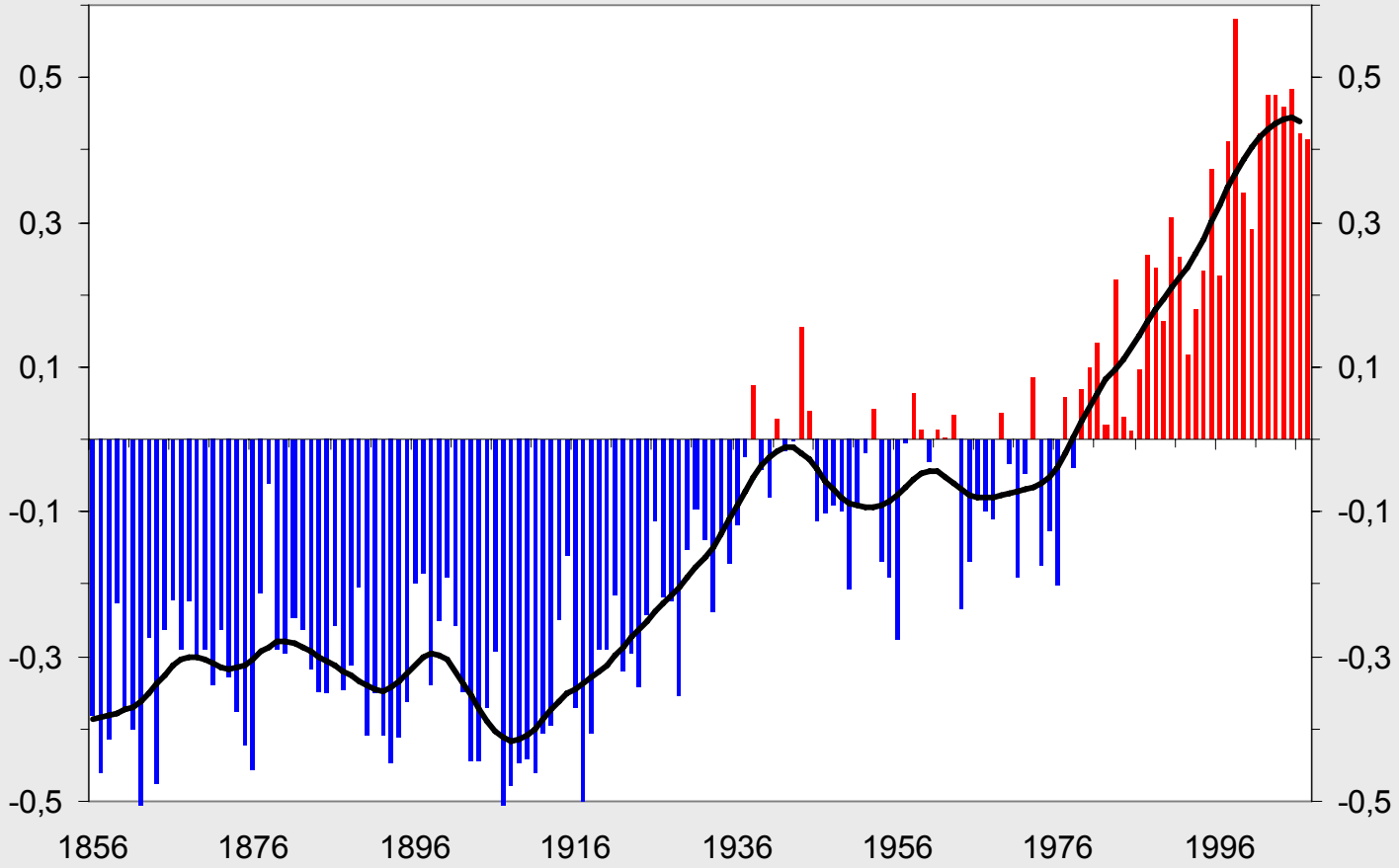
Deviaitons from 1961-1990 mean

Temperature anomaly (°C)



Source: Climate Research Unit, UK (2008) in conjunction with Hadley Centre of the UK Met Office
*As at: 10 January 2008

The warmest years since 1856

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Global annual mean temperatures

All 10 warmest years within the last 11 years!

1. **1998**
2. **2005**
3. **2003**
4. **2002**
5. **2004**
6. **2006**
7. **2007**
8. **2001**
9. **1997**
10. **1999**

Source: Climate Research Unit, UK (2008)

CO_2 concentration in the atmosphere

of the past 650,000 years from the Vostok ice core, Antarctica

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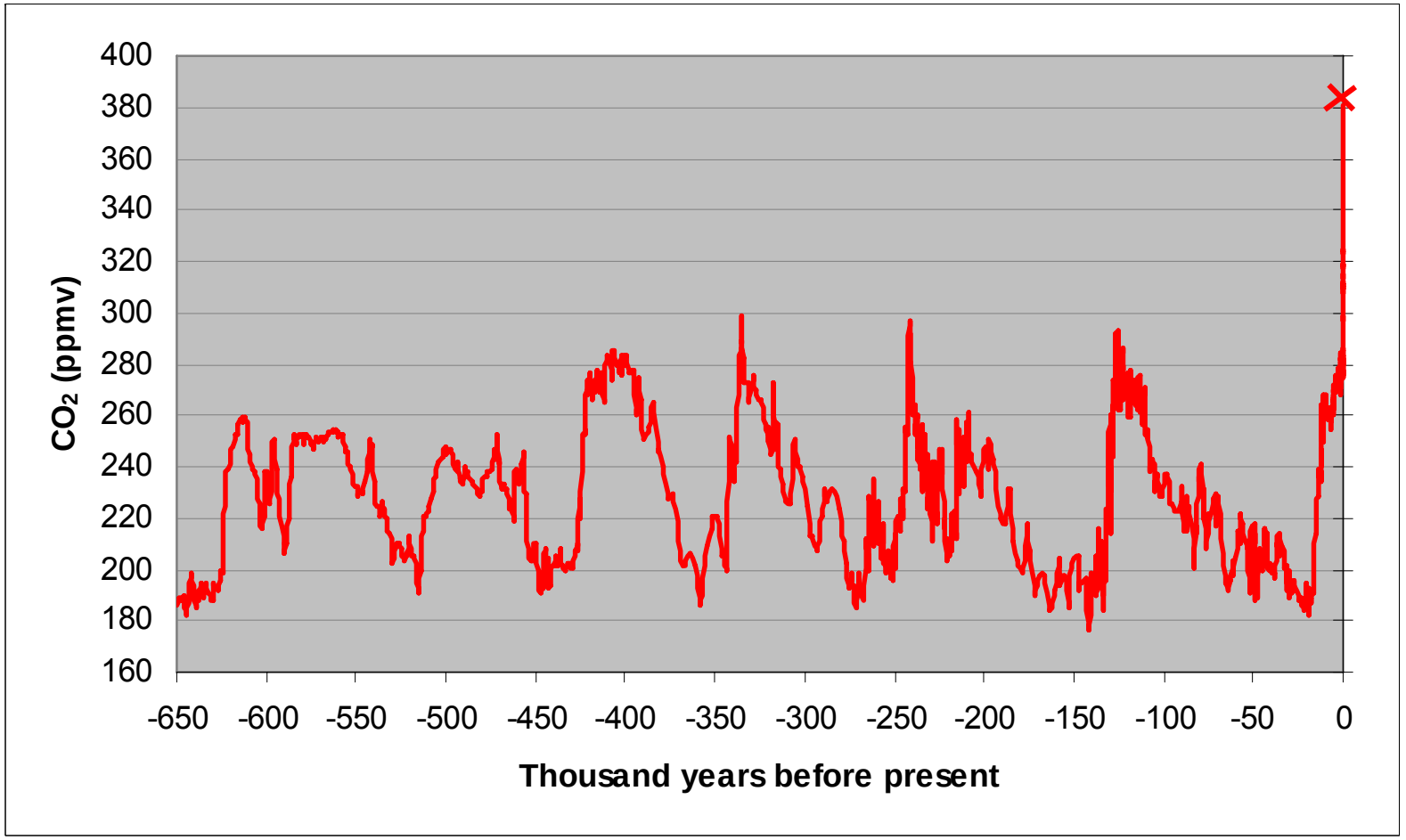

2007:

384 ppmv CO_2

Sources: Siegenthaler et al. (2005), Spahni et al. (2005), Röthlisberger et al. (2004)

The specific vulnerability of cities in respect to climate change

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Many cities are located at or close to the sea -> high exposures to wind storm, storm surge and rise of sea level

Evacuations of big cities ahead of weather disasters like hurricanes cause almost unsolvable logistical problems

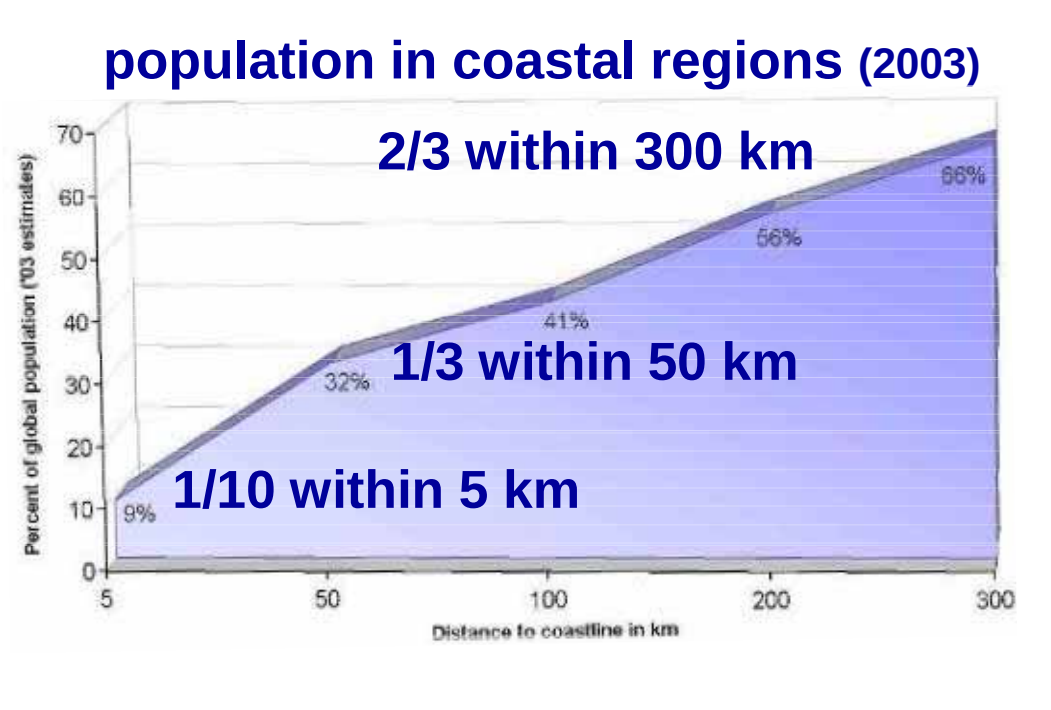
Damages in infrastructure leading to power outages and public transport breakdown disrupt the basis of urban life

The social structure of big cities can cause problems in the post disaster management (crime)

In big cities global warming is an add on to already existing urban heat islands

Most mega cities are located at the coast

15 of the world's 20 largest cities are on coastal plains.



Danger: Sea Level Rise

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Cities threatened by sea level rise (small selection)

Europe:	**Randstad, Venice, London, Hamburg, ...**
America:	**New York, Miami, New Orleans, Long Beach, Georgetown, Paramaribo, Belem, Buenos Aires, …**
Africa:	**Alexandria, Lagos, …**
Asia:	**Karachi, Mumbai, Kolkata, Dhaka, Yangoon, Bangkok, Ho Chi Minh City, Haiphong, Singapore, Shanghai, Tianjin, …**

Mumbai 2006

Changes in sea level rise and projection for different scenarios

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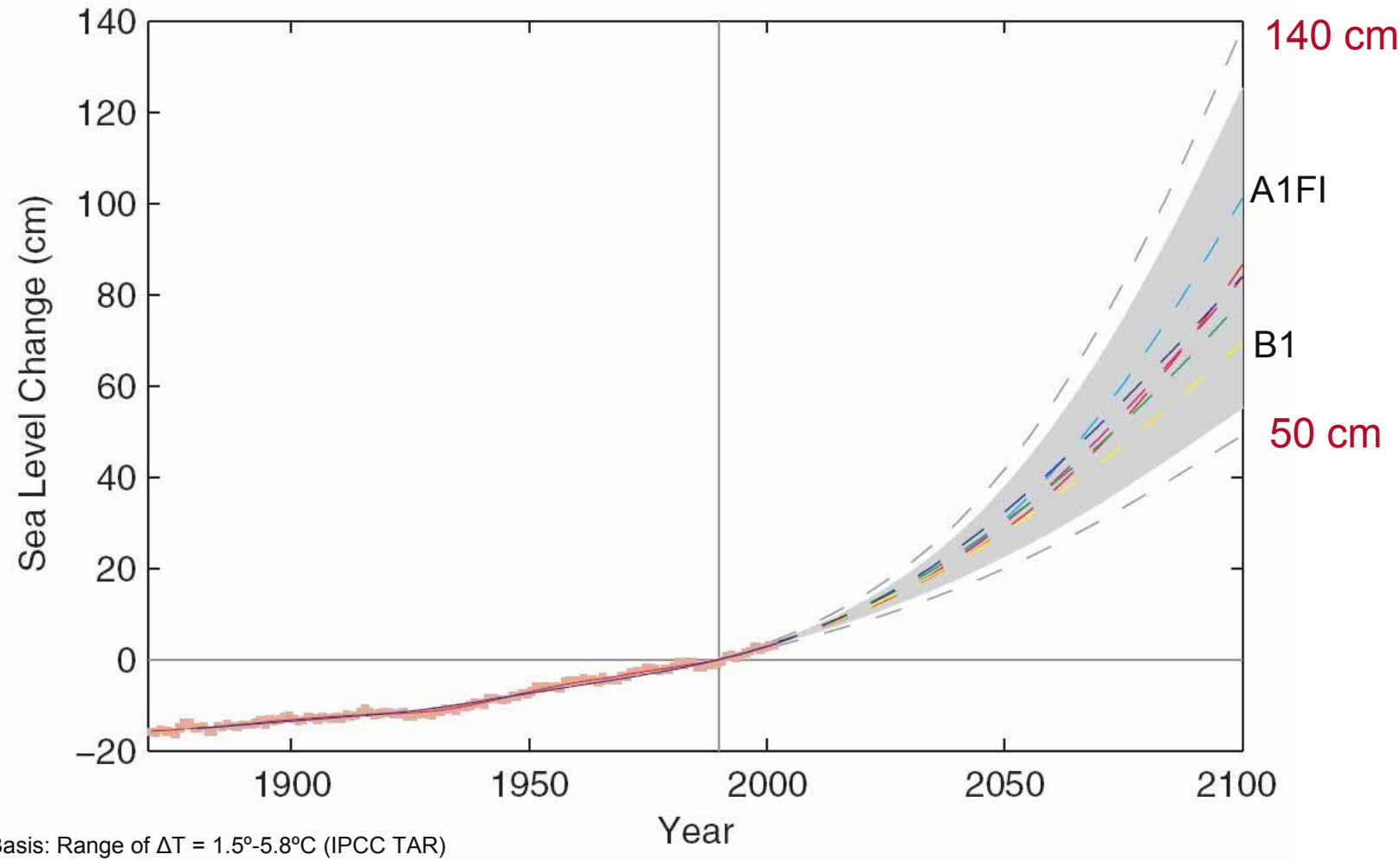
Temperature-dependent approach*



*Basis: Range of ΔT = 1.5º-5.8ºC (IPCC TAR)
Source: Stefan Rahmstorf (2007), Science Vol. 315, p.368

Climate Change and Extreme Weather Events (IPCC, 2007)

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Phenomenon[a] and direction of trend	Likelihood that trend occurred in late 20th century (typically post 1960)	Likelihood of a human contribution to observed trend[b]	Likelihood of future trends based on projections for 21st century using SRES scenarios
Warmer and fewer cold days and nights over most land areas	*Very likely*[c]	*Likely*[d]	*Virtually certain*[d]
Warmer and more frequent hot days and nights over most land areas	*Very likely*[e]	*Likely (nights)*[d]	*Virtually certain*[d]
Warm spells/heat waves. Frequency increases over most land areas	*Likely*	*More likely than not*[f]	*Very likely*
Heavy precipitation events. Frequency (or proportion of total rainfall from heavy falls) increases over most areas	*Likely*	*More likely than not*[f]	*Very likely*
Area affected by droughts increases	*Likely* in many regions since 1970s	*More likely than not*	*Likely*
Intense tropical cyclone activity increases	*Likely* in some regions since 1970	*More likely than not*[f]	*Likely*
Increased incidence of extreme high sea level (excludes tsunamis)[g]	*Likely*	*More likely than not*[f,h]	*Likely*[i]

very likely > 90% **likely >66%** **more likely than not > 50%**

Insurance Industry: Promoting risk awareness

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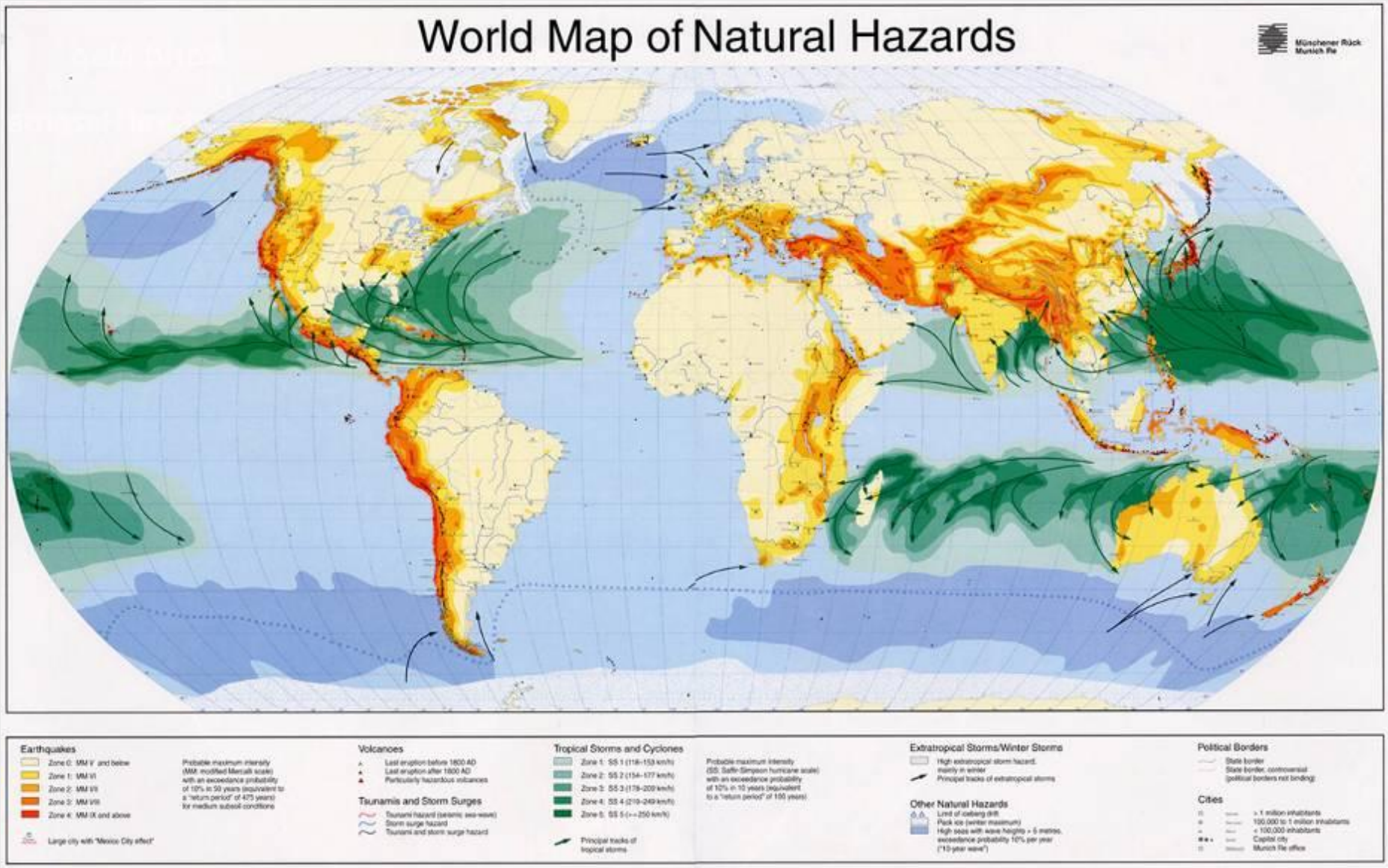

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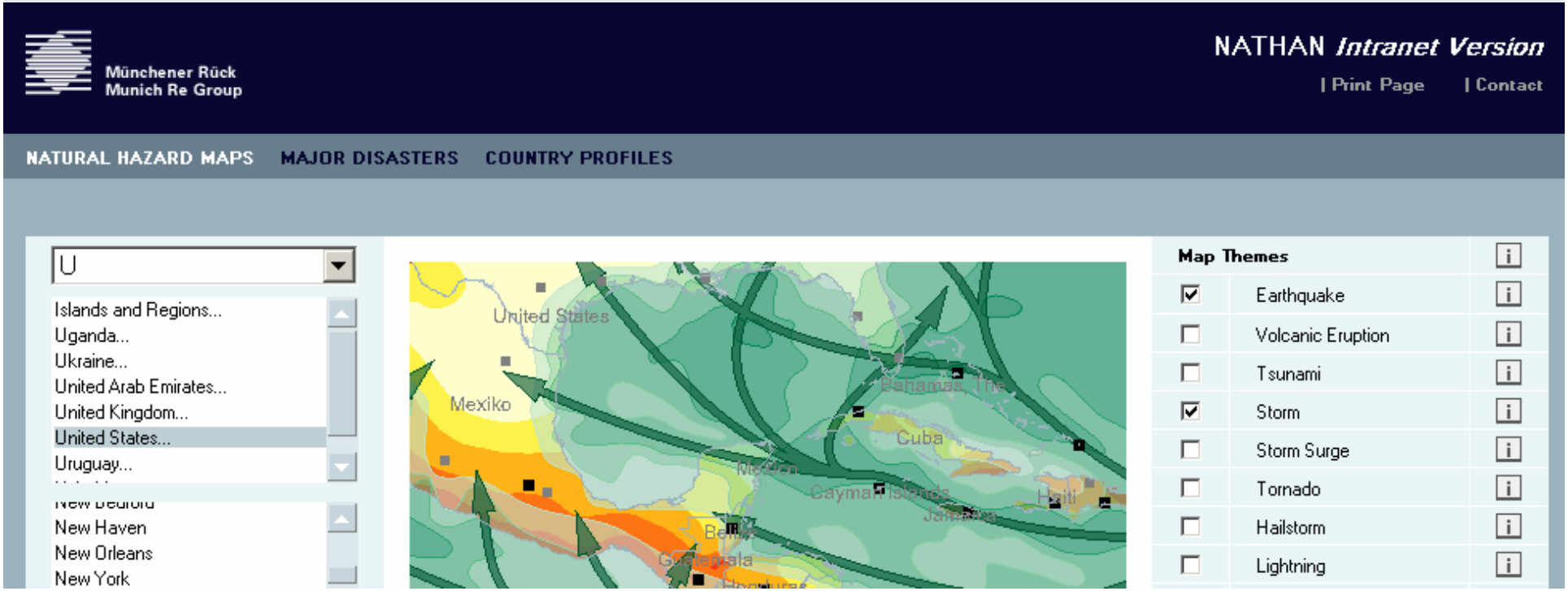
NATHAN http://www.munichre.com/nathan

Munich Re´s Natural Hazards Assessment Network for worldwide risk analysis on natural perils



Natural Hazard Maps

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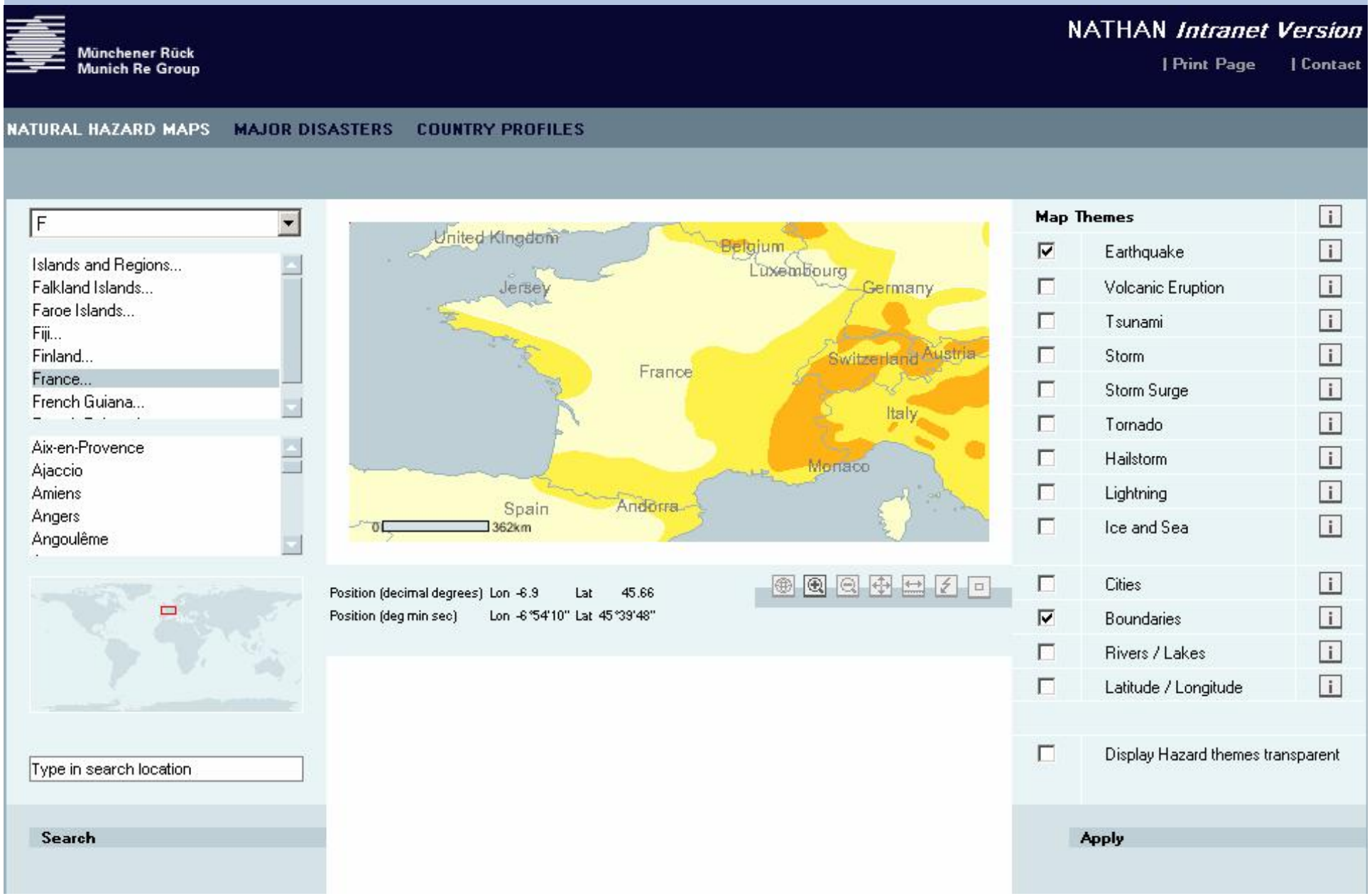

Major Disasters

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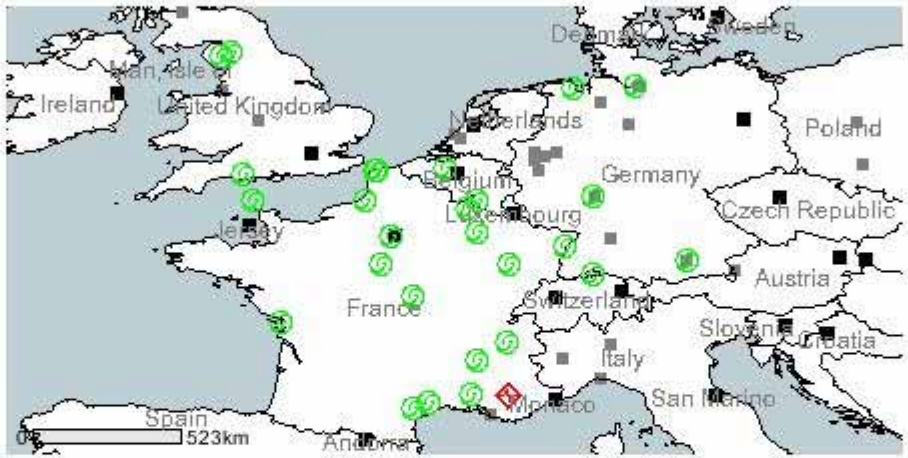
NATURAL HAZARD MAPS | MAJOR DISASTERS | COUNTRY PROFILES

F

Falkland Islands...
Faroe Islands...
Fiji...
Finland...
France...
French Guiana...
French Polynesia...



all

- [x] Earthquake
- [ ] Volcanic Eruption
- [x] Storm
- [ ] Flood
- [ ] Others

Report

- ○ Short Report
- ◉ Long Report

Order

- ◉ by date
- ○ by event

Position (decimal degrees) Lon 26.02 Lat 48.08
Position (deg min sec) Lon 26°01'22" Lat 48°04'30"
33 significant events found in this area (Source: Nat Cat *SERVICE*®)

Apply

Type in search location

Search

Winter storm Franz				MR200701B38
Date	11.-12.1.2007	Damages		
Area	REGION EUROPENorthern, Western, Eastern Europe	Insured Losses	> US$ 200 m	
Deaths	9	Economic Losses	> US$ 300 m	
Winter storm				**MR200412B11**

Country Profile

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F

- Falkland Islands...
- Faroe Islands...
- Fiji...
- Finland...
- France...
- French Guiana...
- French Polynesia...

France

Geography | Government | Demography | Economy | Insurance | Transportation | Natural hazards

Geography location	Western Europe, bordering the Bay of Biscay and English Channel, between Belgium and Spain, southeast of the UK; bordering the Mediterranean Sea, between Italy and Spain	
Total area	547,030 sq km	
Land/ Water	99.7% / 0.3%	
Notes	largest West European nation	
Land boundaries	2,889 km	
Border boundaries	Andorra 56.6 km, Belgium 620 km, Germany 451 km, Italy 488 km, Luxembourg 73 km, Monaco 4.4 km, Spain 623 km, Switzerland 573 km	
Coastline	3,427 km	
Climate	generally cool winters and mild summers, but mild winters and hot summers along the Mediterranean; occasional strong, cold, dry, north-to-northwesterly wind known as mistral	
Terrain	mostly flat plains or gently rolling hills in north and west; remainder is mountainous, especially Pyrenees in south, Alps in east	
Lowest point	Rhone River delta (-2 m)	
Highest point	Mont Blanc (4,807 m)	
Land use	arable land	33.46%
	permanent crops	2.03%
	other	64.51%

Hazard Exposure

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NATURAL HAZARD MAPS MAJOR DISASTERS COUNTRY PROFILES

F

Falkland Islands...
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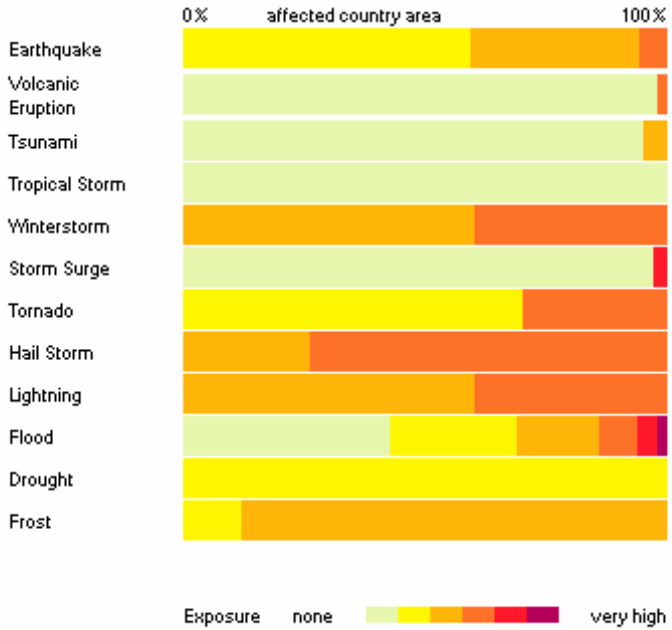
French Polynesia...

France

Geography | Government | Demography | Economy | Insurance | Transportation | Natural hazards



Source: Munich Re Geo Risks Research, Last update: 10/12/2006

Exposure
The bar charts show the degree of exposure to natural hazards and the percentage of area affected (per country).

Notes
Tsunamis and storm surges are a threat to coastal regions, particularly gulfs, bays, and estuaries. The flood hazard results from river floods and torrential rain. The hazard of dryness and drought is caused by major deviations from the normal amounts of precipitation. The frost hazard depends on the elevation and the latitude.

Natural hazard risk index for megacities (Top 10)

Risk = Hazard *Loss susceptibility *Values

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City	Index as a whole1) 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

The Munich Re risk index for megacities: Result

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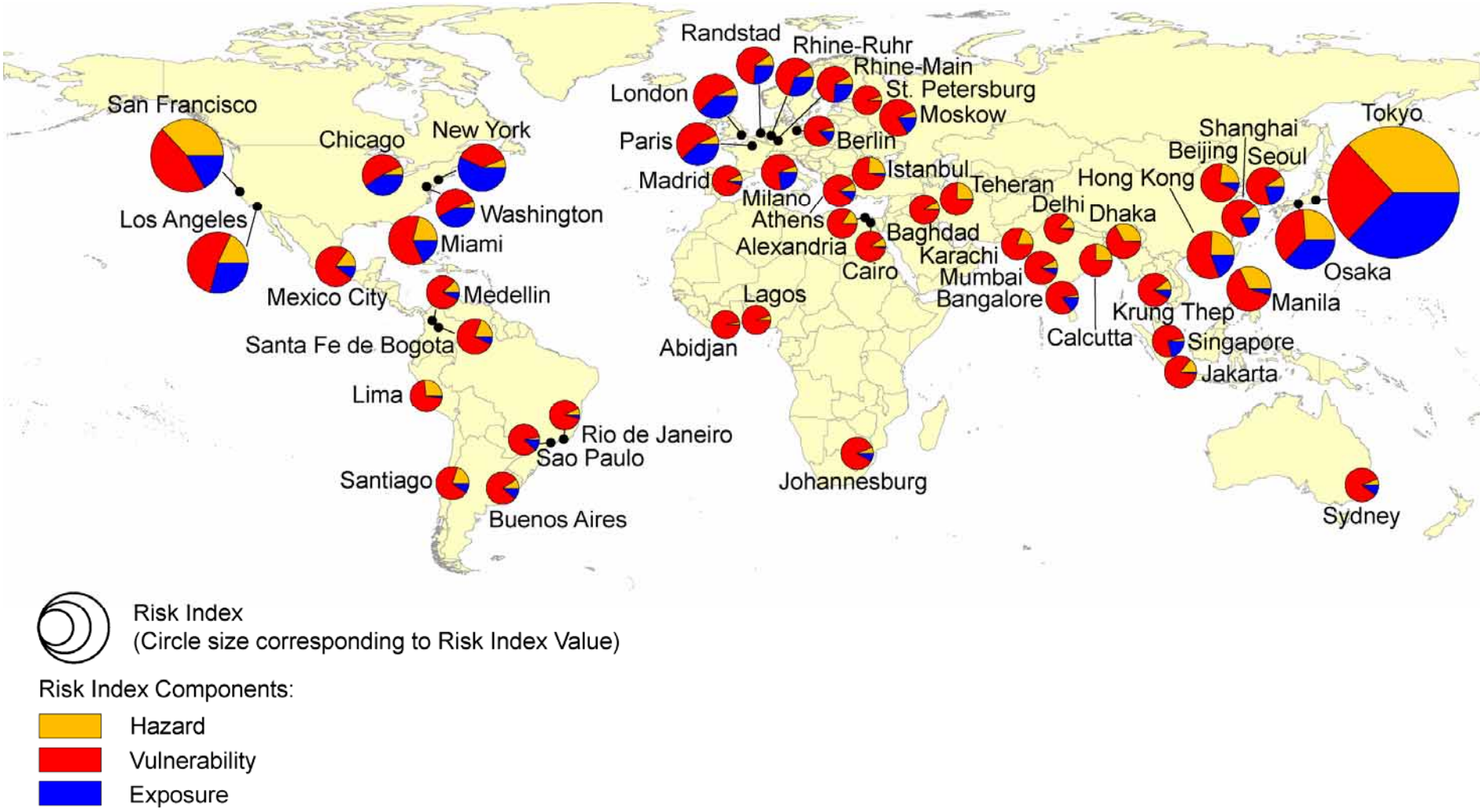
Megacity Risk Index with hazard-component including earthquake, tsunami, storm, flooding, bushfire, volcanism



Conclusions

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- Natural catastrophes, especially weather related events, are increasing dramatically in number and magnitude. Loss potentials have reached new dimensions
- 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
- New building standards and settlement policies are necessary in respect to the already existing and also changing natural hazards in order to reduce the vulnerability
- The insurance industry is a competent partner to minimize risks and maximize awareness

Carbon neutrality at Munich Re

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Munich Re Munich: 2009
Munich Re Reinsurance worldwide: 2012

Measures :

- Reduction of emissions per employee
- Usage of "green" power electricity
- Investment in renewable energies and afforestation
- In return for remaining emissions investment in emission certificates used for climate-protection projects in emerging countries

Thank you very much for your interest

Peter Hoeppe

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