Severe Weather in North America

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ECSS 2013, Helsinki, June 3, 2013

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US Insurance Survey April 2013
Participants: 81 CEOs of US Primary Insurers

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What are the 3 most critical issues facing the primary insurance industry today?

Issue	Rank
Low interest rates and capital market returns	1st (64%)
Natural catastrophes/weather events	2nd (51%)
Price competition	3rd (43%)

Multiple responses allowed. Does not add to 100%.

MR NatCat*SERVICE*

The world‘s largest database on natural catastrophes

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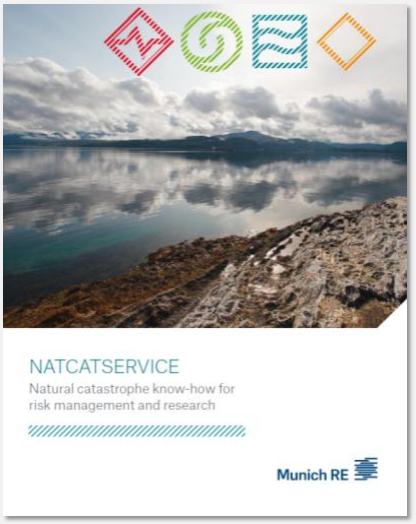

The Database Today

- 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. Vesuvius (3,000 historical data sets).
- **Currently more than 32,000 data sets**

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Weather catastrophes worldwide 1980 – 2012

Percentage distribution – ordered by continent

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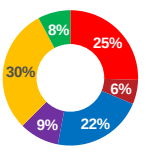
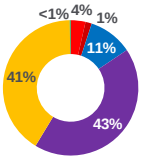
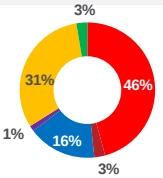
18,200 Loss events



1,405,000 Fatalities

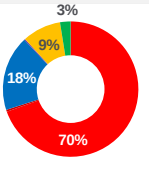


Overall losses* US$ 2,800bn



*in 2012 values

Insured losses* US$ 855bn



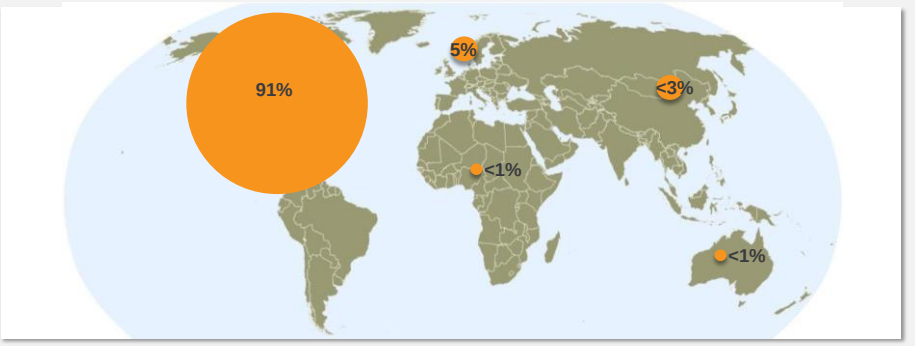
*in 2012 values

Africa | Asia | Australia/Oceania | Europe | North America, incl. Central America and Caribbean | South America

Global Natural Catastrophe Update

Natural catastrophes worldwide 2012

Insured losses US$ 65bn - Percentage distribution per continent



Continent	Insured losses US$ m
America (North and South America)	60,000
Europe	3,200
Africa	200
Asia	1,700
Australia/Oceania	300

Source: Geo Risks Research, NatCatSERVICE – As at January 2013

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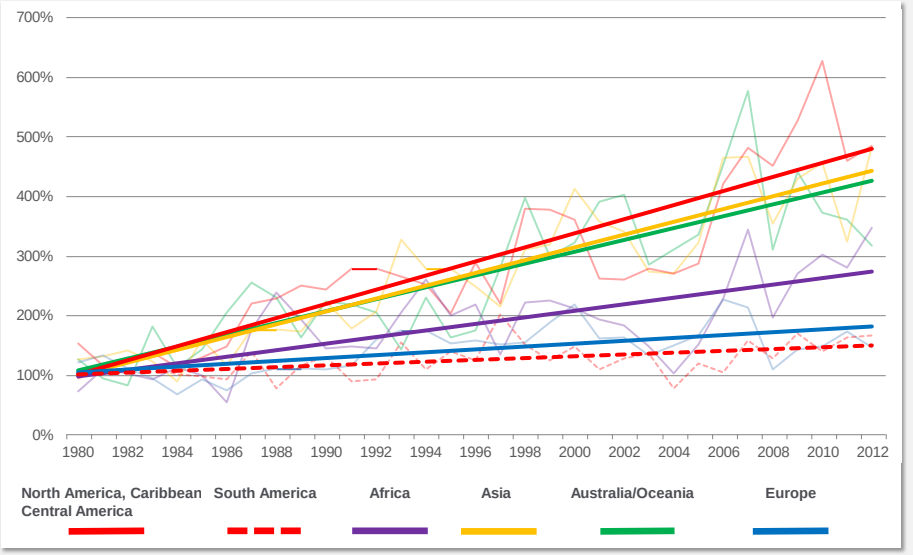
Weather catastrophes worldwide 1980 – 2012

Number of events – relative trends by continent



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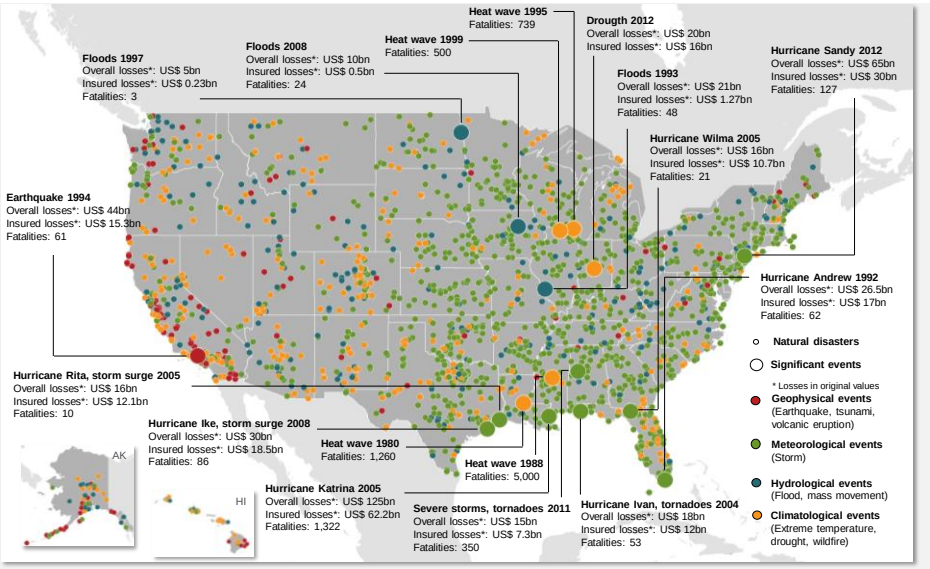
Natural catastrophes in the USA 1980 – 2012



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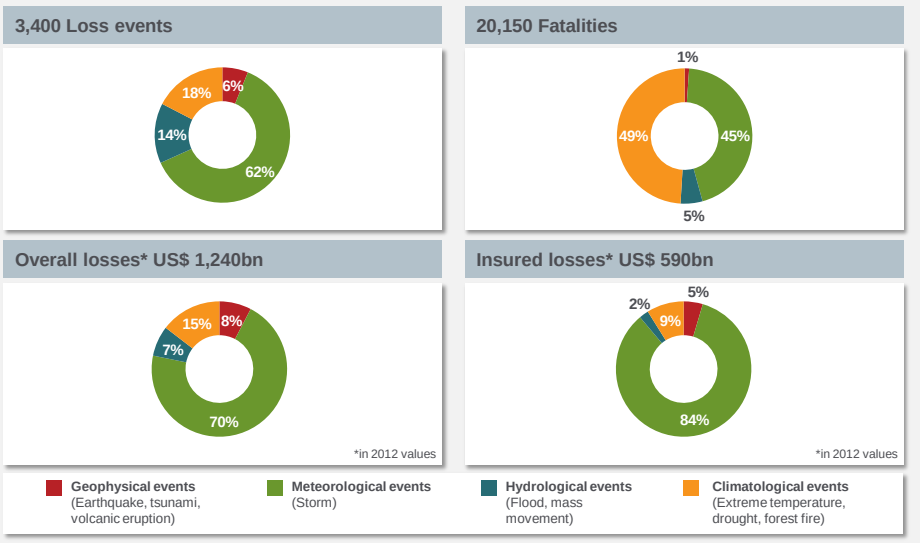
Natural catastrophes in the USA 1980 – 2012

Percentage distribution



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Weather catastrophes in the USA 1980 – 2012

Number of events with trend

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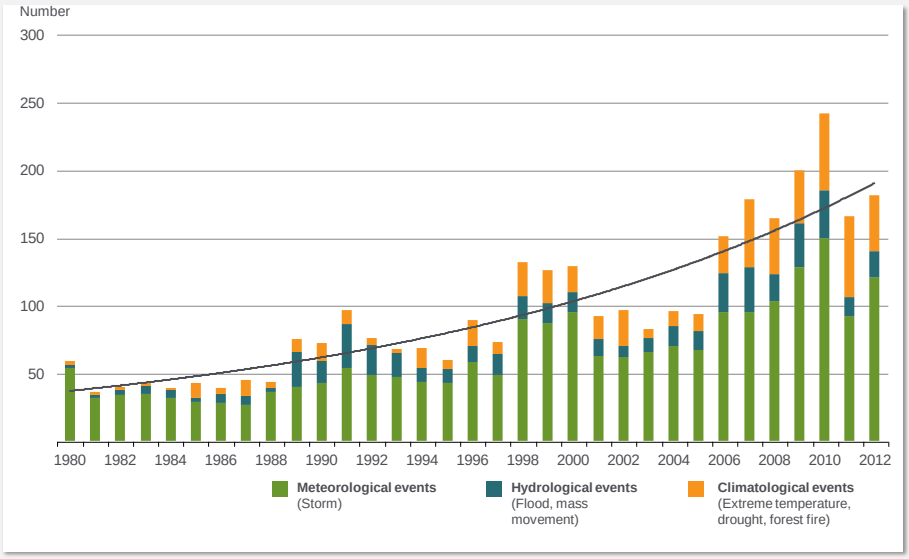

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Weather catastrophes in the USA 1980 – 2012

Overall and insured losses with trend

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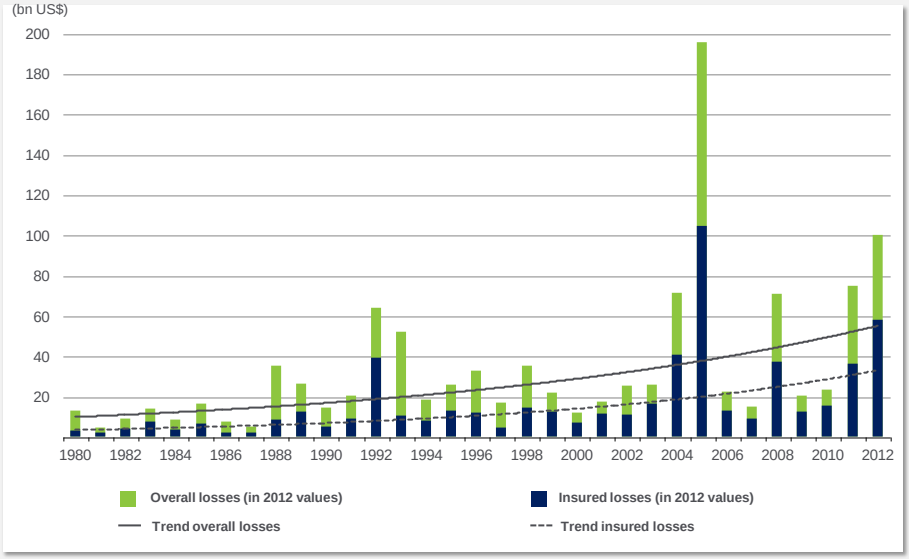

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Natural catastrophes in North-America* 1980 – 2012
Relative trends of number of loss relevant events

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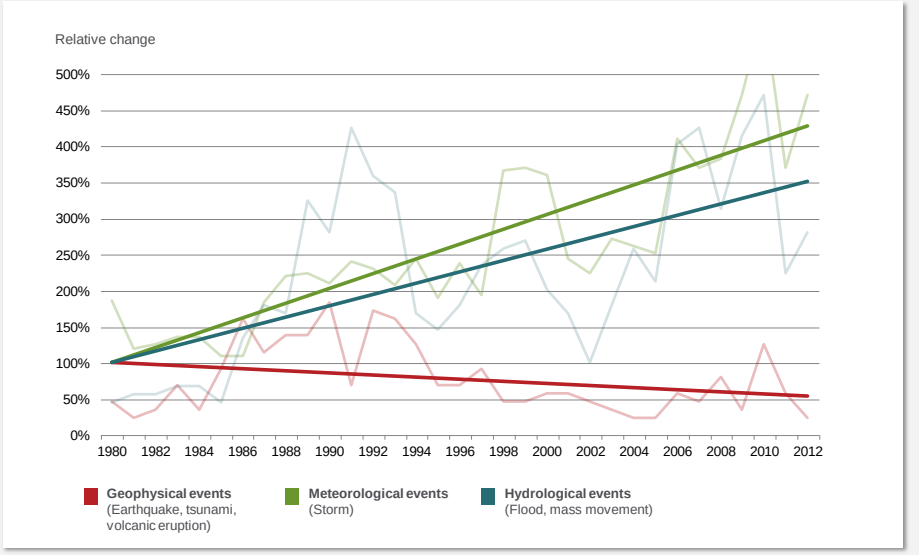

Annual Numbers of US Federal Disaster Declarations from 1953 to 2012

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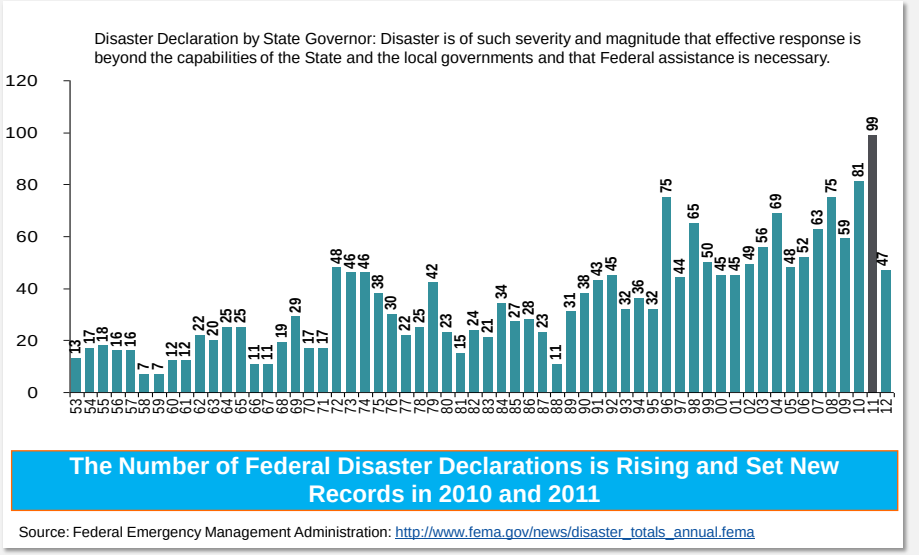
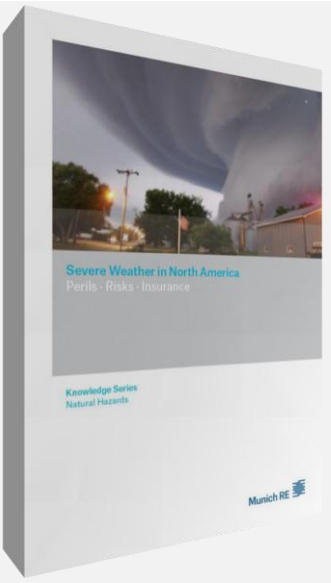
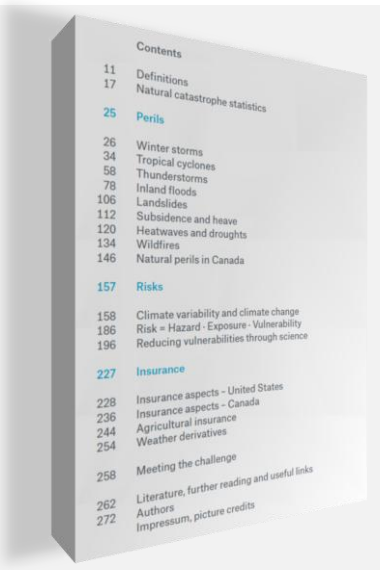


The Number of Federal Disaster Declarations is Rising and Set New Records in 2010 and 2011

Source: Federal Emergency Management Administration: http://www.fema.gov/news/disaster_totals_annual.fema

Severe Weather in North America
274 pages of in depth Munich Re expertise





Winter storms

- Winter storms can occur year-round despite their name
- The types of hazard they produce vary greatly by region

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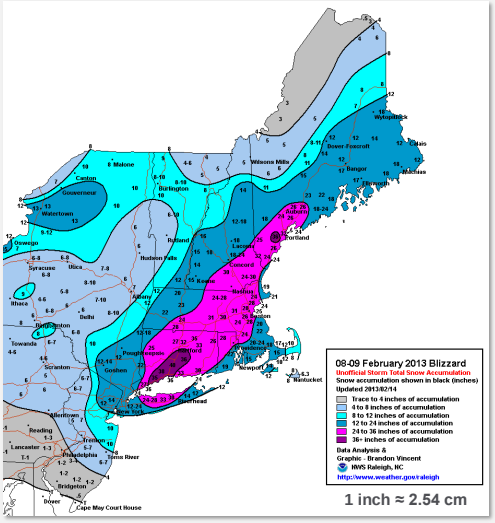
Nor’easter Nemo, United States and Canada

February 2013



Event:

- High snowfall (see map)
- High wind speeds (gusts up to 130 km/h)
- Coastal flooding

Impact:

- 15 fatalities
- Power outages (650,000 households affected)
- Traffic affected (6,000 flights cancelled, traffic accidents)

Costliest winter storms in the United States and Canada since 1980 (ranked by insured losses)

Period	Area	Eco Loss	Ins Loss	Deaths
1993	CAN, USA	5,000	2,000	270
2007	CAN, USA	2,000	1,580	23
1998	CAN, USA	2,900	1,150	45
1992	USA	3,000	1,000	19
2011	USA	1,300	975	36
1983	USA	1,000	880	500
1994	USA	1,000	880	70
1994	USA	3,000	800	9
1999	CAN, USA	1,000	775	25
2008	USA	1,000	745	12
1996	USA	1,500	735	16

Winter storms

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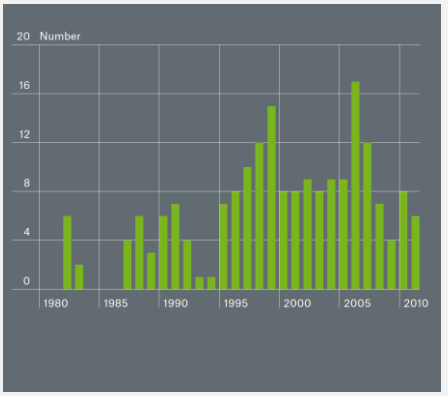
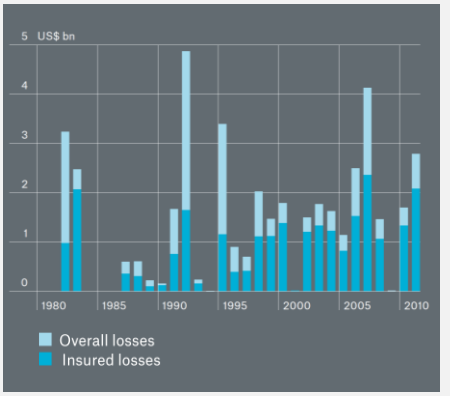
Number of damaging events



Overall and insured losses (in 2011 values)



Tropical cyclones (hurricanes)

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- Tropical cyclones (hurricanes) are the most devastating weather events in North America
- Scenarios in Florida, Texas and the northeast coast constitute extraordinary risks

Hurricanes and tropical storms in North America* 1980 – 2012
Overall and insured losses

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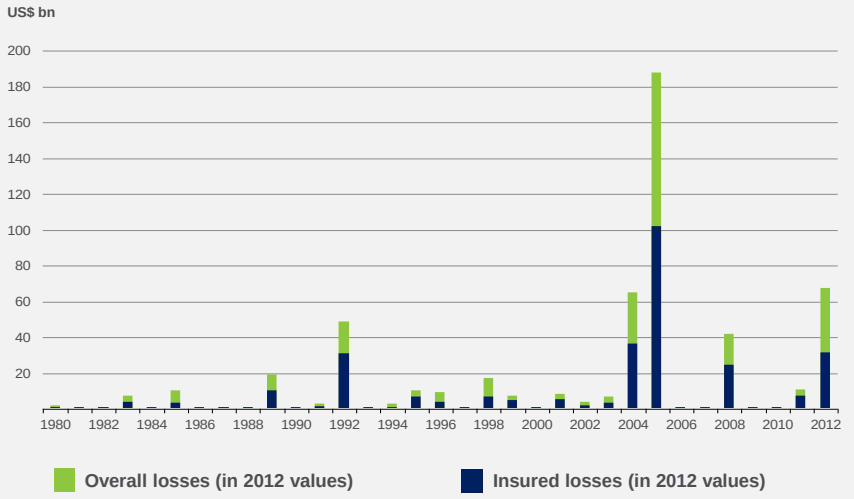
* United States, Puerto Rico, Virgin Islands (US), Canada



The Sandy scenario has been described in the Munich Re book published several weeks before the event

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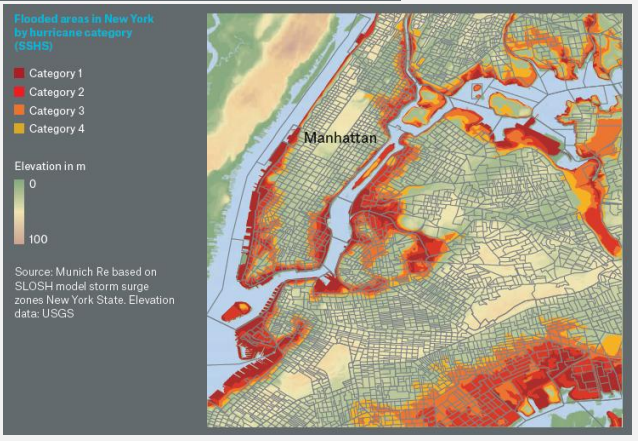
Hurricane U.S.: East coast scenario

Peter Miesen, Munich Re

flooding. A stronger hurricane, like the 1938 Great New England Hurricane, would easily cause more extensive wind damage throughout the region and generate a storm surge that could devastate coastal communities, and the financial hub of the United States, causing losses several times higher than Irene's. Irene should serve as a wake-up call for the region, and lessons learned should be used to help protect against losses from bigger storms in the future.



Hurricane Sandy – October 22-30, 2012
2nd most expensive hurricane in US history

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source: AP

Region	Total losses	Insured losses	Fatalities
USA	US$ 65 bn*	US$ 30 bn*	110

*Loss assessments still ongoing

Sea Surface Temperatures

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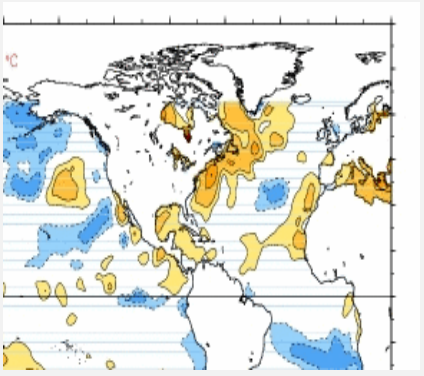
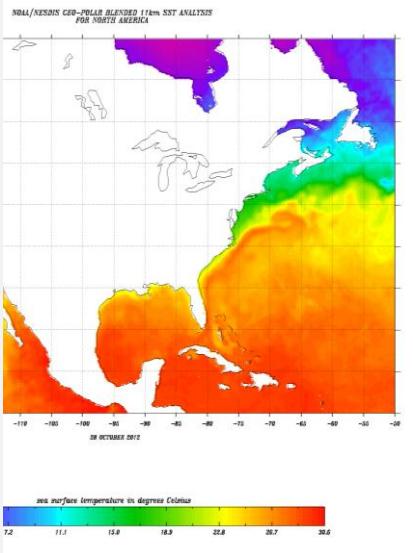
Sea surface temperature anamoly (October 20)





Number of tropical storms in the Northern Atlantic

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	Named storms	Hurricanes	Cat 3-5 Hurricanes
2012	**19**	**10**	**2**
2011	**18**	**6**	**3**
2010	**19**	**12**	**5**
2005	**28**	**15**	**7**
Climatology 1950-2011	10.6	6.3	2.7
Climatology warm phase 1995-2011	14.8	7.8	3.8

Hurricanes and tropical storms in North America

Observed and projected changes

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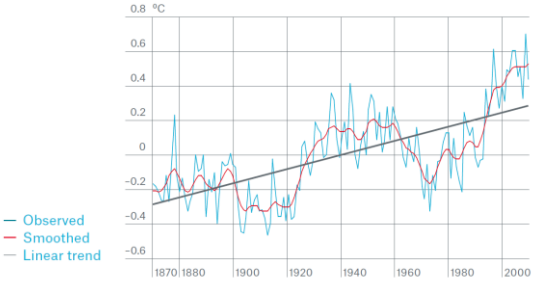
Observed changes

-Year-to-year variability in number of hurricane landfalls is linked to the ENSO-phenomenon: Landfalls are more frequent during La Niña phases

- On a time scale of decades, tropical cyclone frequency is dependent on AMO (Atlantic Multidecadal Oscillation) phases

Multidecadal swing of the North Atlantic sea surface temperature anomalies 1870-2011, indicative of the AMO



Source: Munich Re – Severe weather in North America, 2012

Thunderstorms

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- A strong upward trend in insured losses caused by severe thunderstorms has been observed in recent years
- This hazard will most likely increase further as the climate changes

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Convective loss events in the U.S.
Number of events 1980 – 2012

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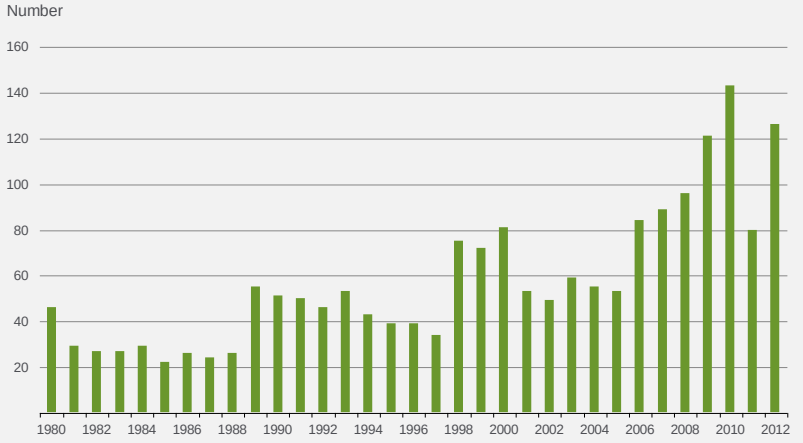

Loss events caused by straight-line winds, tornadoes, hail, heavy precipitation, flash floods, lightning

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Convective loss events in the U.S.
Overall and insured losses 1980 – 2012

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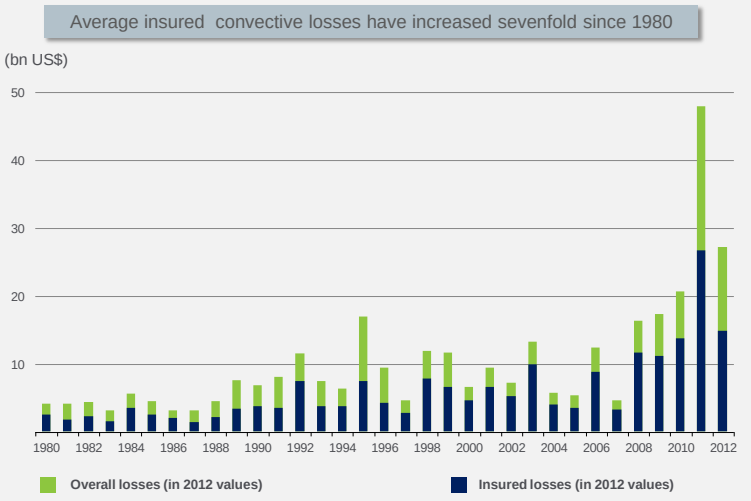

Analysis contains: straight-line winds, tornadoes, hail, heavy precipitation, flash floods, lightning.

New Munich Re Scientific paper on U.S. Thunderstorm Trends

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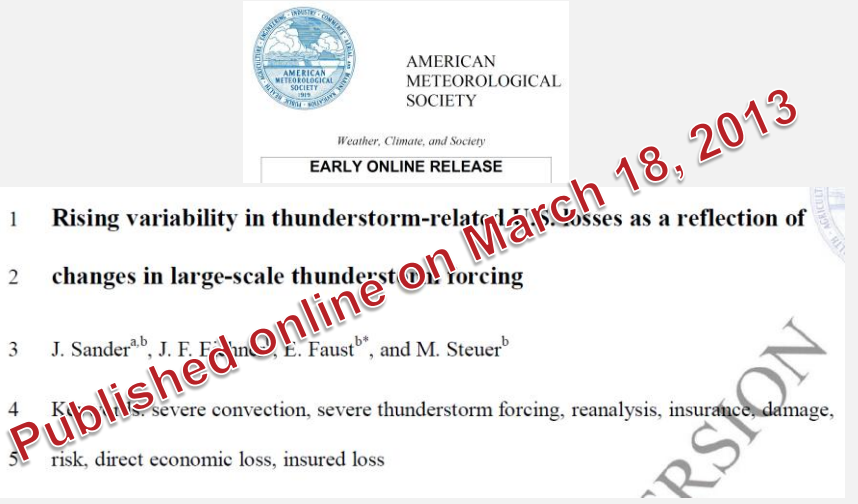
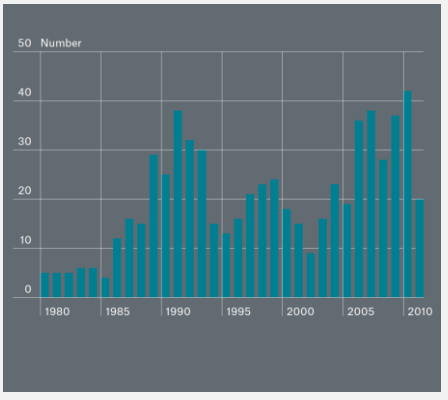


Inland floods

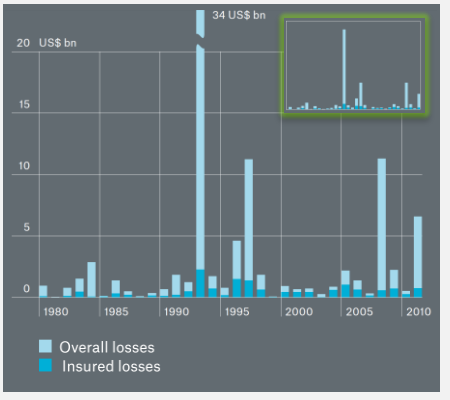
- Inland flooding, one of the most common hazards in North America, ranges from watershed-wide to local events
- The ARkStorm scenario, a severe type of flood event could potentially strike California and involve costs in the order of hundreds of billions of dollars

Inland floods

Number of damaging events



Overall and insured losses (in 2011 values)



Prevention measures have decreased the vulnerability significantly!

Heatwaves and droughts

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- Heatwaves and droughts are extreme deviations from regional temperature and rainfall norms
- They feature a wide variety of consequences ranging from impacts on agriculture to human health
- A highly relevant issue is maintaining stable power supplies

Summer 2012: Heat records and drought in the US
July 2012 warmest month in US since start of measurements

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Region	Total losses	Insured losses	Fatalities
USA	US$ 20 bn	US$ 16 bn	42

New scientific paper on changes in probabilities of extreme temperatures

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Climatic Change
January 2013

Global increase in record-breaking monthly-mean temperatures

Dim Coumou, Alexander Robinson, Stefan Rahmstorf

Worldwide	The **number of local record breaking monthly temperature extremes is now** on average **5 times larger than expected in a climate with no long-term warming**
Regional differences	Summertime records, which are associated with prolonged heat waves, increased by more than **a factor of 10** in some continental regions **including parts of Europe, Africa, southern Asia and Amazonia**

On average there is an 80% chance that a new monthly heat record is due to climatic change

Wildfire

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- The wildfire hazard can be directly influenced by human activity; therefore, prevention measures can be crucial
- Third-party liability insurance is also an issue here

Wildfire

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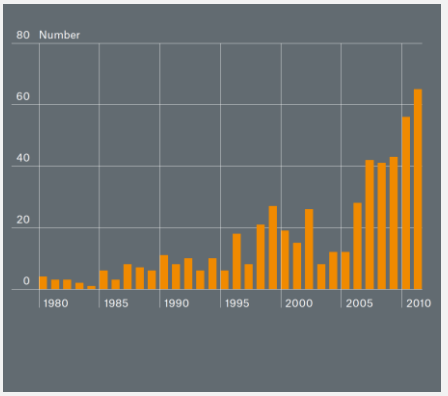
Number of damaging events



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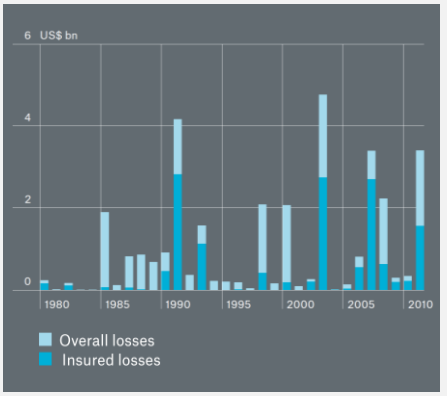

Risks: Climate variability and climate change

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- Phenomena caused by climate variability, such as the AMO and ENSO still have the largest influence on the variation of patterns of severe weather
- In the long term, anthropogenic climate change is believed to be a significant loss driver, though it influences various perils in different ways

Meeting the challenge

With losses in many types of severe weather events in North America increasing, combined efforts are necessary to manage these perils

All parties must work together to find solutions for mitigation and adaptation:

- **Homeowners** (more resilient houses)
- **Businesses** (more resilient buildings, disaster management plans)
- **Science** (provide information necessary for risk mitigation and early warning)
- **Governments** (favorable regulatory frameworks for risk mitigation, funding of research, update flood maps)
- **Insurance industry** (risk awareness, incentivize risk reduction, secure financial stability)

Conclusions

- Due to its geographic location, orography and concentration of wealth North America is the continent with the highest number of loss relevant extreme weather events
- In North America frequencies of loss relevant weather events have increased more than in all other continents since 1980
- If all stakeholders , i.e. science, governments, the public and industry work together, many of the risks can be mitigated, material loss and human suffering avoided
- On the long term we have to mitigate global warming to avoid unmanageable conditions in the 2nd half of this century
- As the critical precondition for appropriate risk management is knowledge of the risks, more research on regional patterns of extreme weather is needed