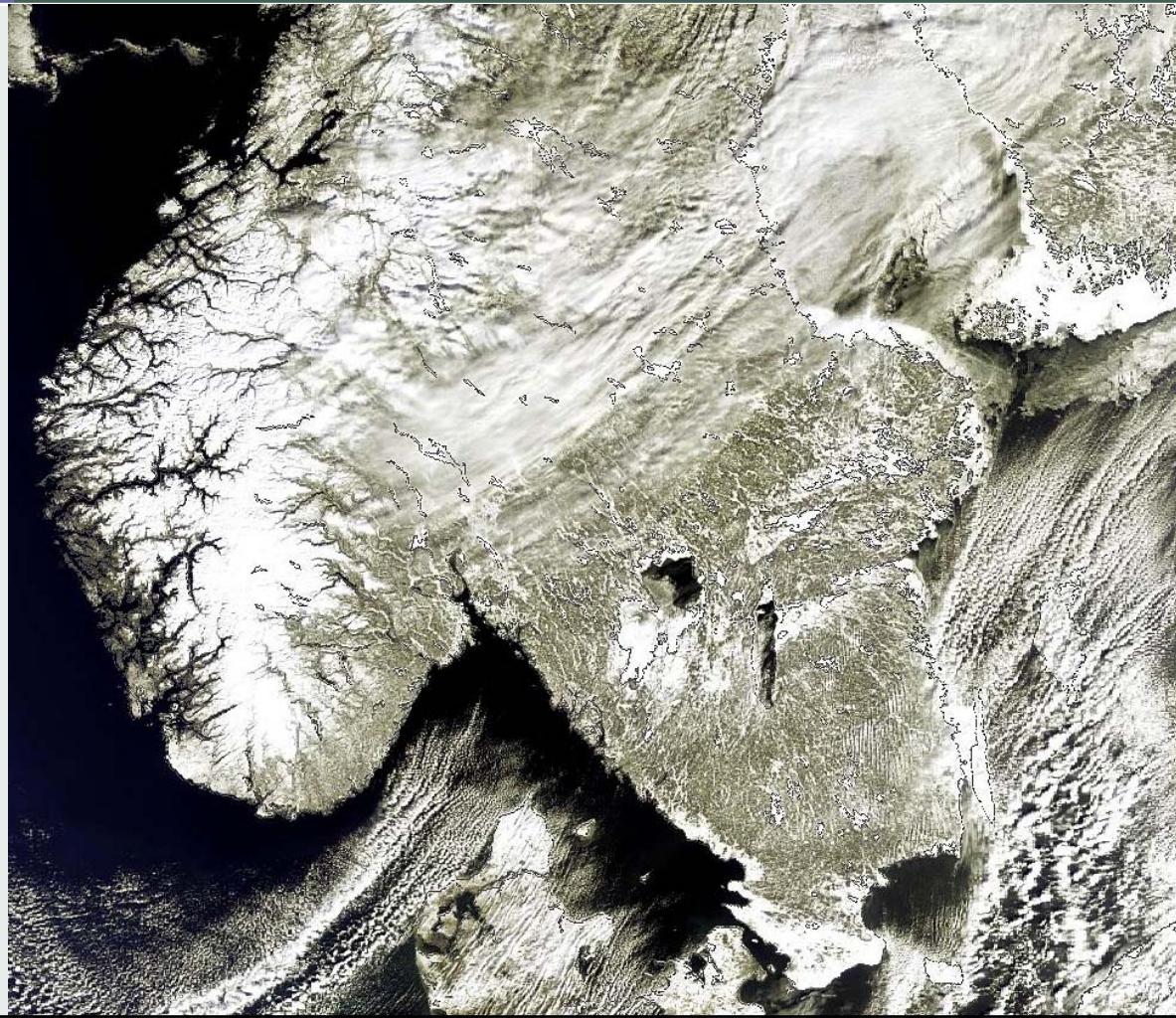


Swiss Re



Global Warming A Changing Risk Landscape

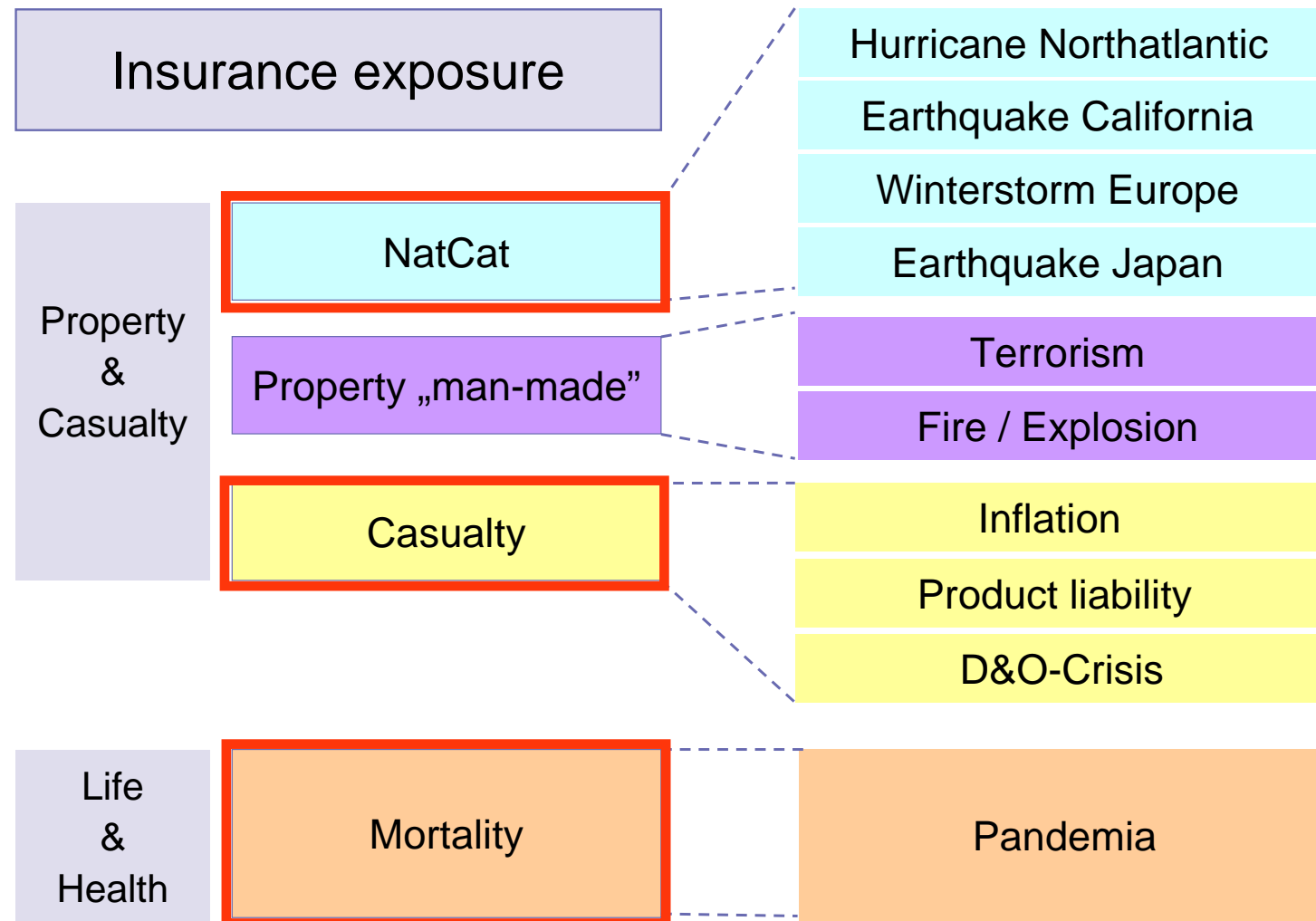


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ASTRA
Project
GTK - Espoo
Dec 11th 2007

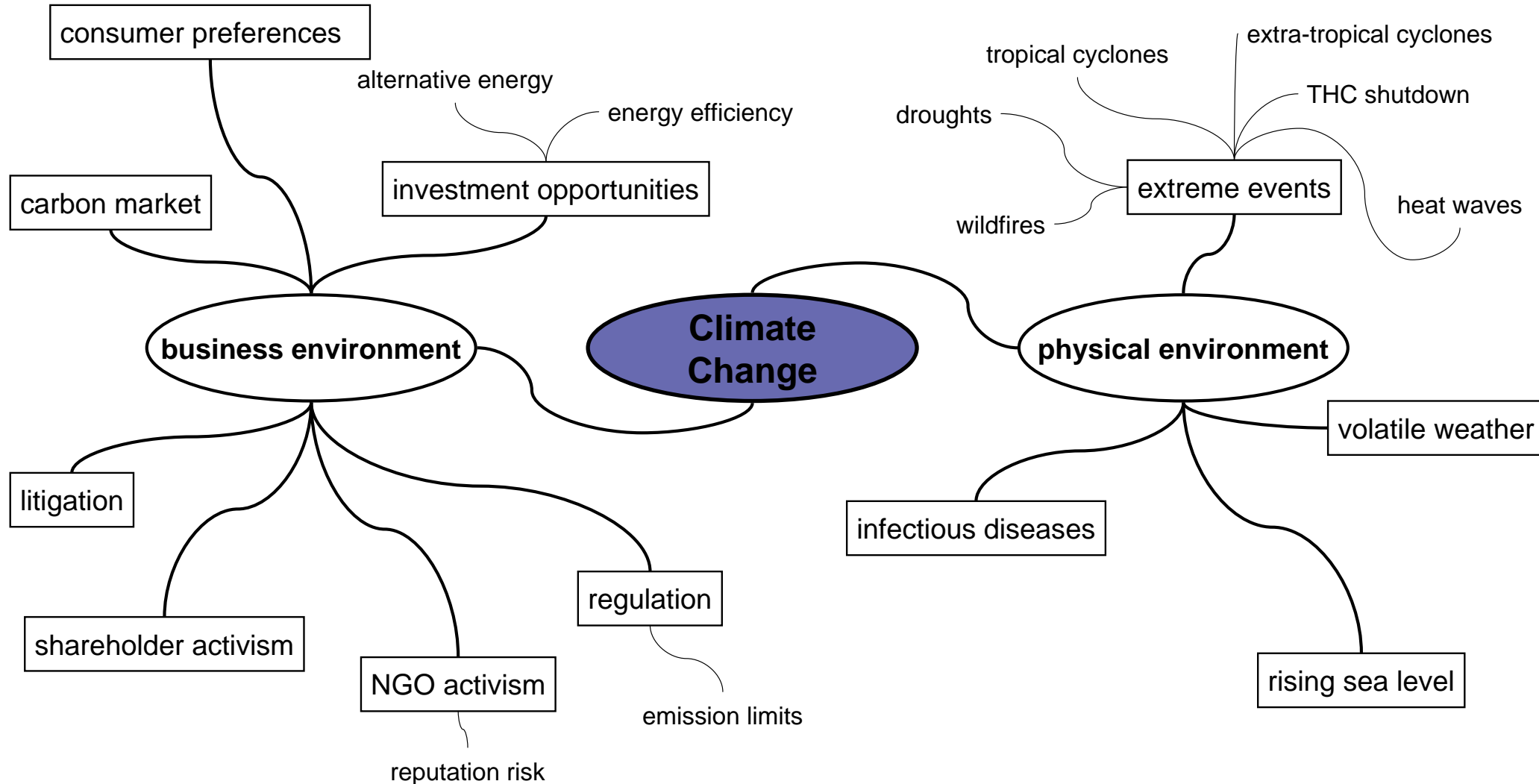


Risk landscape of a reinsurer like Swiss Re





Global Warming A Changing Risk Landscape

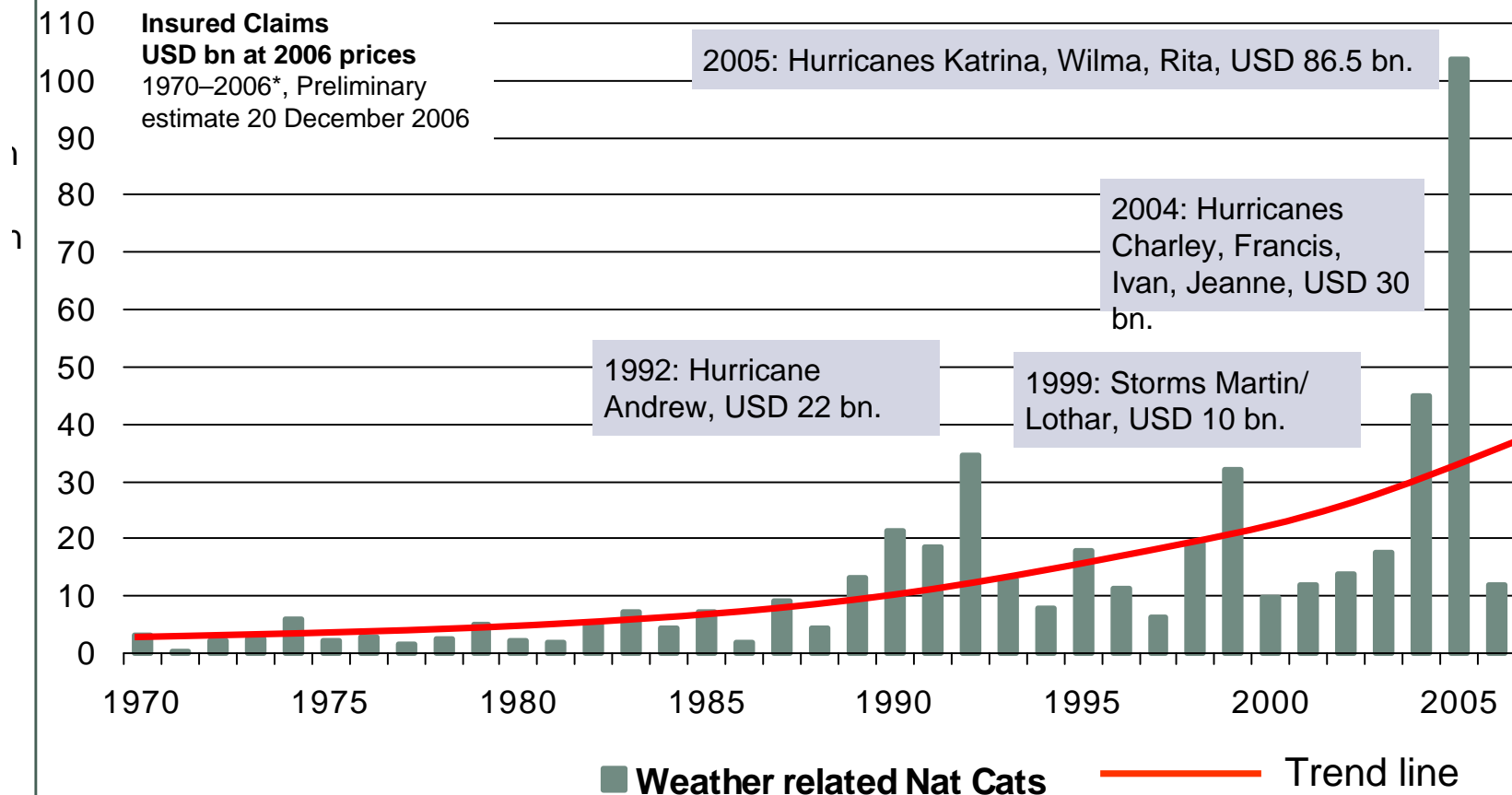


Overview

- Changes in the physical environment
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General observations: Increase in insured claims from NatCat

Swiss Re



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Note (1): Property and business interruption, USD bn, at 2006 prices. **New: insured losses incl. NFIP**

(2): Includes storm, flood, cold, drought, hail (excluding earthquake)

Source: Swiss Re sigma Catastrophe database; preliminary estimates 2006: 20 Dec.06

General observations: Growing population in costal areas

Swiss Re



- The 1926 Florida hurricane caused economic loss in present day USD of 100 m. The similar powerful Andrew in 1992 caused 39 bn.



Ocean Drive, FL, 1926.



Ocean Drive, FL, 2000.

Population Growth Rates

Period	1960-2000	1980-2000	1990-2000
All US	57%	24%	13%
Florida	223%	64%	24%

General observations: Insurance claims – Europe perspective

Swiss Re



<i>Event</i>	<i>Property premium 2007</i>	<i>Economic loss</i>	<i>Insured loss</i>
■ 1990 Vivian			2,8 bn €
■ 1999 Anatol (Winterstorm)			1,3 bn €
■ 1999 Lothar & Martin			5,6 bn €
■ 2005 Storm Erwin / Gudrun			1,3 bn €
■ 2005 Flood Romania	0,14 bn € (10%)	1,5 bn € (1%)	0,015 bn €
■ 2005 Flood Norbert			1,5 bn €
– Share Austria	2 bn € (5%)	0,4 bn € (25%)	0,1 bn €
– Share Switzerland	2,9 bn € (48%)	1,7 bn € (82%)	1,4 bn €
■ 2007 Kyrill			3,6 bn €
■ 2005 Hurricane Katrina	77 bn € (57%)	95,9 bn € (46%)	44,1 bn €



Overview

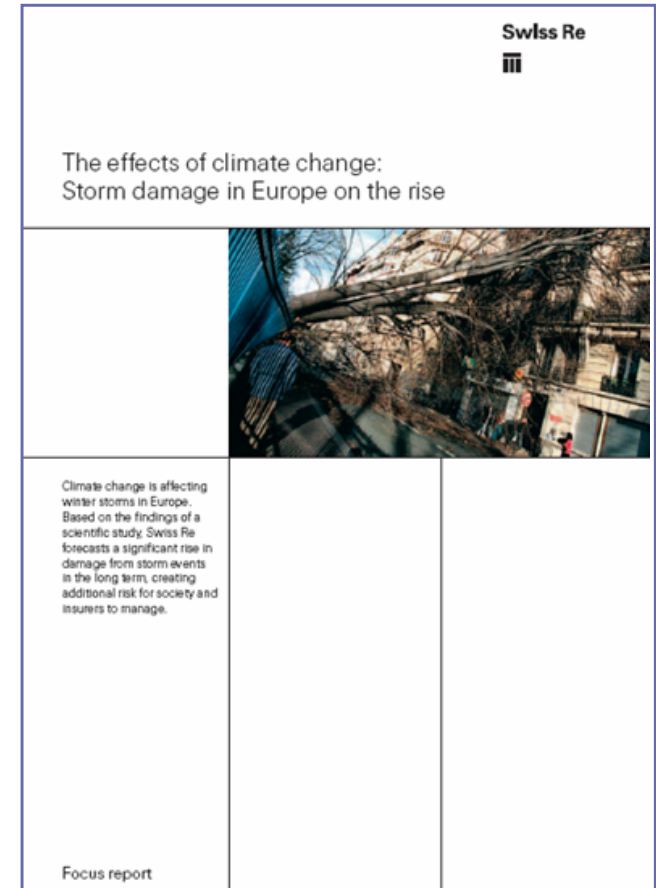
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Changes in extreme events: Winterstorm Europe - Goal and methodology

- collaboration of Swiss Re with university (ETH Zurich)
- 3 different regional climate models driven by global climate scenario A2
- coupling of windfields from climate model to Swiss Re loss model

source: Schwierz et al.: Modelling European winter windstorm losses in current and future climate.

published in Climate Change



Swiss Re

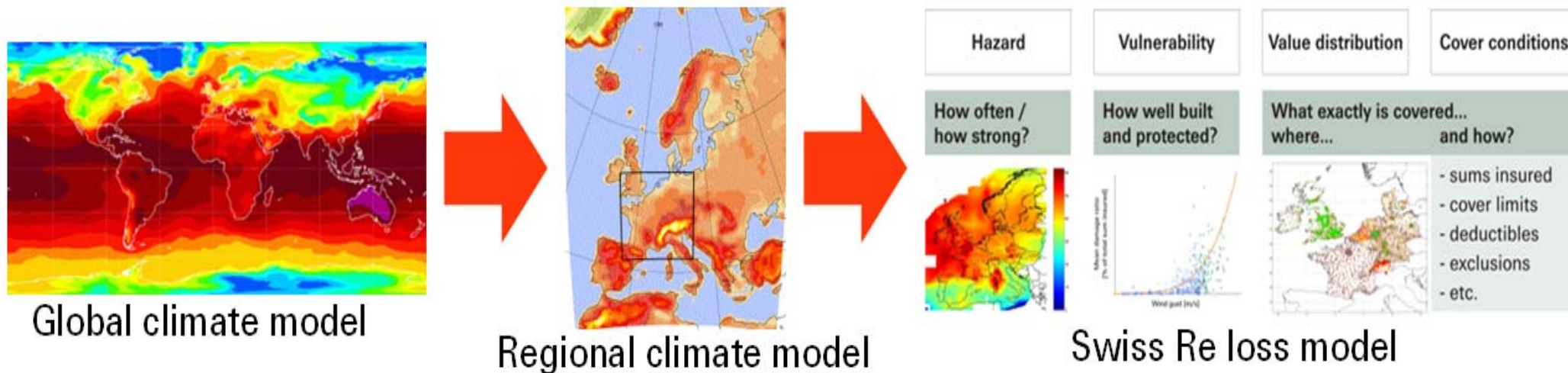
The effects of climate change:
Storm damage in Europe on the rise

Climate change is affecting winter storms in Europe. Based on the findings of a scientific study, Swiss Re forecasts a significant rise in damage from storm events in the long term, creating additional risk for society and insurers to manage.

Focus report

Changes in extreme events: Winterstorm Europe - Goal and methodology

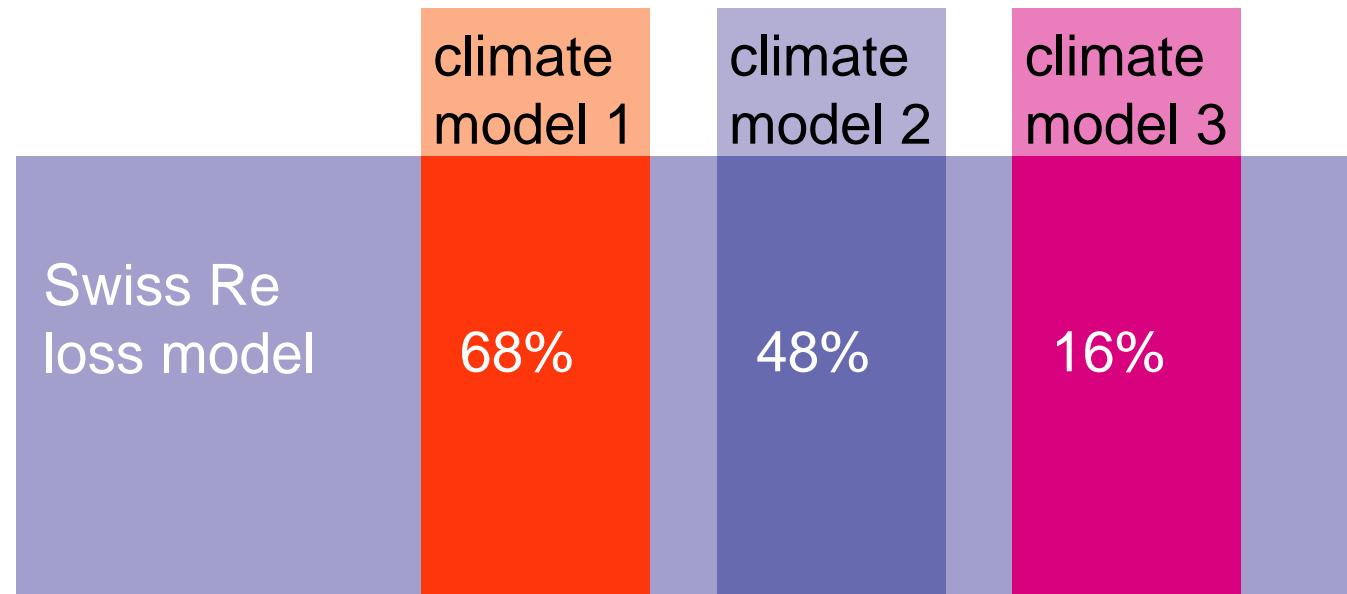
Compare wind storm losses on a Europe-wide property insurance portfolio in current and future climate conditions. Co-operation with Federal Institute of Technology Zurich (ETH):





Changes in extreme events: Storm losses on the rise

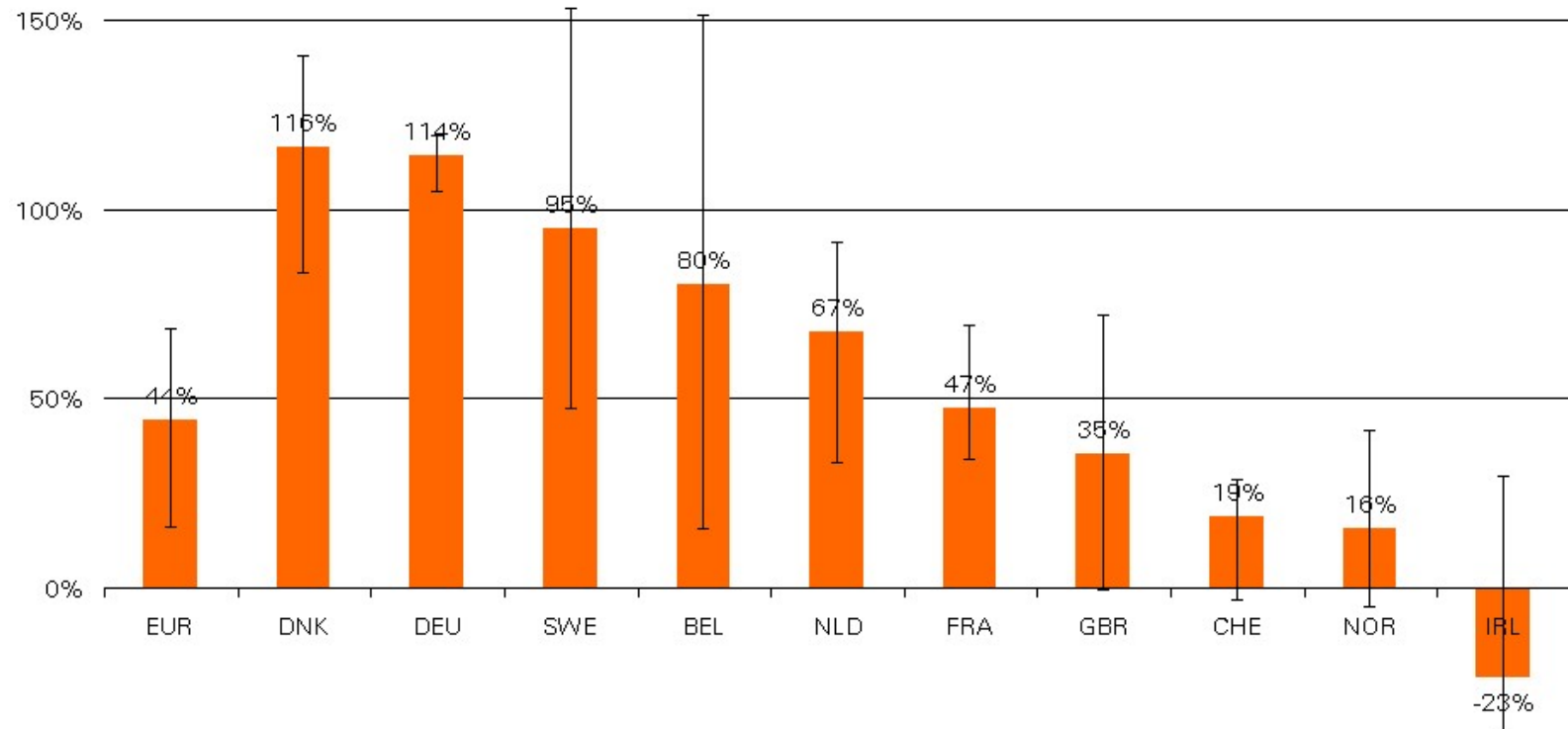
Increase in annual expected loss for the period 2071–2100 compared to a 1961–1990 reference period:





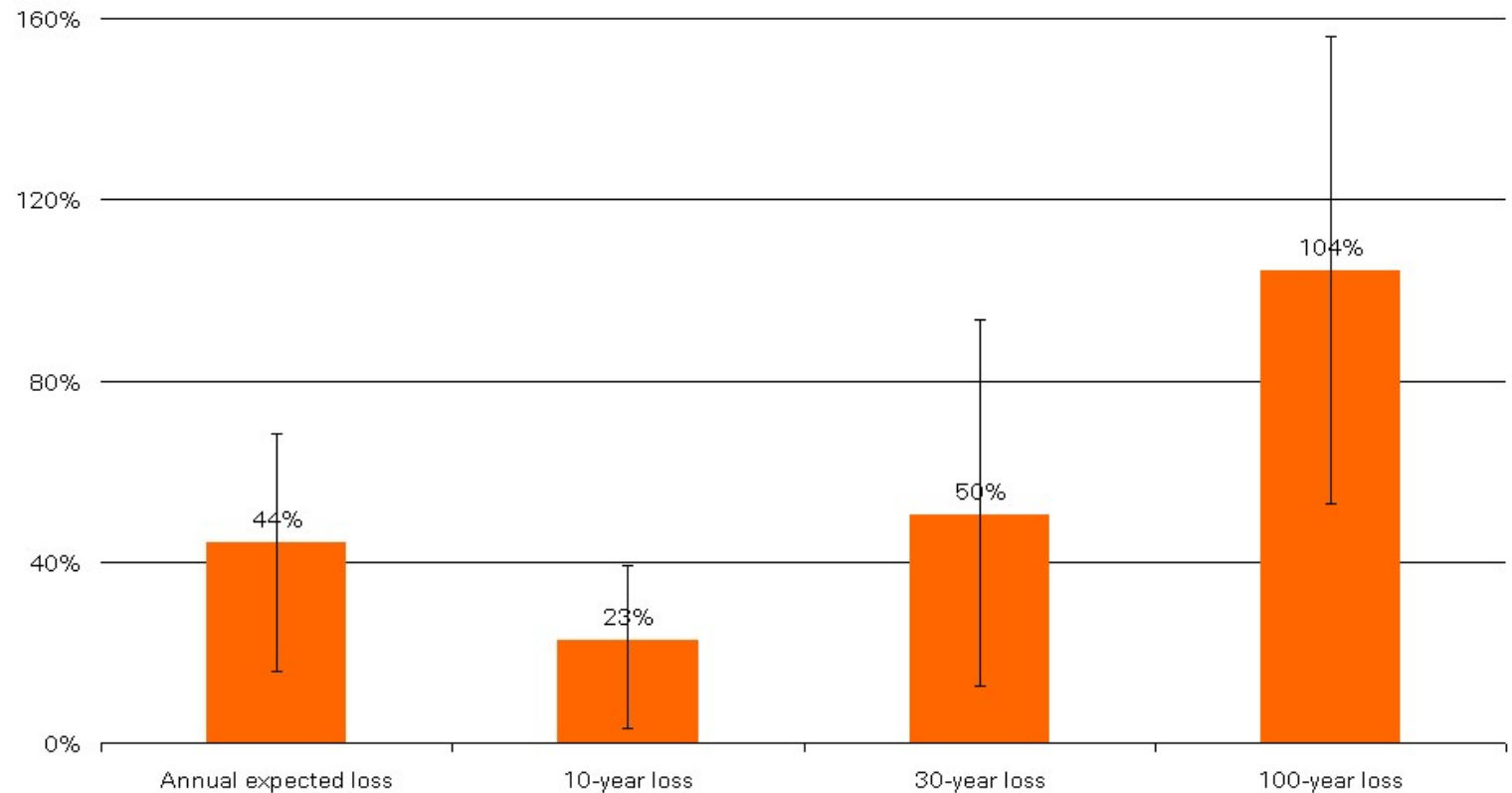
Changes in extreme events: Different impacts for Europe

Swiss Re expects insured storm losses in Scandinavia to double by the end of the century





Changes in extreme events: “the big ones” get bigger



Changes in extreme events: Flood losses in Europe - Joint project with EC

Tackle the problem in co-operation with EC Research Center in Ispra

- Break down **climate change** forecast for Europe:
- Calculate **river discharge** under changing climatic condition
- Quantify the impact of climate change on river **flood losses** in Europe

Preliminary results

- Annual precipitation (over all) will increase slightly
- Less summer- but increased winter-discharge
- Enhanced flood risk during winter and spring
- Return periods of heavy precipitation events could be halved

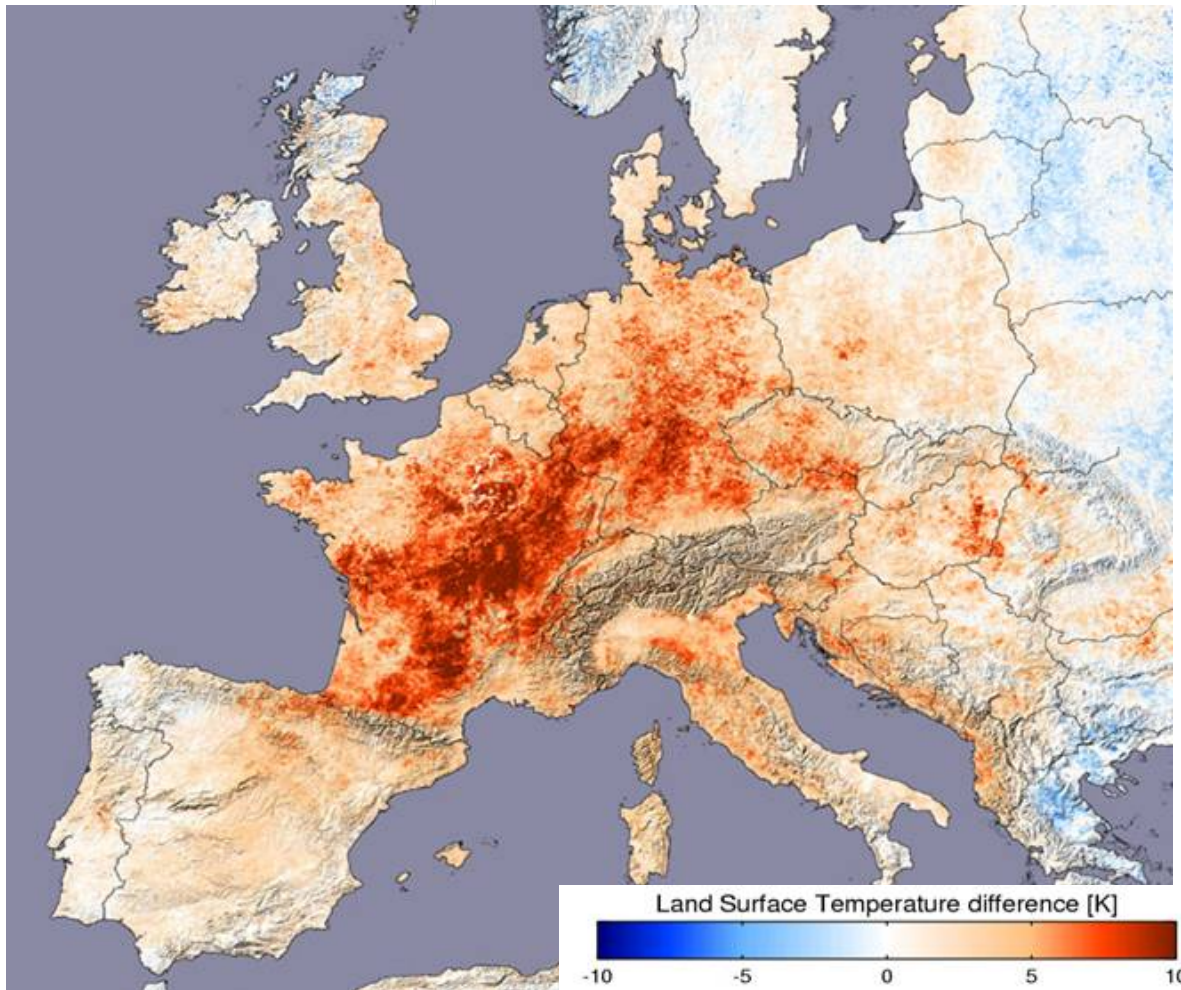


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Changes in extreme events: Heatwave 2003



August 2003 temperatures relative to 2000-2002, 2004

Source: Reto Stöckli, ETH/NASA, MODIS / Prof. Christoph Schär

Economic impacts: downsides

- Agricultural losses:
USD 12.3bn
- Serious problems with
 - freshwater resources (Italy)
 - forest fires (Portugal)
 - freshwater fish (Switzerland)
- Shortage of electricity, peak prices on spot market (EEX)
- Estimated 22 000 to 35 000 heat deaths (excess mortality)

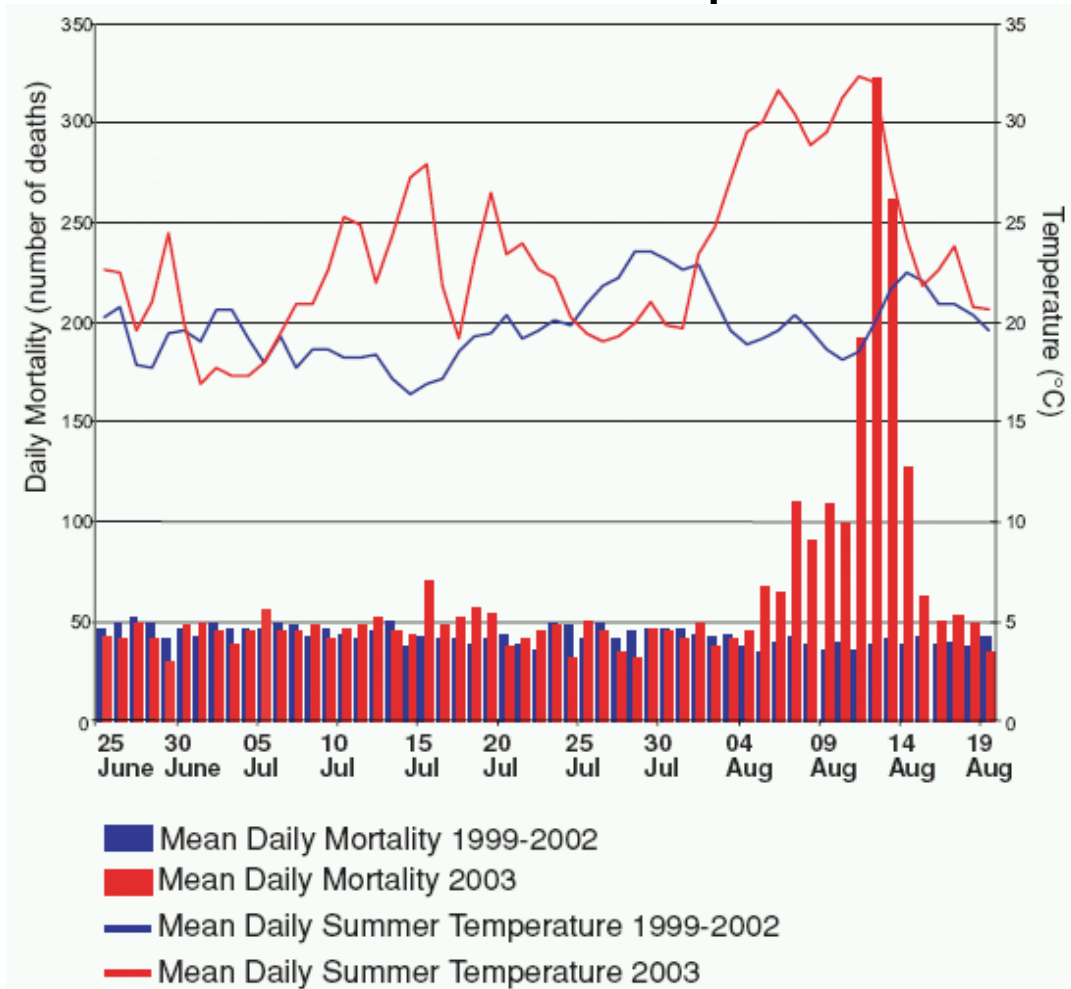
Economic impacts: upsides

- Beverage industry and air conditioning systems, tourism in alpine regions



Changes in extreme events: Mortality increase during heat waves

The Paris heat wave: deaths and temperatures

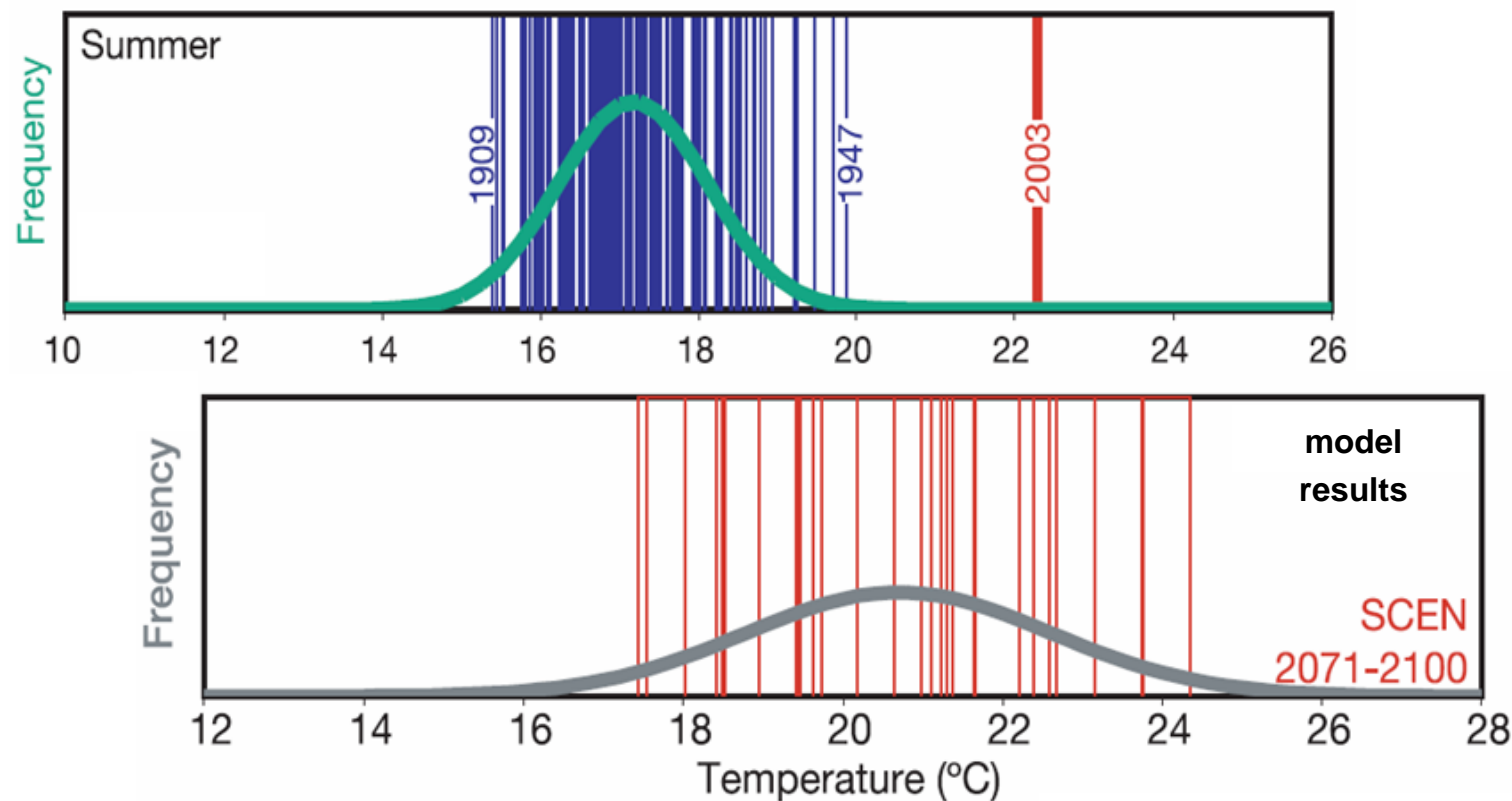


source: "Climate Change Futures", Harvard Medical School, 2005



Changes in extreme events: Heat waves expected to increase significantly

By the end of the century, every second summer in Europe might be as warm as 2003.



Gradual changes – Draughts

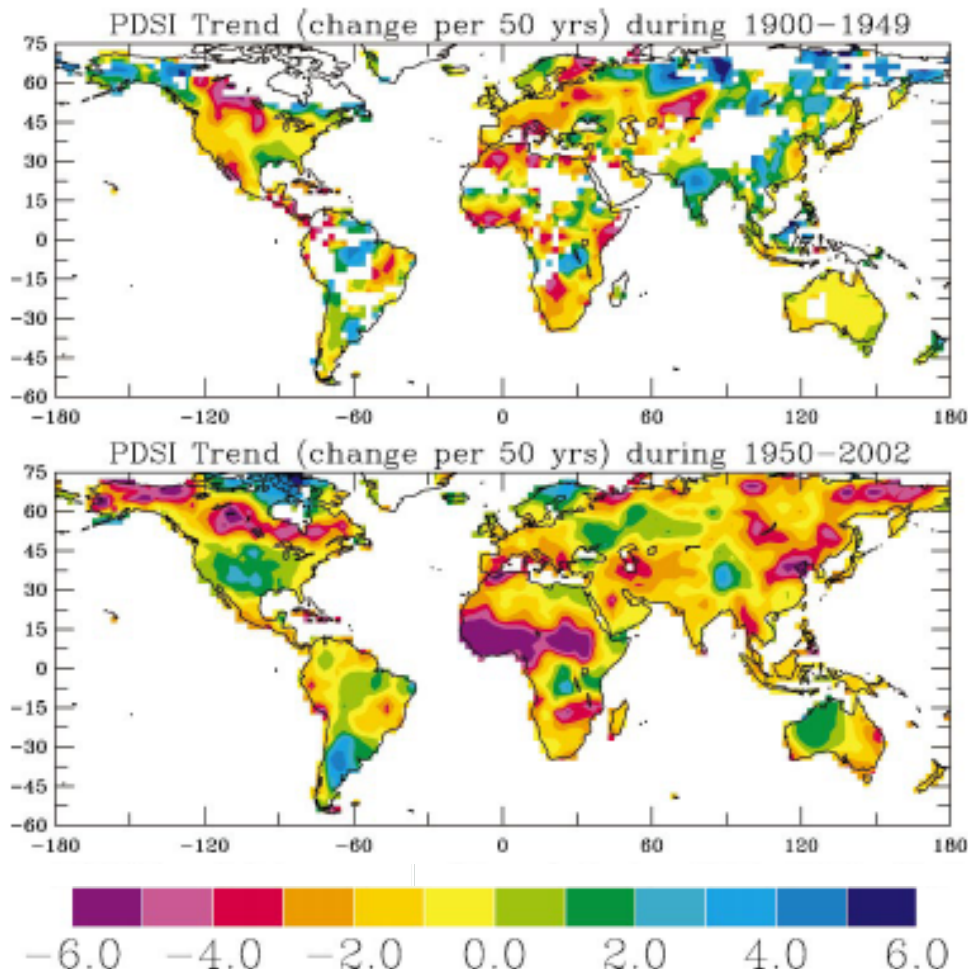


FIG. 7. Maps of linear trends of PDSI [change (50 yr)⁻¹, calculated with both precipitation and temperature changes] during (top) 1900–49 and (middle) 1950–2002. (bottom) The trends of PDSI calculated without temperature changes. Red (blue) areas indicate drying (wetting).

Palmer Drought Severity Index PDSI [-10 (dry) to +10 (wet)]

- The global very dry areas, defined as PDSI < -3.0, have more than doubled since the 1970s.
- Together, the global land areas in either very dry or very wet conditions have increased from 20% to 38% since 1972, with surface warming as the primary cause after the mid-1980s

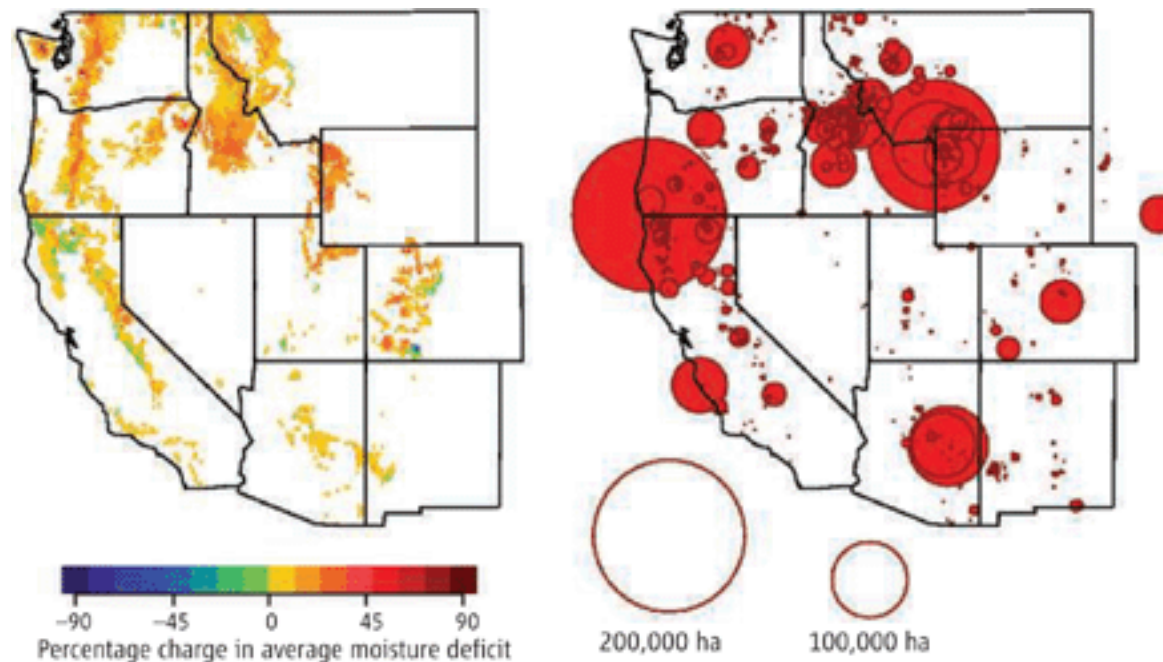


Gradual changes – Wildfires larger & expanding

1987-2003 versus 1970-1986 (Western US)

- fourfold increase of major wildfires
- sixfold increase in the area of burned forest

This increase is associated with increased spring and summer temperatures and earlier snowmelt in spring, while there is only little influence of land-use changes.



- Between 1970 and 2003, spring and summer moisture availability declined in many forests in the western United States (**left**).
- During the same time span, most wildfires exceeding 1000 ha in burned area occurred in these regions of reduced moisture availability (**right**).

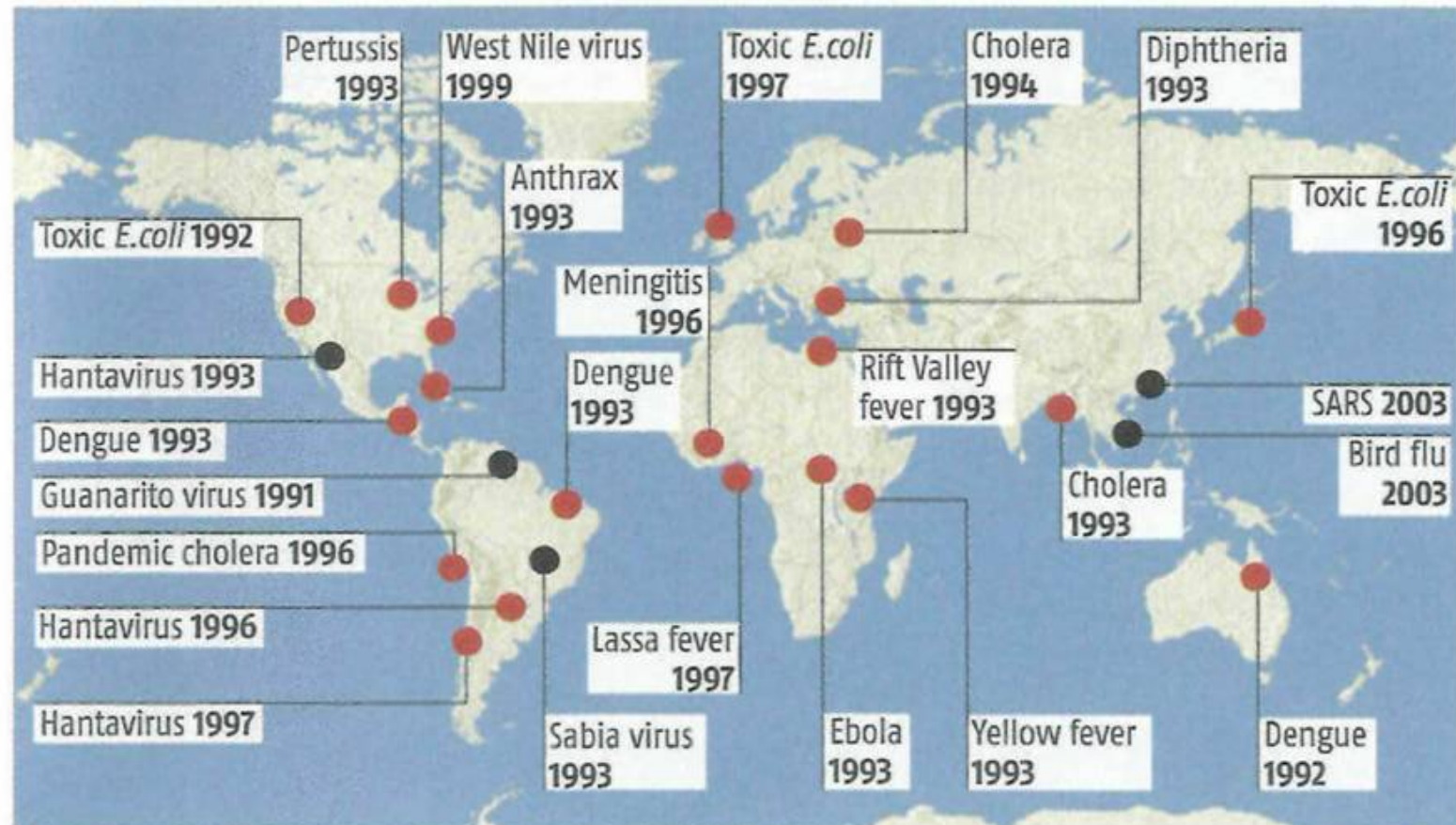
Gradual changes: Emerging & resurgent infectious diseases

Swiss Re



Infectious disease is on the increase

● Emerging disease ● Resurgent disease



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Gradual changes: Sea level rise

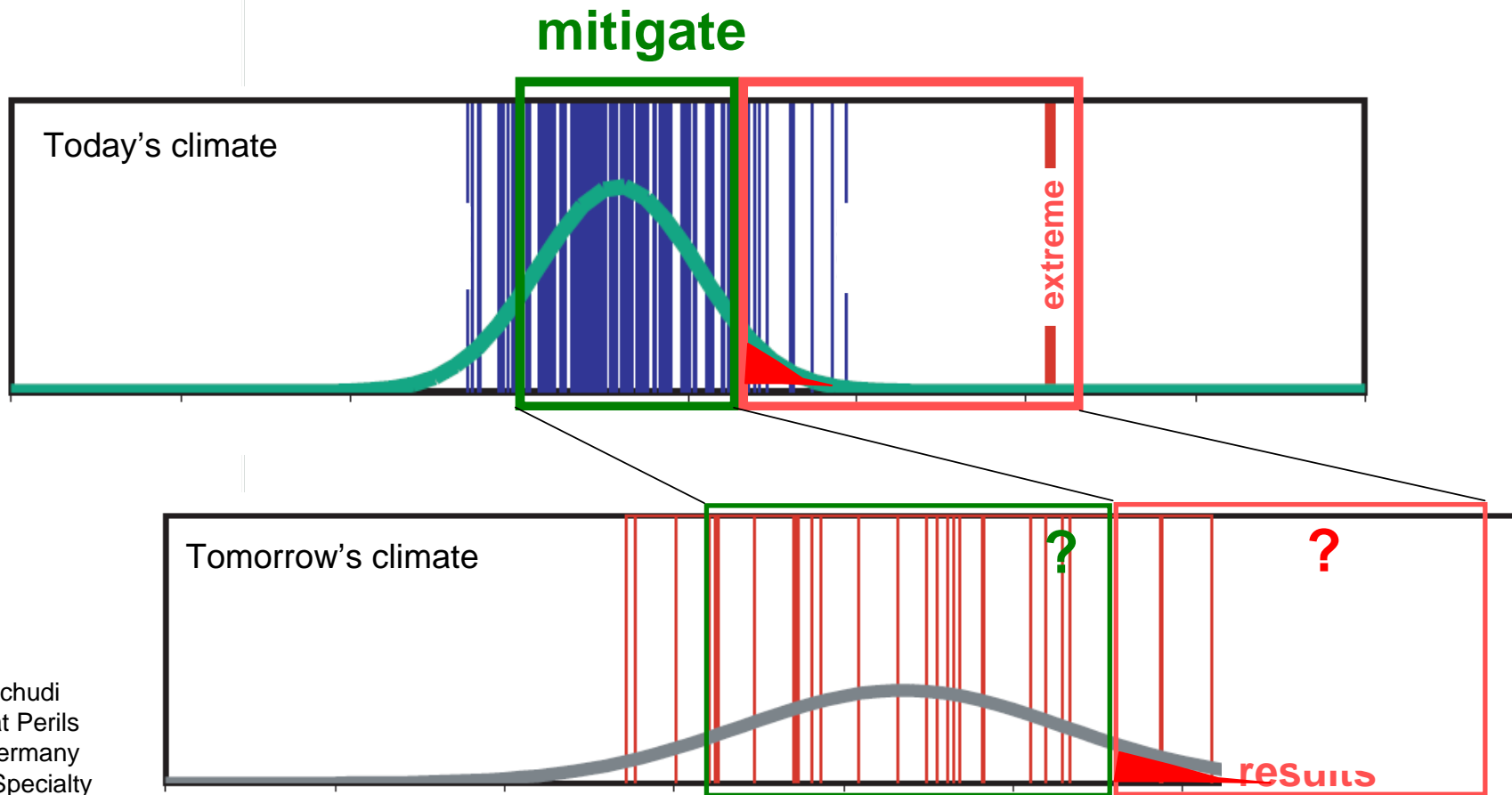
- IPCC 4th report: range of expected sea level rise until the end of this century (mainly thermal expansion): 18-59 cm
- **BUT:** models used to date do not include uncertainties in climate-carbon cycle feedback nor do they include the full effects of changes in ice sheet flow which could lead to large-scale disintegration

scenarios	effect	timeline
1m sea level rise	<ul style="list-style-type: none"> - 17% of Bangladesh inundated - homes of 60mn people in coastal areas of developing countries at risk - increased risk of storm surges for many major cities 	end of this century?
melting or disintegration of <ul style="list-style-type: none"> - Greenland ice sheet - West Antarctic ice sheet 	<ul style="list-style-type: none"> - sea level rise of 6 meters - sea level rise of 7 meters 	many centuries

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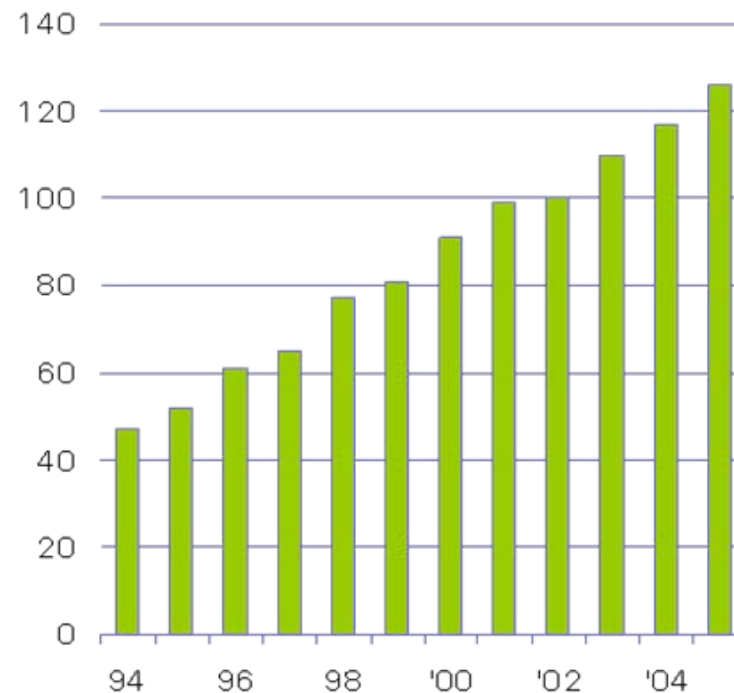
Changed physical environment – Changed insurance perspective



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Changed physical environment – Consequences for the insurance industry



■ Demand growth for cat(astrophe) reinsurance cover

- via “classic” event protection
- via securitization (ILS –
Insurance **L**inked **S**ecurities)
- via weather derivatives (e.g.
farming, power industry)

Total reinsurance cover purchased in 2006



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Regulation: Emerging of a climate change framework

Non-exhaustive list:

Region:	Implemented binding targets	Planned binding or aspirational emission targets	Frameworks/ Markets
World:	Kyoto Protocol: -5.2% by 2012	- Post 2012 targets negotiations start COP/MOP2007	- Kyoto (CDM, JI) - Bali?
Europe:	- Kyoto target: 8% by 2012 - EU: -20% (-30%) target by 2020 (awaiting country split)	- UK: -60% target by 2050 (binding, decision in 2007 legislature) - ...	- EU ETS related to Kyoto
US:	- CAAB 32: -25% by 2020	- Federal: 18% reduction in carbon intensity from 2002-2012 (aspirational) - US Mayors climate protection agreement: -7% by 2012 - CA: -80% by 2050 - New Mexico: -75% by 2050 - ...	- CCX - RGGI - Pending cap and trade proposals: Bingaman, Feinstein-Carper, Kerry-Snowe, McCain-Lieberman, Sanders-Boxer
Australasia:	- Kyoto target: Japan: - 6% by 2012	- China: -846 mio tCO ₂ e by 2020 - Australia: +8% above 1990 levels by 2012 - ...	- AUS ETS (dev) - Hong Kong/Guangdong pilot - Beijing announced trading scheme plans



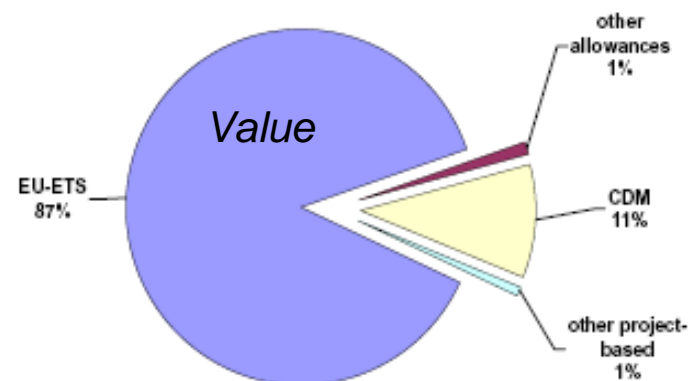
Litigation: Emerging of a climate change pattern?

	Reports in Specialist Publications	First Regulations	First Lawsuits Filed	Successful Litigation
Asbestos :	1906 French factory report of 50 deaths of asbestos textile workers	1931 UK Asbestos Regulations specify compensation for asbestosis	1950's First lawsuits filed requesting compensation for asbestosis	1966 First lawsuit in Beaumont, Texas, against eleven manufacturers of asbestos-products 2001 Estimates of the eventual cost of asbestos mass torts range from \$200 to \$265 billion. - US Insurance loss as of 2004: USD 55 bn - Total estimated future losses: USD 275 bn
Climate change:	1950's Observations of increasing CO2 concentration in the atmosphere	2005 Kyoto protocol enters into force	2004 First lawsuits filed challenging regulatory inaction, relief against emitters, recovery of damages	?



Innovation: Carbon market

- Global carbon market grew in value to an estimated US\$21.5 billion (Sept 2006) and is estimated to grow at a rate of around 20% p.a. for the next 5 years.
- Dominated by European Union Emissions Trading Scheme
- Volume of EU Allowances (EUA): 764 million tonnes CO₂e
 - present day value: some 30 USD per ton CO₂e



■ Example*):

- Flight MUC – HEL (and back)
- about 1 ton CO₂
- => some 30 USD (20€)

Source: European Climate Exchange Market Update - January 2007;
States and trends of the carbon market 2006 Q3, Worldbank, IETA, October 2006

*) http://www.lfu.bayern.de/luft/fachinformationen/co2_rechner/index.htm



Innovation: New insurance solutions

- **Energy savings insurance**
protecting the installer or owner of an energy efficiency project from under-achievement of predicted energy savings
- **Renewable energy project insurance**
covering performance risk for renewable energy systems, e.g. through wind power derivatives
- **Green building insurance**
replacing conventional property damaged or destroyed in a covered loss with improved green and/or energy-efficient property
- **Pay-as-you drive insurance**
insurance premiums are charged according to actual miles driven
- **Carbon insurance**
covering business and performance risks associated with projects designed to achieve emission reduction certificates

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Swiss Re's response

Jacques Aigrain, CEO of Swiss Re:

„... climate change has become an important element of our long-term risk management strategy.“

Four strategic priorities:

- Understand the risk & adapt pricing and risk models accordingly
- Influence the business environment by raising awareness at industry & governmental level
- Leverage the opportunities by developing products & services for mitigation and adaptation
- Address own environmental footprint

