

Climate change

ESG

Sustainability Research

Adaptation: Underwriting risks for (re)insurers



Sustainability Research



Count with more than +2°C and increased vulnerabilities

The +2°C scenario is out of reach and climate change is likely to bring new weather extremes challenging the resilience of companies' operating results and assets. Hurricane Sandy was only an early signal of future changes: studies point to a ~70% upside risk in storm damage potential in Europe and the US. As part of our 'Adaptation series', we assess exposure of European (re)insurers to underwriting risks in a changing climate.

We map climate change exposure of European (re)insurers

We first identify insurance lines and countries the most adversely exposed to climate change impacts, and propose an in-house risk exposure rating, based on companies' business and geographical exposures. Property insurance in the UK notably appears as a hot spot. Pure life insurers are much less concerned.

And test the financial resilience of reinsurers

In the long term, we expect reinsurers to benefit from increased retrocession of weather risks from insurers. Despite projected increase in EU and US hurricane damage of 70%+ under climate change scenario, the risk of default for European reinsurers remains low in our view, especially for Hannover Re - the least exposed.

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Contents

Executive summary	3
The warm-up	5
What science tells us	5
Climate change policies fall short of GHG mitigation prescriptions	7
Climate change: not factored in yet	12
Recent years marked by high impact of weather catastrophes	11
New and more acute extremes ahead	17
Integrating climate change in risk models	19
Exposure to climate change impacts	22
A fairly good level of risk perception by insurers	21
But limited capacities to quantify it	24
Building a climate change impact exposure index	25
Mitigating the risks	32
Reinsurance, main winner, unless	38
Testing reinsurers' resilience to climate change scenarios	37
A driver for alternative risk transfer solutions	40
Beyond risks: market opportunities?	43
Will adaptation needs further boost the P&C insurance market?	42
But beware of blind growth!	45
Research ratings and important disclosures	49
Legal and disclosure information	51

Executive summary

The warm-up: adaptation is a growing theme

The +2°C scenario seems clearly out of reach. A few degrees more is enough to significantly increase vulnerabilities and the need for adaptation to climate risks. This report is part of our 'Adaptation' series and analyses the risks for (re)insurers in a changing climate, with a focus on underwriting risks.

Climate change has yet to be factored in

Climate change remains barely detectable in trends in overall and insured losses due to weather-related catastrophes. Other factors have been dominating. This is expected to change though, as scientists predict an increased frequency of intense storms, and extreme precipitation events that are up to 4x more frequent by the 2080s. Once factored in, studies point to a ~70% upside risk in storm damage potential in Europe and the US. Is it time to reassess exposure?

Our in-house climate change exposure rating

We propose an in-house rating to assess insurers' exposure to climate change threats, based on both business and geographical exposure. Names with high exposure to property insurance lines (e.g. Mapfre), the UK (flood and storm risk, e.g. Admiral) or Italy (flood risk, e.g. Unipol) appear the most challenged.

Fair perception but little quantification of climate risks

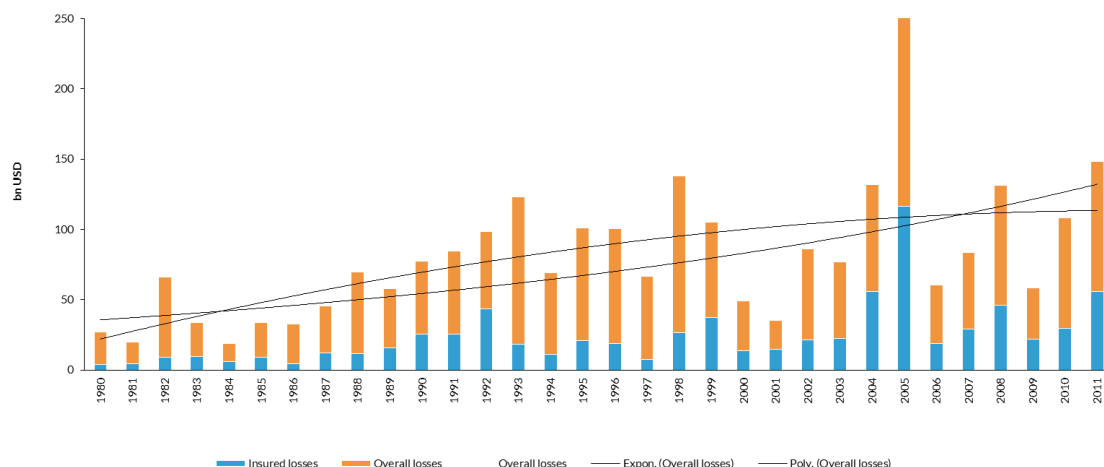
We analyse the CDP answers of 79 (re)insurance companies across the world and conclude that the sector has a fair perception of future climate risks. However, most insurers – and US-based groups in particular – generally fail to quantify this. We review the risk mitigation actions of European insurers, with a focus on modelling capacities and peak risk retrocession strategies.

Reinsurers are the main beneficiaries, unless...

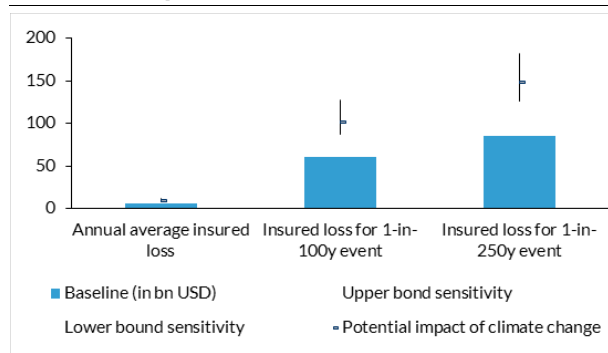
Stretched between Solvency II and uncertain climate risks, we expect insurers to further retrocede nat cat exposure to reinsurers. To test the resilience of the capital base of main European reinsurers, we apply a climate change stress test scenario to reported peak exposure of European reinsurers to 1-in-200yr US hurricane and EU windstorm perils. Hannover Re appears the least exposed. Swiss Re and Munich Re can rely on strong modeling capacities to adjust their exposure over time, while Scor has deployed coco bonds as a safety net. Overall, we see little risk that even climate change-inflated events create a risk of default for European reinsurers.

Beyond risks: market opportunities?

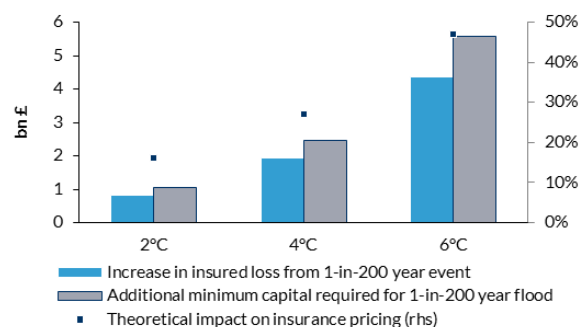
Companies remain generally cautious on the mid-term market potential for specific climate risk insurance products. Nat cat underwriting risk is heightened in emerging markets due to lack of coverage by sophisticated models. Companies with in-house risk modelling capacities and advanced products such as parametric insurance are a better position, in our view, to safely grow there.

Chart 1: Weather catastrophes worldwide (1980-2012) – overall and insured losses with trend


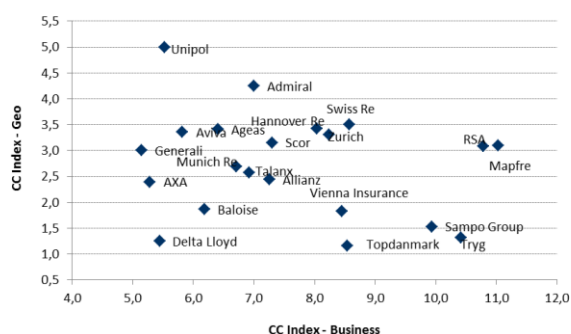
Source: Kepler Cheuvreux, Adapted from 2013 Munich Re, Geo Risks Research, Nat catSERVICE

Chart 2: CC impact on losses from US hurricanes*


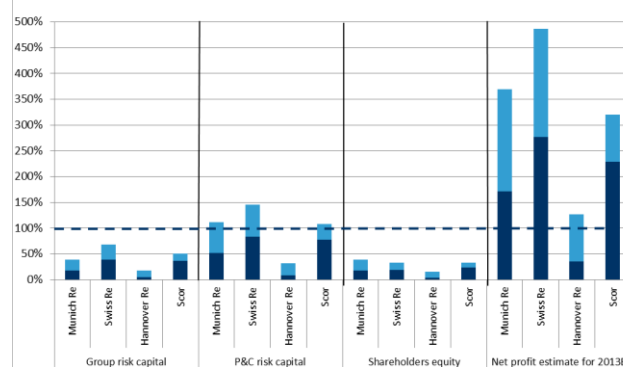
Source: Simulated by AIR for ABI

Chart 3: CC impact on losses from inland flooding in GB*


Source: ABI

Chart 4: Mapping of exposure to climate change impacts


Source: Kepler Cheuvreux

Chart 5: Stress test on financial metrics for reinsurers


Source: Kepler Cheuvreux

The warm-up

Three years after the “Climategate” scandal, the IPCC’s climate change science has restored its credibility and continues to drive the international political consensus on the need to act against rising carbon emissions.

However, international talks on climate change remain at a standstill notably due to the lack of leadership of the US, and dissension as to what the nature of a post-Kyoto framework should be.

The emissions reduction targets agreed to by countries under the Copenhagen Agreement clearly fall short of the “+2°C only” scenario.

What science tells us

Back to basics

In 2007, the fourth assessment report (AR4) of the Intergovernmental Panel on Climate Change (IPCC) concluded with an increased level of certainty that:

- Warming in the climate system is unequivocal;
- Most of the observed increase in global average temperatures is very likely (i.e. >90% probability) due to an increase in GHG concentrations;
- Continued GHG emissions would induce many changes that would very probably be larger than those observed. Among these changes, it was estimated as virtually certain that most land areas would experience warmer and fewer cold days and nights, and warmer and more frequent hot days and nights, while an increase in the frequency of heat waves and heavy precipitation events was deemed very likely.

This call by the scientific community has been heard by global leaders, who have been endeavouring to ramp up efforts for further commitments to cut carbon emissions within the UN Framework on Climate Change.

What has changed three years after Climategate?

Confidence in the conclusions of the IPCC was shaken in November 2009, just a few days before the start of the Copenhagen UN meeting on climate change, which gathered most global leaders. Hacked e-mail exchanges from the Climatic Research Unit of the University of East Anglia (a unit contributing to the IPCC) sparked allegations of scientific malpractice in climate sceptics’ blogs. In addition, some mistakes were discovered in the IPCC’s fourth assessment report in the following months, further fuelling the debate over the quality of the climate science proposed by the IPCC.

The IPCC’s scientific findings are robust

Since then, official inquiries have concluded that the allegations of a lack of integrity among scientists were unfounded and that despite the few “typos” in the report, the IPCC’s scientific findings were robust.

The debate is not over yet, but no scientific research has come out to invalidate the IPCC’s consensus so far. The conclusions reached by the IPCC are based on a consensus forged on the results of climate modelling, integrating many different scientific disciplines that deal

Climategate ultimately did not affect the robustness of the IPCC’s climate science...

with aspects of the Earth’s climate. The consensus reflects the current state of scientific knowledge, and it is important to follow up any new research that could cause the current consensus to evolve.

Some scientists have contested the conclusions of the IPCC, notably arguing that the level of certainty (>90%) that human-made carbon emissions are the major cause of global warming is too high given the remaining gaps in scientific knowledge on factors that might be underestimated (or even unaccounted for) in current climate models contributing to the IPCC. These factors include the role of solar activity and clouds.

A research paper published in 2010 by the NASA Goddard Institute for Space Studies (GISS) reaffirmed the role of atmospheric CO₂ as “the principal control knob governing earth temperature”. Moreover, it concludes that “ample physical evidence shows that CO₂ is the single most important climate-relevant greenhouse gas in Earth’s atmosphere (over water vapour and clouds)”, and states that “Of the climate control knobs relevant to current climate, those on the solar side of the energy balance ledger show only negligible impact. Several decades of solar irradiance monitoring have not detected any long-term trends in solar irradiance beyond the 11-year oscillation associated with the solar sunspot cycle” (Lacis *et al.*, 2010).

Conversely, recent research papers suggest that the influence of solar spectral variations on radioactive forcing of the climate may have led to temporary warming (Haigh *et al.*, 2010) and could influence temperature conditions on a continental scale over Europe or the US without any substantial influence on the global average temperatures (Inesson *et al.*, 2011).

Overall, at this stage, we consider that the scientific and political consensus over the IPCC’s scientific findings remains solid. We expect the 5th assessment report due by the end of this year to generally confirm the findings of the report published in 2007.

The shadow of Climategate is still affecting the US

However, Climategate has been widely publicised and has cast doubt on climate science among citizens of the world. The results of a Gallup poll show a clear loss in confidence among citizens of developed countries (which have better access to information) that human activities (through carbon emissions) are responsible for climate change.

...but it severely eroded public support for climate action, especially in the US

Table 1: Public perception of human contribution to global warming worldwide

	A result of human activities + both in 2007-2008	A result of human activities + both in 2010	Difference (percentage points)
World	43%	48%	+5
Canada	72%	72%	0
Developed Asia	88%	83%	-5
Western Europe	76%	69%	-7
Eastern and Southern Europe	74%	68%	-6
Latin America	59%	65%	+6
Commonwealth of Independent States	51%	51%	0
United States	60%	48%	-12
Developing Asia	34%	39%	+5
Middle East and North Africa	40%	37%	-3
Sub-Saharan Africa	24%	32%	+8

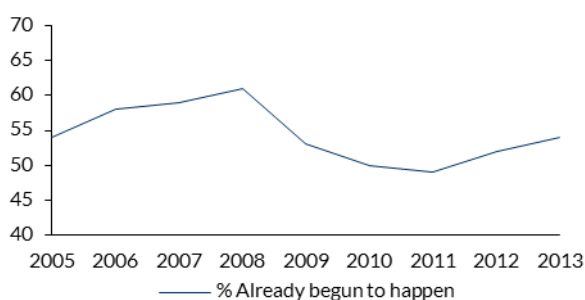
Source: Gallup

We believe that Climategate had direct consequences on the results of the Congressional elections held in 2010. Given the clear partisan split on the climate change issue in the US, Climategate probably helped Republicans regain control of the House of Representatives, making it even more difficult for the Obama administration to pass a federal climate bill and to take a firm commitment at international negotiations on climate change. A few Democratic Representatives were said to have been voted out due to their support of the US Climate Bill reviewed by Congress in 2009.

The fact that the second largest contributor to global carbon emissions has failed to pass a domestic climate policy directly hampers any progress on international climate change talks.

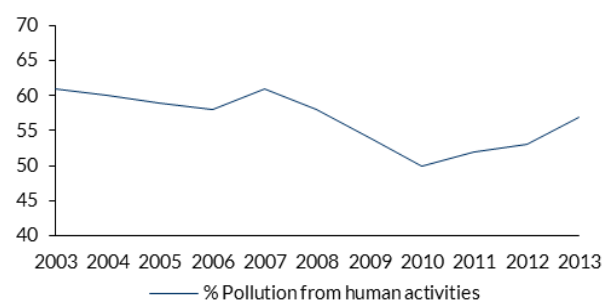
Despite a gradual recovery in the US in the attribution of climate change to human activities and in a sense of urgency (see charts below), we see little room for manoeuvre for President Obama to pass a Federal carbon scheme as long as the Republicans have a majority at the House of Representatives.

Chart 6: Views of when CC* effects will begin to happen



* Climate Change
Source: Gallup

Chart 7: Views on the main cause of global warming



Source: Gallup

Climate change policies fall short of GHG mitigation prescriptions

The central scenario (the 'New policies scenario') of the latest World Energy Outlook released by the International Energy Agency (WEO 2012) points to an emissions path corresponding to a long-term global average temperature increase of +3.6°C.

It also mentions that without additional action, the carbon budget corresponding to the +2°C scenario would be locked-in as soon as 2017.

Emission reduction targets set by countries fall short of the +2°C pathway

A post-Kyoto framework for countries to commit to 2020 emission reduction target has yet to be found, with a decision due in 2015.

As a whole, the emissions reduction commitments made by the developed (Annex I) countries fall significantly short of the climate stabilisation target (450ppm / +2°C), since even the higher proposals (which are subject to conditions) would mean a level of GHG emissions for these countries only 18% below 1990 levels, whereas scientists of the IPCC state that a 25% to 40% decline would be required for this group of countries.

The benchmark energy scenario points to a +3.6°C global warming scenario...

...and carbon reduction pledges give little downside

Table 2: Emissions reduction commitments made by developed countries under the Copenhagen accord

	Emissions 2008 (mtCO ₂ e)	% of total	Lower proposal (%)	Higher proposal (%)	Base year	Target 2020 (mt)	Target 2020 (mt)	Lower % reduction vs. 1990	Higher % reduction vs. 1990
Australia	550	3%	-15%	-25%	2000	422	372	1%	-11%
Canada	735	4%	-17%	-17%	2005	607	607	3%	3%
EU 27	4 940	28%	-20%	-30%	1990	4 454	3 897	-20%	-30%
Japan	1 282	7%	-25%	-25%	1990	952	952	-25%	-25%
Russia	2 240	13%	-15%	-25%	1990	2 831	2 498	-15%	-25%
Ukraine	428	2%	-20%	-20%	1990	743	743	-20%	-20%
Belarus	91	1%	-5%	-10%	1990	133	126	-5%	-10%
US	6 925	40%	-17%	-17%	2005	5 897	5 897	-4%	-4%
Norway	54	0%	-30%	-40%	1990	35	30	-30%	-40%
Switzerland	53	0%	-20%	-30%	1990	43	37	-20%	-30%
N. Zealand	75	0%	-10%	-20%	1990	55	49	-10%	-20%
Croatia	31	0%	-5%	-5%	1990	30	30	-5%	-5%
Total	17 403	100%				16 200	15 237	-13%	-18%
Cut required according to IPCC scientists								-25%	-40%

Source: UNFCCC, Kepler Cheuvreux

A few degrees more...

We estimate that the current emission reduction targets, if met, point more to a minimum +3°C global warming scenario.

Given the fact that:

- Developed countries are falling short of the targeted 25-40% reduction recommended by the scientific community to match a +2°C global warming mitigation scenario, and
- Proposals from developed and developing countries overlap to a certain extent, due to double accounting of actions generating international offsets,

We estimate that these emission reduction targets as a whole are not sufficient to comply with the scenario defined by the IPCC to limit the concentration of GHG in the atmosphere to 450ppm CO₂-eq.

Only 1°C degree more...

Table 3: Different stabilisation pathways proposed by the IPCC

Climate stabilisation scenario	Parties	2020	2030
+2°C (450 ppm CO ₂ -eq)	Developed countries	-25% to -40%	-80% to -95%
	Emerging countries	Substantial deviation from the baseline	Substantial deviation from the baseline
+3°C (550 ppm CO ₂ -eq)	Developed countries	-10% to -30%	-40% to -90%
	Emerging countries	Deviation from the baseline	Deviation from the baseline, especially in LatAm and the Middle East
+4°C (650 ppm CO ₂ -eq)	Developed countries	0% to -25%	-30% to -80%
	Emerging countries	Baseline	Deviation from the baseline in LatAm, the Middle East and East Asia

Source: IPCC

...will increase vulnerability

The concept of adaptation was introduced at the Copenhagen climate conference in 2009, and since then, it has gained an important place in political debate and the climate change agenda. For a long time, this subject was not pushed forward, as the community in favour of climate change mitigation was afraid that some countries could use adaptation as an excuse

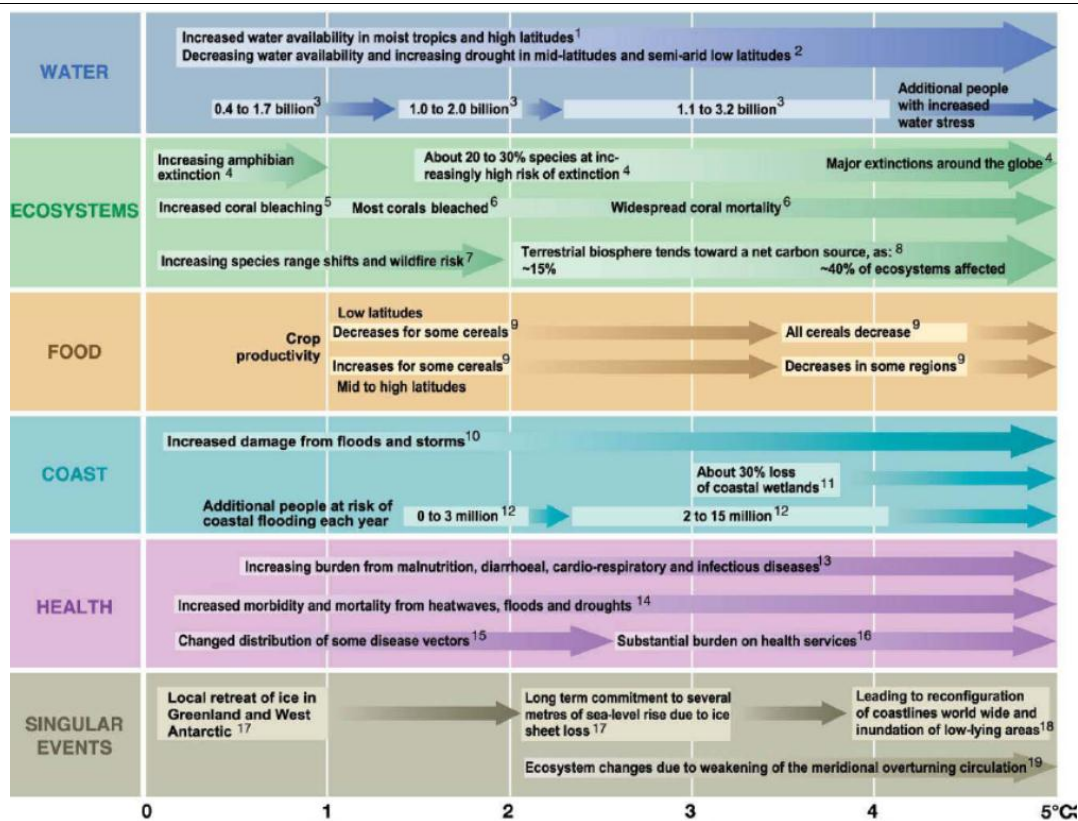
for not taking measures to reduce GHG emissions. Now, regardless of the emissions scenario for the next few decades, preparations must be made for future changes in the climate.

The IPCC has defined “adaptation”, in the context of climate change, as the “adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects that moderates harm or exploits beneficial opportunities”.

The concept of adaptation to changes in the climate is not new. Throughout history, human societies have had to adapt to changing environments and to make the most of it. However, historical records from direct observations and past climate data show unprecedented changes in the climate system not only in magnitude, but also in a rate never before encountered over many thousands of years. The more substantial and more rapid the climate changes, the more difficult and thus more expensive it will be to adapt.

...triggers new above-threshold vulnerabilities...

Chart 8: Climate change



Source: IPCC, WMO, UNEP

Investments needed to contend with expected climate changes are sizeable. According to an estimate made by the World Bank in 2007, the necessary adaptation investments would amount to between USD44bn and USD166bn p.a. (Agrawala and Fankhauser, 2007), of which EUR1bn-6bn for France. A more recent report gave dramatically higher estimates of between USD422bn and USD475bn p.a. (Parry M. *et al.*, 2009).

...and more climate change adaptation investments

UN climate talks at Cancun notably created the Cancun Adaptation Framework in an attempt to develop financing capabilities for fast-start investments in adaptation projects identified by Least Developed Countries: a necessary task since, until then, the capacity of the UN Adaptation Fund, fed with 2% of the proceeds of Kyoto carbon credits issued (i.e. only some 23 millions credits with a market value of EUR115m) by the end of 2012, was too limited.

Climate change: not factored in yet

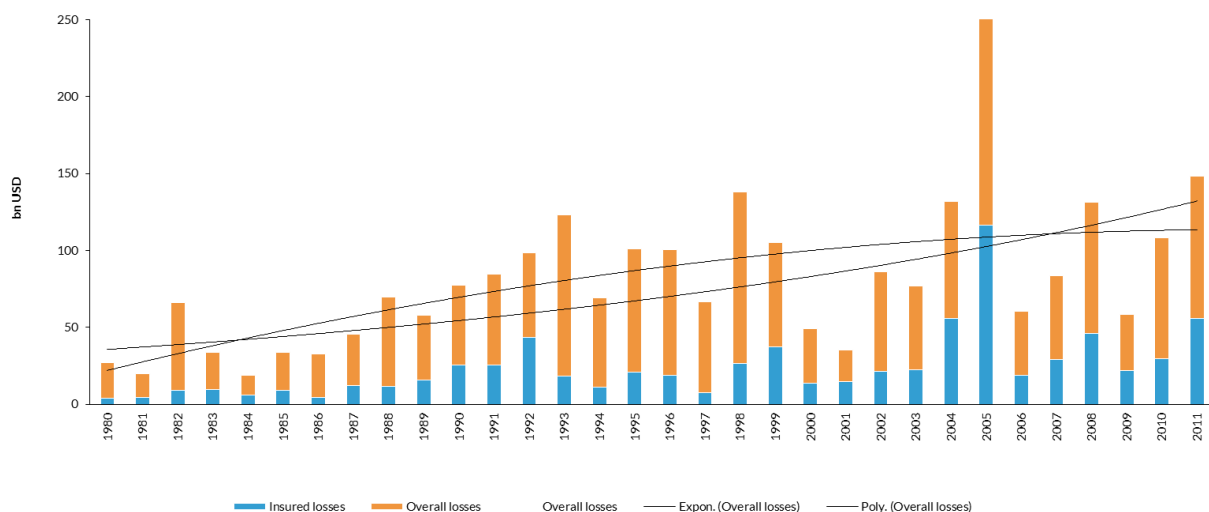
Climate change remains barely detectable in trends in insured losses, but this is expected to change as scientists predict increased frequency of intense storms, and 1-in-20yr extreme temperature events up to 10x more frequent by the 2080s. Once factored in, studies point to ~70% risk upside in total 1-in-100yr storm damage potential in Europe and the US. Is it time to reassess exposure?

Recent years marked by high impact of weather catastrophes

Munich Re's and Swiss Re's databases of extreme events show that weather-catastrophe-related overall and insured losses, along with the number of weather-related events, have increased over more than three decades. Globally, 2011 and 2012 were the two most intense nat cat years for the (re)insurance industry, after 2005 (Katrina).

These charts are often used to suggest that climate change is one of the factors behind the trend. However, there is no consensus at this stage that climate change effects can be detectable in such trends.

Chart 9: Weather catastrophes worldwide (1980-2012) – overall and insured losses with trend



Source: Kepler Cheuvreux, Adapted from 2013 Munich Re, Geo Risks Research, Nat catSERVICE

Munich Re considers that there is increasing scientific evidence that climate change is driving more frequent and more intense natural catastrophes. Economic losses due to hurricanes have increased by ~8% p.a. in the past three decades in the US, and Munich Re released a report in 2012, which, for the first time, attributed part of the rise in weather natural catastrophes to climate change.

This is far from being a consensus, however.

According to Stéphane Hallegatte (Member of the IPCC and Senior Economist at the World Bank), analyses that conclude that climate change is a main factor behind the exponential

trend are flawed. Other factors are dominant. Notably in the case of the US, constructions have accumulated in risky areas because of bad land use planning. The influence of climate change is not significant enough to be detected. Socio-economic factors are dominant.

From the chart above, we retain:

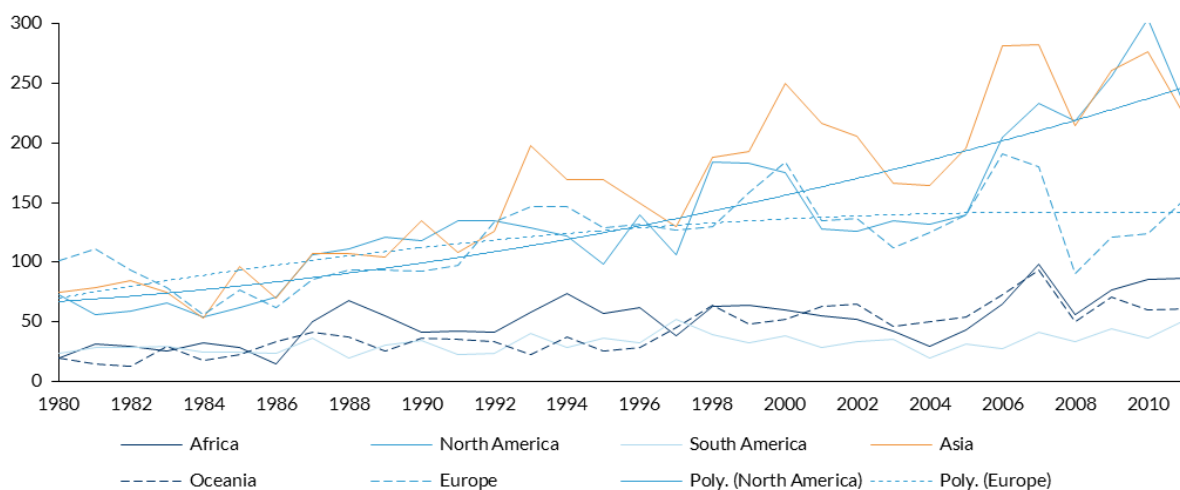
- From a statistical standpoint, applying exponential or polynomial regression lines to the data series provides diverging trends, while the R-square factors are relatively close.
- Volatility seems to have increased since the 2000s, especially for overall losses.

Climate change, natural climate variability, or both?

Looking at records of the number of events enables us to prevent the bias due to increased vulnerability to weather-events. Nat cat records established by Munich Re and Swiss Re show that the frequency of weather-related natural catastrophes is clearly on the rise, with an average increase of 4% p.a. over the past 30 years.

However, trends across the globe are uneven. Closer analysis, on a regional basis, shows that the sharpest increases in the number of events occurred in North & Central America and Asia (mostly driven by meteorological events such as storms, representing ~50% of the rise) and in Asia (where ~70% of the rise relates to hydrological events i.e. floods). The trend is much less clear in Europe, where the number of reported events over the period 2008-2010 was below the average number for 1993-2007.

Chart 10: Trend in the number of weather-related events by continent



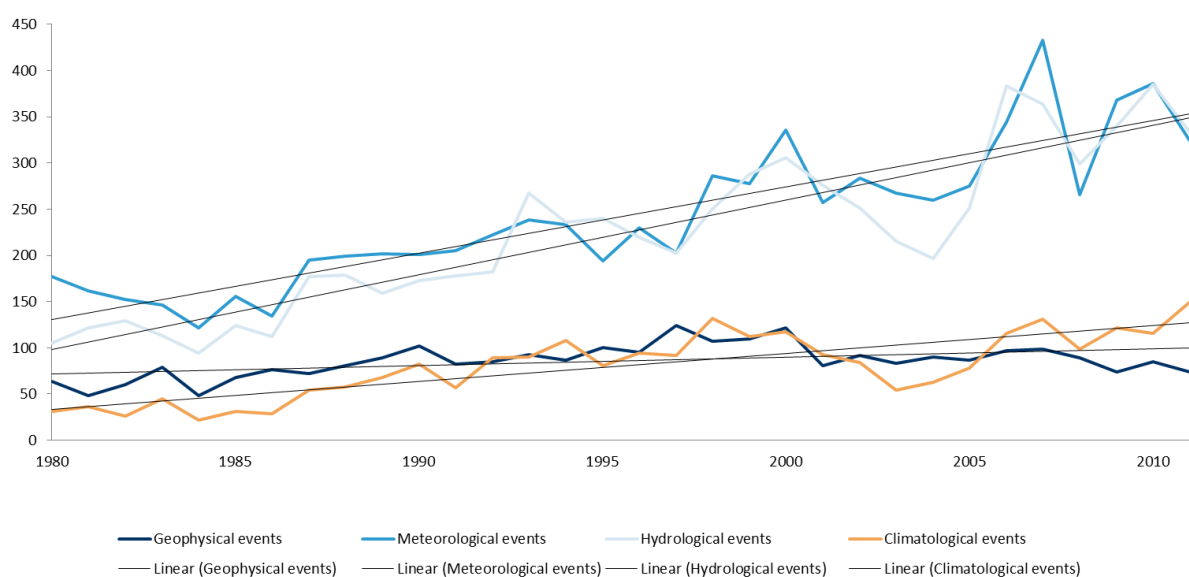
Source: Kepler Cheuvreux based on Munich Re data

An analysis of trends in the various types of events also provides some insight. As shown in the chart below, according to Munich Re's database, the number of meteorological (storms) and hydrological events (floods) is clearly on the rise, while earthquakes and climatological events (extreme temperatures, droughts, forest fires, etc.) are relatively more flat.

Can these trends be attributed to climate change?

The latest IPCC report on extreme events (SREX, 2012) concludes that there is low confidence only that anthropogenic climate change has affected the frequency of floods on a global scale and tropical cyclones. Conversely, there is a higher level of confidence that it has an influence on drought (medium confidence) and extreme temperatures (considered likely). According to Stéphane Hallegatte, the only detectable trend linked to climate change so far concerns heat waves.

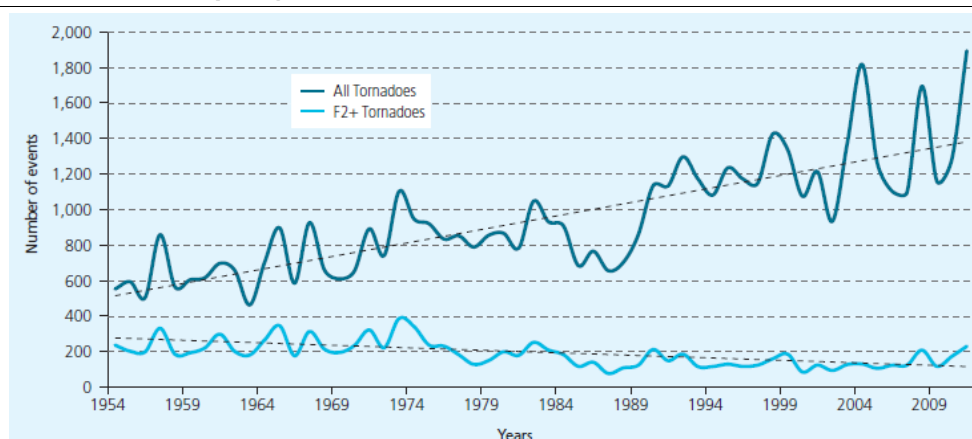
Chart 11: Trend in the number of weather-related events by type of event



Source: Kepler Cheuvreux based on Munich Re data

AXA also tends to have a cautious approach in its interpretation of these trends, quoting a potential bias due to more accurate and comprehensive reporting over time. In addition, growth in exposure may create a bias, here again, as some natural catastrophes in the database are defined in relation with the number of people affected, for instance.

On a specific hazard (tornado risk in the US), Scor reaches the conclusion that it is very difficult to conclude anything about the trend in tornado frequency since the 1950s, as it notes increased public awareness, the introduction of enhanced monitoring tools and an increased population observing the events as potential biases that explain why the overall number of reported tornadoes has increased, while there is no detectable trend when only stronger tornadoes are considered.

Chart 12: Tornado frequency since the 1950s

Source: Storm Prediction Center, in Scor's Global P&C report, 2012

The first limitation is due to the fact that the trend is analysed over only 30 years, which is too short a period for detecting long-term climate change. Natural climate variability must also be taken into account.

We present below a number of major weather patterns affecting the global climate and hence the occurrence of extreme events.

Table 4: The main natural climate oscillations

	What it is	Scope of influence	Periodicity	Impact	Current phase	Predictability
ENSO	Variations in the temperature of the surface of the tropical eastern Pacific Ocean and air surface pressure in the tropical western Pacific	Global, with greatest fingerprint in tropical pacific	Every 5-7 years, episodes last 6-18 months	Extreme weather in many regions of the world, especially countries bordering the Pacific Ocean	Neutral	Good predictability skills for 6-12 months ahead
PDO	A long-lived El Nino-like pattern	Strongest signature in the North Pacific	20-30 years	Modulating effect on the climate patterns resulting from ENSO	Negative	Causes are not understood
AMO	Long-duration changes in the sea surface temperature of the North Atlantic ocean	The Atlantic	20-40 years	Air temperature and rainfall especially over North America and Europe. Droughts tend to be more frequent and/or severe during the AMO warm phase. More frequent US hurricanes	Warm since mid-1990s	Not yet capable of predicting exactly when the AMO will switch
NAO	A north-south shift (and vice versa) in the track of storms and depressions across the NA Ocean and into Europe	North America, Europe	Extremely volatile	Particularly dominant in winter. Positive NAO: Wet northern Europe; dry Mediterranean Europe; mild and wet eastern Europe (and the opposite during a low NAO winter)	High NAO in winter 2012/13	The NAO is a noisy mid-latitude phenomenon and even the best predictions to date have not been able to capture more than 10% of its year-to-year variance

Source: Kepler Cheuvreux

The AMO (Atlantic Multidecadal Oscillation) and tropical cyclonic activity

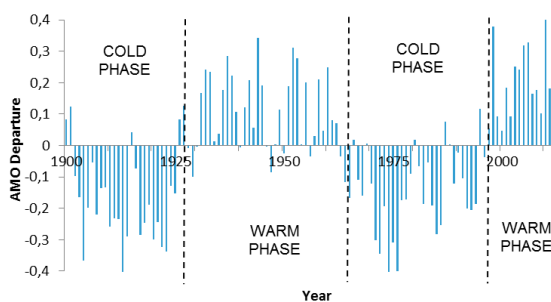
The Atlantic Multidecadal Oscillation (AMO) switched to a warm phase in the mid-1990s. As this typically warms the band of the Atlantic Ocean where cyclones emerge, it tends to increase the probability of intense tropical cyclones.

Apart from Hurricane Andrew in 1992, the ten most damaging tropical cyclones ever to hit the US have occurred during the current warm phase of the AMO.

However, other conditions are required and the El Niño–Southern Oscillation (ENSO), which is a band of anomalously warm ocean water temperatures that can cause climatic changes across the Pacific Ocean (with warming and cooling known as El Niño and La Niña, respectively) is also said to play a role.

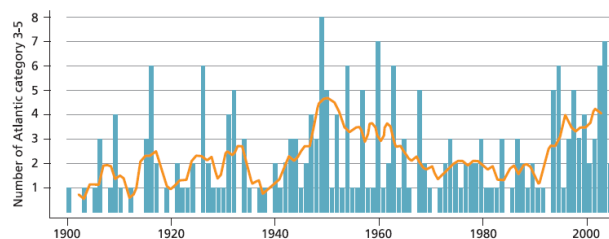
The El Niño episode in the winter of 2004-2005, which ended in summer 2005, created favourable conditions for Hurricane Katrina to emerge later that year. Conversely, in 2006, La Niña tended to cool down the ocean, which led to a relatively calm and benign cyclonic season.

Chart 13: Trend in the AMO*, 1900-2010



Source: NOAA

Chart 14: Hurricane activity in Atlantic basin*, 1900-2005



* Annual number of category 3-5 hurricanes in the Atlantic basin between 1900-2005 and 5-year running mean
Source: Scor

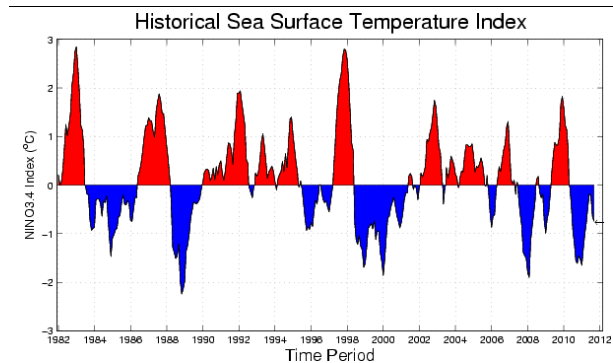
As climate change tends to warm the oceans (+0.6-0.7°C already registered), global warming is also expected to lead to more intense tropical cyclones. However, natural oscillations may dominate in the short to mid term (one to five-year view generally taken by risk modellers).

By comparing the average annual US hurricane landfall frequencies between the current and the last warm phase of the AMO (1926-1970), Munich Re found a spread, which could be indicative of the influence of global warming (67% more landfall of the strongest hurricanes).

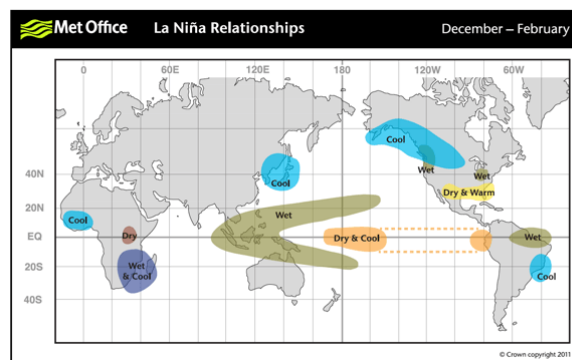
The ENSO (El Niño-Southern Oscillation) and precipitation events

The ENSO is one of the most important factors in the global climate and it has considerable impact at both the local and regional levels. The winter of 2010-2011, in particular, was notably marked by a moderate-to-strong La Niña episode.

The heavy precipitation, which led to severe floods in Australia that winter is typical of La Niña events. In terms of impact, El Niño (warming phase) and La Niña (cooling) have basically opposite patterns (as shown in the chart below).

Chart 15: Trend in the ENSO


Source: IRI

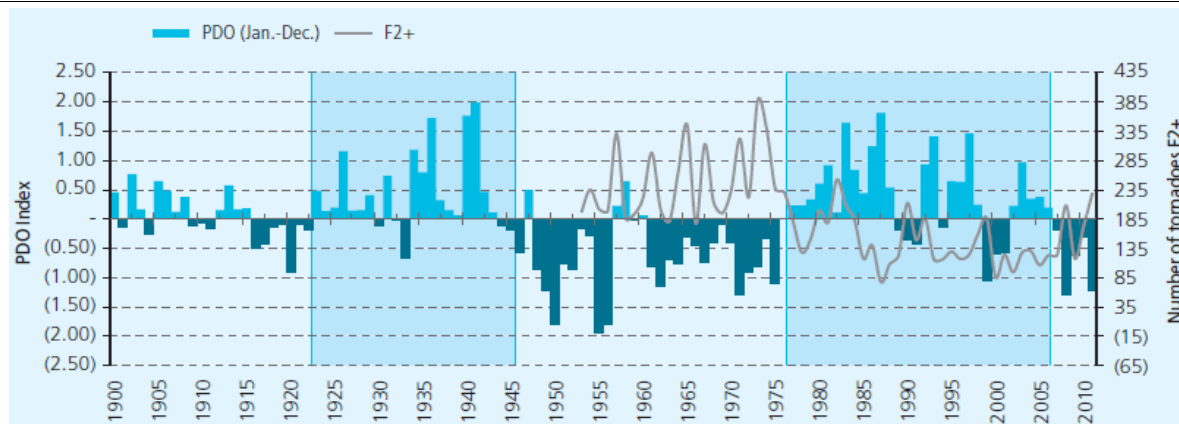
Chart 16: Typical influence of La Niña


Source: MetOffice

The PDO index and tornados

The PDO is a long-lived ENSO pattern that tends to reinforce the ENSO effects when both occur in the same phases.

The PDO index switched relatively recently to a negative phase and scientific research is trying to establish a link between the PDO and the frequency of strong tornados in the US.

Chart 17: PDO* index vs. Tornado (F2+) frequency
Source: <http://jisao.washington.edu/pdo/PDO.latest> in SCOR Property Cat: key strategic issues and trends ahead

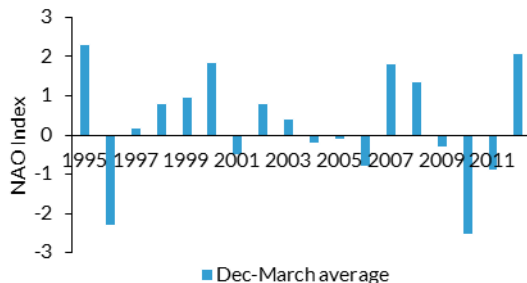
The NAO (North Atlantic Oscillation) is a key factor in Europe's winter climate

The North Atlantic Oscillation has a strong influence on winter weather in Europe. Positive NAO phases are usually associated with more intense European storm activity.

In a recent Willis Research Network note, it is estimated that aggregate losses for European windstorms show a strong dependence on the NAO, with positive NAO phases associated with a 10-15% increase in aggregate losses at all return periods.

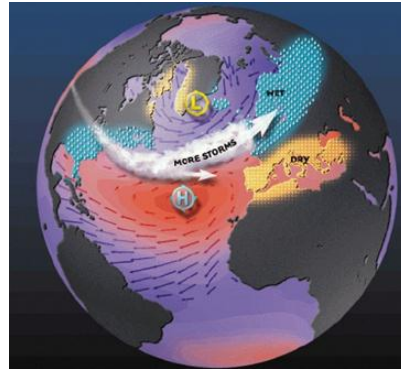
Although the majority of the most damaging European windstorms have occurred during positive NAOs (e.g. Lothar/Martin in 1999-2000), there is no automatic link. Winter 2012-13 was marked by a high positive NAO phase, but no major storm occurrences.

Chart 18: Trend in the NAO index



Source: CRU

Chart 19: Climate consequences of positive NAO phase



Source: MIT PAOC

The NAO, which cannot be predicted beyond a one-week timeframe, was characterised by a long-term upward trend through the 1960s to 1990s. However, the pattern has reversed since and scientific research observed lower storm activity in Europe in recent decades compared to the 40-year average. This argument was notably used by global reinsurance broker Guy Carpenter to argue for an adjustment in the parameter used in Risk Management Solutions's model.

There is no scientific consensus on the impact of climate change on the NAO.

To conclude

Attribution is an emerging science. Scientists at the MetOffice and the NOAA published a report in 2012 in which they looked at six extreme weather events of 2011. However, they were unable to conclude that a particular event was or was not caused by climate change. Nevertheless, the research showed how global warming has increased the probability for a few events. For example, while the heat wave in Texas in 2011 was associated with La Niña conditions, this kind of heat wave is now ~20x more likely to occur during La Niña years than in the 1960s.

New and more acute extremes ahead

Climate change can be seen as a long-term trend with a slow mean evolution of global average temperatures, but we still see it as a short-term threat, as new and more acute extremes are likely to occur, challenging the solidity of historical records when it comes to modelling peak risks.

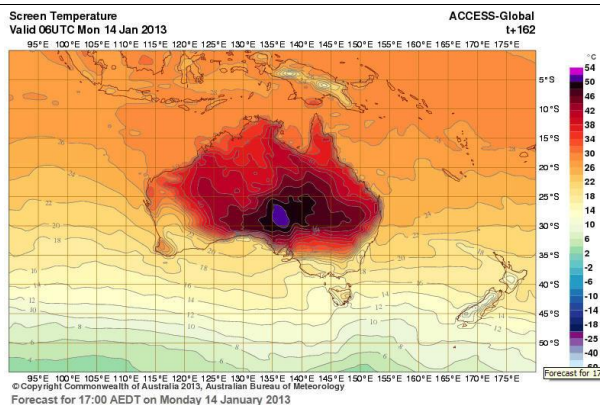
In 2012, the IPCC released a special report on the risks of extreme events. The report notably updated climate forecasts based on most recent research and concluded that there has been a clear increase in the frequency of extreme events. We present the key findings below:

- A 1-in-20 year annual hottest day is likely to become a **1-in-2 year annual extreme** by the end of the 21st Century;
- A 1-in-20 year annual maximum 24-hour precipitation rate will **likely** become a **1-in-5 to -15 year event** by end of the century;
- Medium confidence in the **projected increase in duration and intensity of droughts** in some regions of the world, incl. Southern and Central Europe, Central and North America, Mexico, Northeast Brazil and Southern Africa;
- Likely decrease or no change in frequency of tropical cyclones, but **likely increase in intensity + likely increase in associated rainfall**;
- Medium confidence in a reduction in the number of mid-latitude storms and in the projected poleward shift of mid-latitude storm tracks;
- **Still some areas of great uncertainty:** Low confidence for hail projections; low confidence in projections of extreme winds; low confidence in global projections of changes in flood magnitude and frequency because of insufficient evidence.

New records ahead

The increase in the number of records is usually low. Climate change may result in more and new extreme records (e.g. the heat wave in 2003 in Europe and maximum temperatures in Australia in January 2013). As statistical formulae used in risk modelling adjust to these new records, in our view, this may gradually revise up the general exposure to perils concerned.

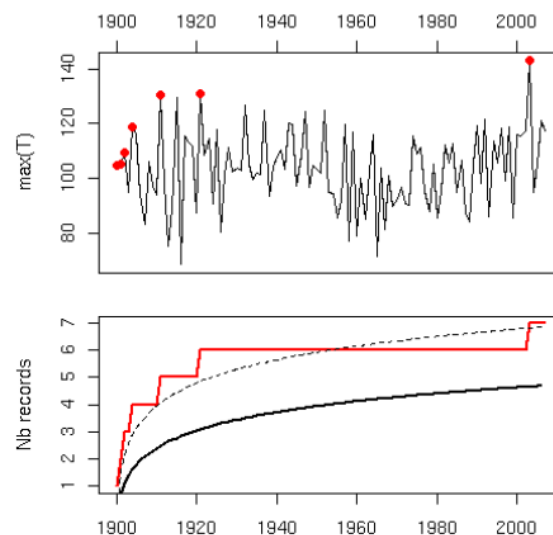
Chart 20: Temperature extreme in Australia (Jan 2013)*



*New temperature grade on an official Australian temperature scale (Jan 2013)

Source: Australian Bureau of Meteorology

Chart 21: Impact of the heatwave on the record curve*



* Impact of the heatwave in Europe in 2003 on the standard record curve

Source: P. Yiou, LSCE, La Rochelle, 2011

Integrating climate change in risk models

A large swathe of the insurance industry relies on risk modelling software provided by three specialised companies: RMS, AIR Worldwide and EQECAT.

Risk modelling challenge in a changing climate

Risk models are used by insurers to estimate their exposure and hence the capital required to ensure their solvency.

Since the 1980s, the risk modelling industry has continuously increased the sophistication of its tools and switched from historical to exposure-based methodologies. Notably for low-probability climate events, the switch to stochastic models made it possible to circumvent the lack of reliable historical data by extrapolating from a limited historical time period a catalogue of extreme events with lower return periods (not yet observed). These techniques also have some limitations, however, as they assume a static climate and fail to model the complexity of weather systems. The use of academic climate models would make it possible to bridge part of this gap, but their use by the industry is still in the relatively early stages.

More generally, in a changing climate, the level of uncertainty in the output provided by these models (probable maximum loss curves) is likely to increase. To take sound decisions relative to their capital needs and risk appetite, insurers will have to understand the level of uncertainty in the model outputs.

This is something highlighted by AXA, notably in its latest risk report. The company recognises that modelling software available on the market may provide imperfect estimates of real exposure, and may underestimate important factors such as climate change. According to AXA France's Head of P&C Risks, speaking at a conference organised by the French Meteorological society, integration of climate change in models is at a very early stage.

Where do main risk modellers stand on integrating climate change?

The risk modellers' mission is to provide a view of risk for the one to five years to come.

In 2011, RMS (Risk Management Solutions) released new versions of its two core climate risk models covering North Atlantic Hurricanes and Europe Windstorms. RMS recognises that it is its responsibility to determine whether there is enough scientific evidence to suggest that the frequency and severity of catastrophe events is changing to the extent that the historical record is no longer a sufficient baseline for determining medium-term (i.e. next five year) activity rates. On this matter, RMS currently considers that long-term historical figures alone are not adequate for observers to assess the mid-term probability of Atlantic Hurricanes.

AIR Worldwide tracks scientific research on the projected impact of climate change on perils, but is conservative in integrating this directly in models given the remaining uncertainties surrounding current risk projections. Should the scientific literature on the impact of climate change become robust enough (i.e. a high level of confidence), AIR could consider integrating the findings.

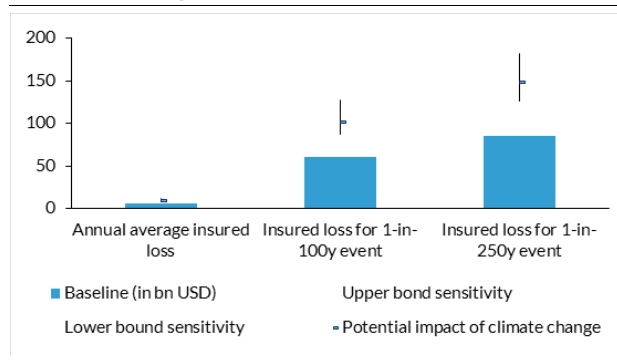
We understand that most primary insurers do not have the internal skills and expertise to tweak these models by changing parameters to reflect climate change scenario. Models provided by external vendors are considered by many as a black box.

However, these companies (e.g. EQECAT, AIR) have used their models to make ad-hoc simulations of the potential impact of climate change and losses. The results provide food for thought.

For instance, EQECAT published the results of the impact of climate change (based on current knowledge) on damage due to windstorms in Europe. The report found that the impact of climate change would lead to a potential 50-70% increase in total 100-year storm damage potential and a two- to three-fold increase in the frequency of most severe storms (with a damage potential forecast at more than EUR10bn).

Air Worldwide carried out similar simulations for flood risk in the UK, notably in a report ordered by the Association of British Insurers.

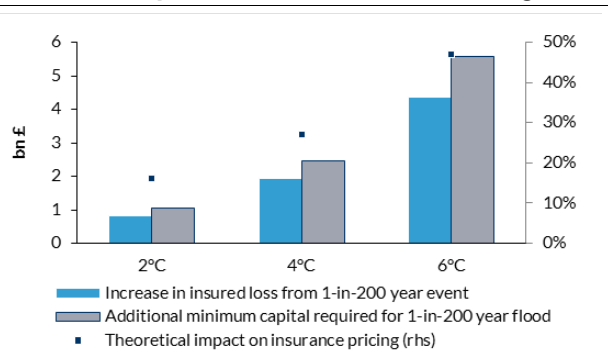
Chart 22: CC impact on losses from US hurricanes*



*Potential impact of climate change on insured losses for US hurricane peril

Source: Simulated by AIR for ABI

Chart 23: CC impact on losses from inland flooding in GB*



*Insured loss, pricing and capital requirements for rain-induced inland flooding in Great Britain

Source: ABI

Prices continue to be negotiated based on the historical trend

We understand that these sensitivity tests are not used to set the rates on the reinsurance market, given the mismatch with the time horizon considered by the industry (one to five-year risk).

On the contrary, arguments looking at recent historical trends in the evolution of event frequency and/or intensity continue to fuel the rate negotiations between insurers and reinsurers. For instance, a recent scientific research paper tends to confirm that the bi-decadal trend in European windstorms shows a decrease relative to long-term historical records (40 years). Guy Carpenter uses this argument to suggest that insurers tweak the new RMS model by assuming a lower frequency of storms.

To conclude

The industry is at a relatively early stage when it comes to integrating climate change in risk models. We understand that prices on the markets continue to be based rather on historical considerations, apart from the hurricane risk in the US.

Exposure to climate change impacts

We analyse the CDP answers of 79 (re)insurance companies across the world polled on their perception of climate change risks. We find that ~75% of them quote at least one climate change trend as a factor of risk. Views are relatively in line with IPCC forecasts. Reinsurers and multi-line insurers consider themselves the most at risk – as opposed to pure life insurers. US-based insurers single out by failing to quantify the risk for their business.

Most insurers are far from being able to quantify the sensitivity of their nat cat exposure to climate change scenarios. To fill the disclosure gap, we propose an in-house rating to assess insurers' exposure to climate change threats. Names with high exposure to property insurance lines (e.g. Mapfre), the UK (flood and storm risk, e.g. Admiral) or Italy (flood risk, e.g. Unipol) appear most challenged.

We review risk mitigation actions, i.e. how climate change is integrated in group risk management, with a focus on modelling capacities and peak risk retrocession strategies. Uncertain climate risks combined with solvency requirements are likely to push insurers to further transfer nat cat exposure to reinsurers and capital markets in our view.

A fairly good level of risk perception by insurers

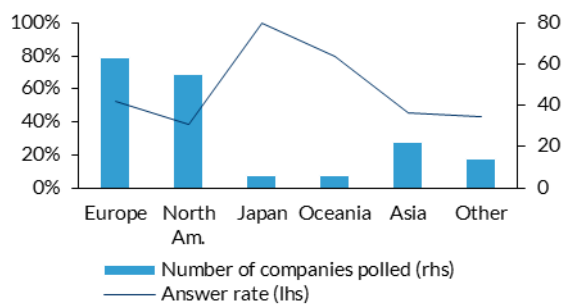
We partnered again with the Carbon Disclosure Project (CDP) for this report. The following analyses are derived from company disclosures to the Carbon Disclosure Project's 2012 report. The CDP polled 166 companies within the global (re)insurance industry last year and 79 answered the questionnaire.

The answer rate led to counter-intuitive results

Japan and Australia were the two regions with the highest answer rates, as shown in the charts below.

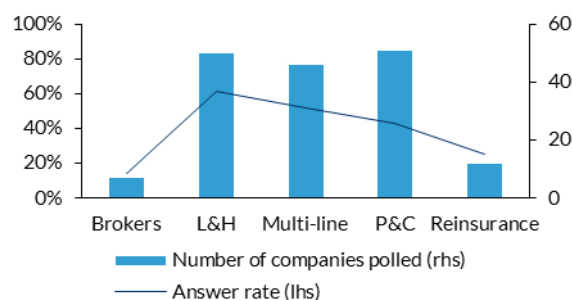
The analysis on answer rates by sub-industry led to counter-intuitive results, as one would have legitimately expected P&C and reinsurance companies to feel more exposed to the effects of climate change than Life & Health insurers and, consequently, would more likely feel concerned by and thus respond to the CDP questionnaire. However, this was clearly not the case. The same applies to US insurers.

Chart 24: Answer rate by region



Source: CDP, Kepler Cheuvreux

Chart 25: Answer rate by sub-industry



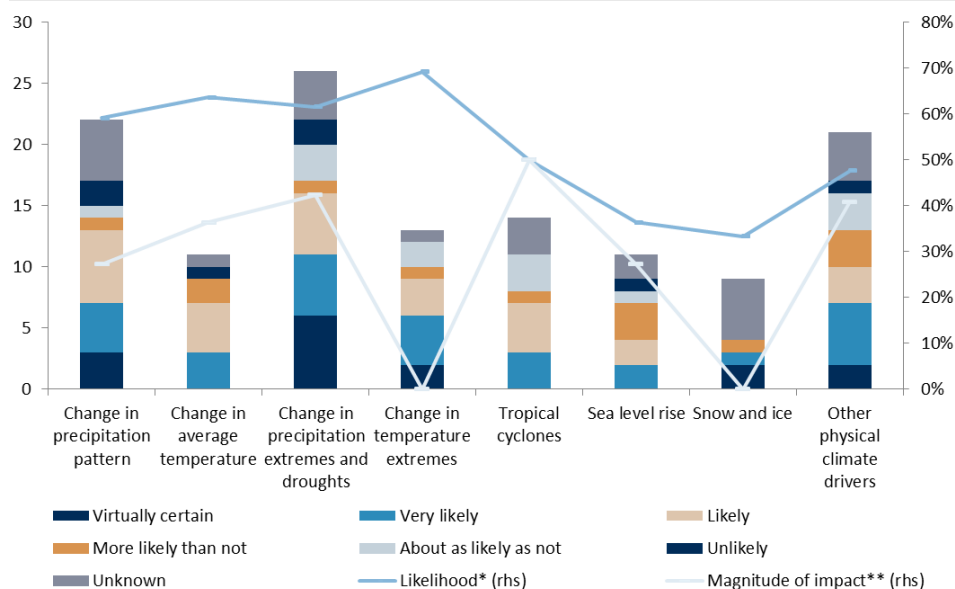
Source: CDP, Kepler Cheuvreux

Risk perception: a change in precipitation extremes and drought were seen as a imminent and significant risk.

Analysis of the answers to the CDP questionnaire highlighted the following conclusions:

- **Change in precipitation extremes and drought.** This was perceived as a key risk for 26 companies responding, with 73% of them considering that the trend is likely-to-virtually certain within a timeframe of less than five years. Such a trend creates of medium-high to high risk, according to 42% of respondent companies.
- **Change in tropical cyclones (hurricanes and typhoons)** appears to be the second major risk. This was cited by only 14 respondents, but, for 50% of these companies, it is viewed as creating a significant risk, with a relatively high likelihood (50%) attached to the scenario of increased activity.
- Conversely, **change in temperature extremes** is also seen as a likely risk, to occur in the short term (less than five years) but no company believes that these events can have a more-than-medium impact on their business.

Chart 26: (Re)insurance companies risk perception of the effects of climate change



Source: CDP, Kepler Cheuvreux

Overall, these views are relatively in line with the trends projected by global climate models used by the IPCC and the level of confidence attached to the projections.

Highest impact expected by reinsurers and multi-line insurers

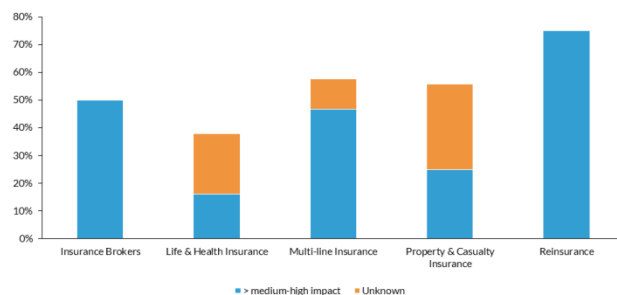
A closer analysis by industry segment and country of origin shows that most reinsurance and multi-line insurance companies consider that climate change raises medium to high risks for their business. Life & Health insurance segment players feel much less exposed (see left-hand chart below).

The appreciation of the level of risk also differs widely from one country to the next. Most Asian (re)insurers in Japan and South Korea perceive a medium-to-high risk for their business, whereas less than 10% of US-based insurers share this view. This is particularly surprising, given the natural exposure of the US insurance industry to climate risks and climate change risks. Hurricane Sandy, for instance, has seriously hit US primary insurers and is the kind of storm that is likely to become more frequent under climate change scenarios.

Within Europe, Italian insurers have attached a relatively high impact risk to climate change trends, while Spanish and Nordic insurer feel less exposed.

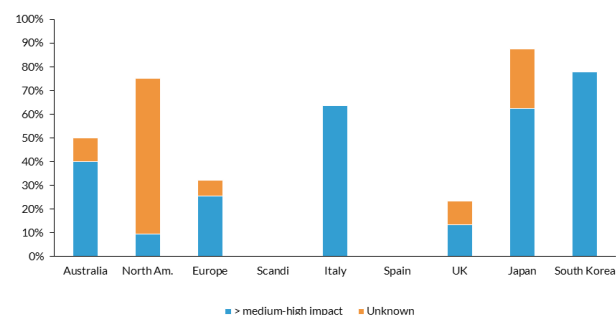
In the following section of this report, we show that Italy is deemed particularly at risk of increased flood damage. The attitude of Spanish insurers can be attributed to the fact that the country is expected to face lower storm-related claims in a changing climate. In Nordic countries, one reason mentioned is that public insurance programmes in Norway and Denmark cover climate risks (flood), resulting in more limited exposure for private insurers.

Chart 27: Perception of climate change risk by segment



Source: CDP, Kepler Cheuvreux

Chart 28: Perception of climate change risk by country*



* country of origin

Source: CDP, Kepler Cheuvreux

But limited capacities to quantify it

Unlike reinsurance companies, very few primary insurers report on their nat cat peak exposure. In general, small and mid-sized insurers have limited modelling capacities and tend to fully outsource nat cat exposure quantification to external risk modellers.

However, this may increasingly change as regulators tend to put pressure on insurers to better understand their exposure to nat cat risks. This is the case of the EU Solvency II Directive, which is now expected to be implemented in 2016/17.

Catastrophe risk is an important component in the calculation of Solvency Capital Requirements. Under such requirements, European insurance companies have to report to regulators that they have an adequate level of capital to match liabilities. For nat cat risks in particular, liabilities (the amount of claims) are highly uncertain and the EU regulator has decided to use loss scenarios with a level of probability 1:200 (or 0.05%) or 99.5% Value-at-Risk, under Solvency II.

In order to fulfil these requirements, insurers can either use a Standard Formula designed for the purpose of Solvency II to assess the catastrophe element of their underwriting risk, or use one or more catastrophe models.

Willis Re (an insurance and reinsurance broker) deemed that, using the current Standard Formula would force European insurers to raise their Solvency Capital Requirements (SCR). Under the new version of the formula (Q15), Willis Re estimates that up to 30% of European insurers may fail to meet SCR. The motivation to move to internal models is likely to be enormous according to the broker.

The EU Solvency II Directive (article 126) clearly places the responsibility on insurers when it comes to understanding the robustness and the results provided by the model(s) used. Companies must be able to demonstrate that they have appropriate in-house understanding of model selection and model change, including an understanding of uncertainty associated with catastrophe models.

Building an internal model requires at least five to ten people even for small insurers.

Climate change is not directly mentioned under Solvency II texts, although it is a source of uncertainty, categorised as a non-sampling error by Guy Carpenter (see its Managing Catastrophe Model Uncertainty report).

By moving to internal models and internalising expertise, we believe that insurers will also be better positioned to understand the uncertainties related to climate change modelling.

Constrained by Solvency Capital Requirements and better understanding of the uncertainties behind estimates of their peak exposure to nat cat events in a changing climate creates an environment which is likely to push primary insurers to further retrocede risks to reinsurers or through alternative risk transfer solutions.

In addition, In the current environment of stress on public deficits, **Governments/Public programmes** may increasingly leave the field to private (re)insurers.

Sandy will further increase the deficit of the already debt-burdened National Flood Insurance Programme, and is therefore likely to reopen the discussions regarding development towards differentiated premiums depending on location.

In the Netherlands last year in 2012, Neerlandse (backed by Lloyd's insurer Kiln) began offering flood insurance using an innovative underwriting and risk assessment tool.

This may also hamper governments to randomly step in when nat cat occur (e.g. Germany in 2002).

Building a climate change impact exposure index

In this section, we provide a mapping aimed at identifying (re)insurers, which are relatively more exposed to climate change risks. Exposure to the impact of climate change is uneven amongst (re)insurers. Our rating is based on:

- **The exposure of the portfolio to different insurance lines: overexposure to insurance lines such as property or agriculture tends to increase the exposure to climate risks.**
- **The geographical mix of the portfolio: overexposure to countries such as the UK, which is particularly at risk of increased activity of weather-related events under climate change scenarios, tends to play negatively in our rating.**

Exposure to the climate change impact of different insurance lines

Property and agriculture lines face a greater climate change-related risk according to Munich Re's analysis (see table below), while motor own damage insurance is slightly less at risk from such effects, and notably the impact of heat waves and drought. Business interruption risk (covered by contingency insurance) is also particularly exposed to the consequences of natural catastrophes and was a particularly important area of claims following floods in Thailand.

The life/health insurance industry is not immune to climate change effects. Heat waves such as those experienced in Europe in summer 2003 can lead to increased mortality and hospitalisations. However, some projections for Europe show that the increase in the number of deaths due to more frequent heat waves could be more than offset by the decrease due to less frequent cold snaps.

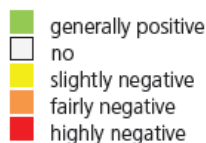
In general, we understand that the relationships between climate and health are much less understood.

In October 2010, the Climate Change & Health Working Group at the ClimateWise global insurance industry association proposed that the Health & Protection industry explores how to incorporate the health impacts of extreme weather into risk models. A research project was designed to understand what a 4% rise in cardiovascular disease and respiratory-driven hospital admissions for every one-centigrade rise in temperature means for critical illness and income protection claims.

Chart 29: Impact of climate change on losses in individual insurance lines

Hazards	Timeframe	Property (individual and commercial lines)	Engineering (EAR, CAR*)	Marine	Agricultural (crop and livestock)	Motor own damage	Aviation and space	Contingency risks (cancellation of event)	Life and health	Liability
Floods, storm surge	5-10 years	yellow	orange	yellow	yellow	yellow	yellow	orange	yellow	orange
	10-30 years	orange	red	orange	yellow	orange	yellow	red	yellow	red
Storms, flash floods	5-10 years	orange	orange	yellow	yellow	yellow	yellow	orange	yellow	yellow
	10-30 years	red	red	red	orange	red	orange	red	yellow	orange
Heatwaves and drought	5-10 years	yellow	yellow	yellow	orange	yellow	yellow	yellow	yellow	yellow
	10-30 years	yellow	orange	yellow	red	yellow	orange	orange	orange	orange
Less frost and cold weather	5-10 years	green	green	green	green	green	white	orange	green	white
	10-30 years	green	green	green	green	green	white	red	green	white
Rising sea levels	5-10 years	yellow	yellow	white	white	white	white	white	white	orange
	10-30 years	orange	orange	yellow	yellow	white	white	white	white	red
Tropical cyclones	5-10 years	orange	orange	yellow	yellow	yellow	yellow	orange	white	orange
	10-30 years	red	red	yellow	orange	yellow	yellow	red	white	red
Extratropical storms	5-10 years	orange	yellow	white	yellow	yellow	white	yellow	white	yellow
	10-30 years	red	orange	yellow	yellow	yellow	white	orange	white	orange
Melting of polar icecaps	5-10 years	white	white	red	yellow	white	white	white	white	yellow
	10-30 years	yellow	yellow	red	yellow	white	white	white	white	orange

* EAR = Erection All Risks, CAR = Contractors All Risks



Source: "Globe of Natural Hazards", Munich Re, 2009

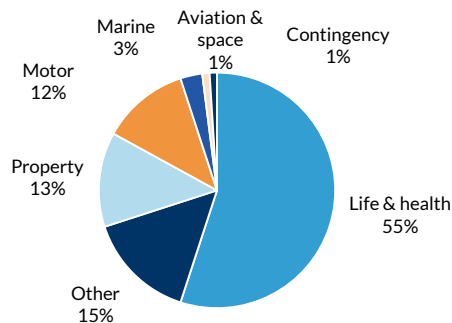
Based on Munich Re's risk matrix table above, we have attributed a climate change risk rating for each insurance line. Then we calculated an aggregated exposure rating for companies based on company-specific exposures to different insurance lines (% of premiums).

Chart 30: Climate change risk assessment

	Flood, storm surge	Severe weather, flash flood	Heat, drought	Total
Property	2	3	2	7
Engineering (CAR)	3	3	2	8
Engineering (EAR)	2	3	2	7
Marine	2	3	2	7
Motor own damage	2	3	1	6
Aviation, space	1	2	2	5
Contingency risks	3	3	2	8
Agriculture	2	3	3	8
Health	1	1	2	4
Life	1	1	2	4

Source: Munich Re

Chart 31: Munich Re – premiums by insurance line

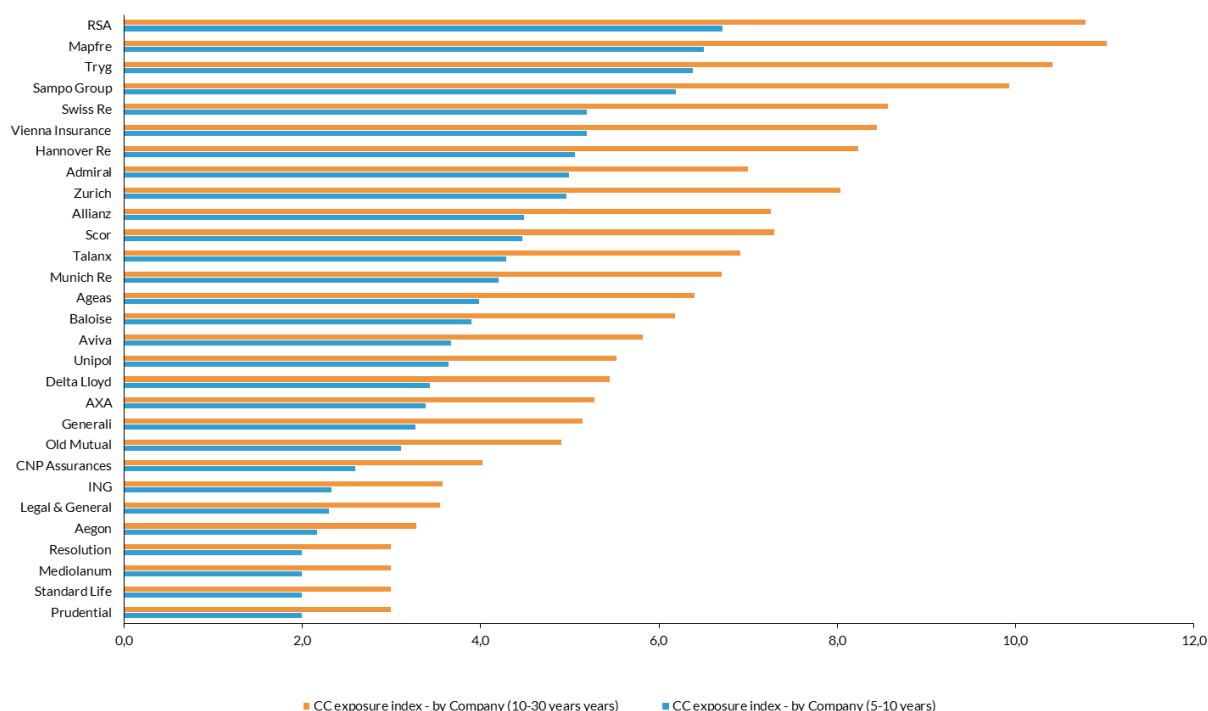


Source: Munich Re, Kepler Cheuvreux

For some companies, we had access only to a limited level of detail of their portfolio mix and we applied average rating for P&C exposure, namely Ageas, Allianz, Hannover Re, Talanx, and Delta Lloyd in particular.

The results presented in the chart below are relatively intuitive, with pure Life insurers appearing to be much less exposed (e.g. Prudential and Standard Life) while the companies the most exposed to property insurance top the ranking (e.g. Mapfre).

Chart 32: Kepler Cheuvreux's climate change impact exposure index



Source: Kepler Cheuvreux

Building a geographical risk index

Some countries are more at risk from the projected effects of climate change than others. In order to rate companies' geographical exposure to climate change, we used a methodology similar to the one we used above for business exposure: climate change risk exposure by country and exposure to countries based on P&C premiums.

Country rating: in-house assessment based on most recent scientific research

Some profit or non-profit (e.g. GAIN) organisations have come up with climate change country vulnerability indices. The methodology used better reflects the potential change in welfare due to climate change than the potential risk of higher insured losses due to climate change.

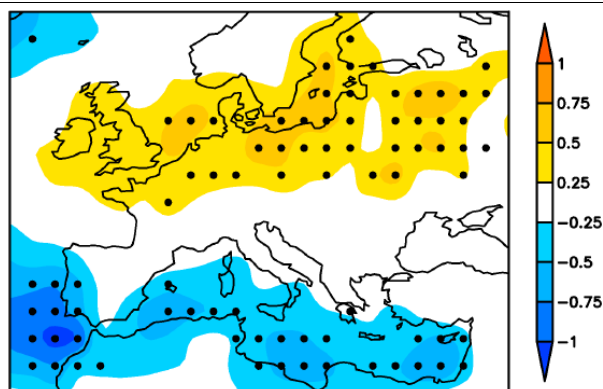
In the next section, we explain how we have rated countries to give a view of the risk exposure of insured portfolios. Since the publication of the IPCC's AR4, researchers have tried to estimate the impact of projected climate change with higher spatial resolution. We

have based our country rating on the most recent climate change impact modelling and following an approach similar to that of Munich Re's risk exposure by insurance line.

We looked at each category of extreme events' impact in terms of insured losses.

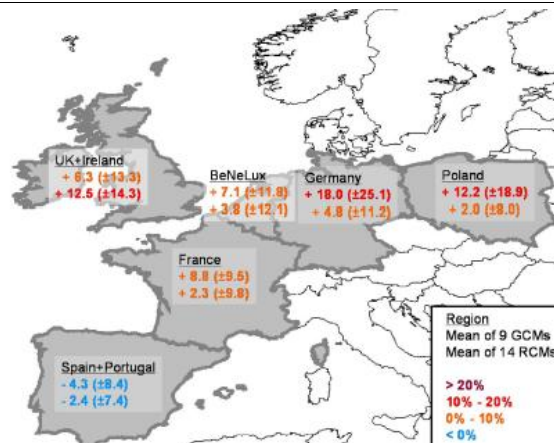
Storms are the extreme events with the largest impact in terms of insured losses in Europe (64% of total insured losses over 1980-2011). Unfortunately simulation of extra-tropical storms remains a scientific challenge and there is no clear consensus on projected trends under climate change scenarios. Several studies suggest that the frequency of storms may decrease in Europe while the most intense and damaging storms may increase in frequency, especially in Northern and Western Europe. However, more recent studies tend to invalidate the poleward shift of storm tracks to Northern Europe and conversely predict an equator-ward shift. Although uncertain, most results tend to point to the **UK, Sweden, Denmark, Germany and the Benelux** as the most at risk. Damage costs due to storms may, however, decline in Iberia.

Chart 33: Projected change in maximum wind speeds*



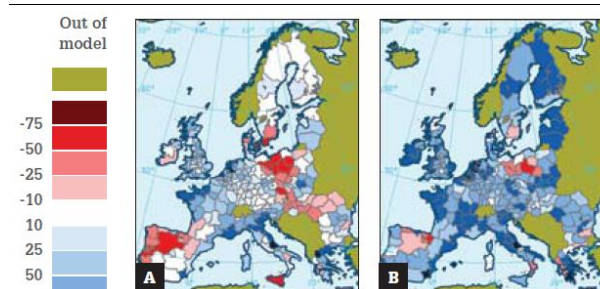
* for 2071-2100 relative to 1961-2000 (M/S)
Source: Donat, Leckebusch, Wild, Ulbrich – Future changes in European winter storm losses and extreme wind speeds inferred from GCM and RCM multi-model simulations, 2011

Chart 34: Projected change in damage from EU storms*

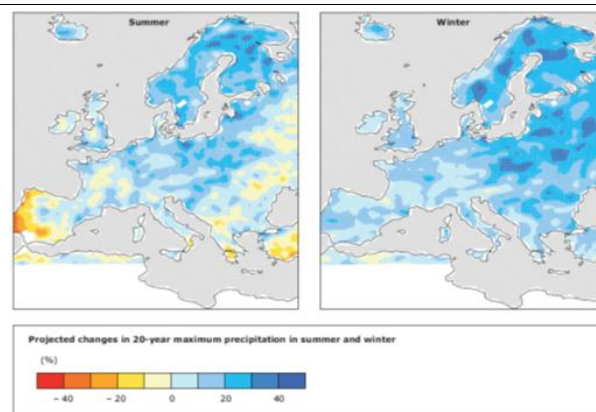


*Relative change (%) of mean annual storm loss potential for the 2050s compared to recent climate conditions (1961-2000)
Source: Donat, Leckebusch, Wild, Ulbrich – Future changes in European winter storm losses and extreme wind speeds inferred from GCM and RCM multi-model simulations, 2011

Floods are the second costliest natural disaster in Europe for insurers, with 28% of total insured losses since 1980. In our risk assessment matrix, we differentiate coastal floods due to the rise in sea levels from river floods due to change in mean precipitations and extreme precipitations (flash floods). **UK, Italy and Benelux are seen as the most exposed to increased river flood damage due to climate change.** Extreme precipitation events are likely to become more frequent across Europe with the strongest impact on Scandinavian countries (winter) and Central and Eastern Europe (summer). Damage due to rising sea levels may increase from the current EUR1.9bn p.a. to EUR5.1bn in the 2020s (mostly sea flood costs), with the Benelux, the UK, France and Germany the most adversely impacted.

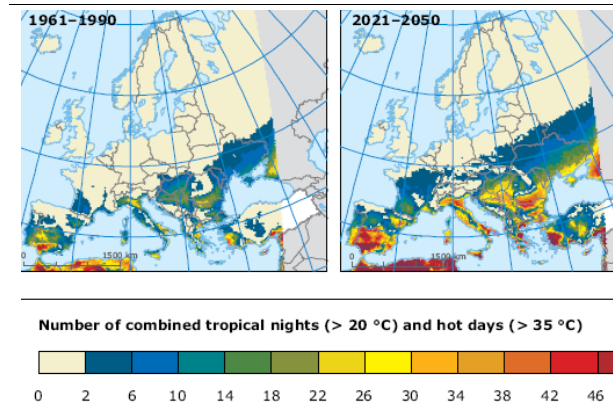
Chart 35: Projected change in flood damage

*Relative change in direct flood damage from floods due to climate change only for (A) current and (B) 2020s relative to 1961-1990
Source: ClimateCost project

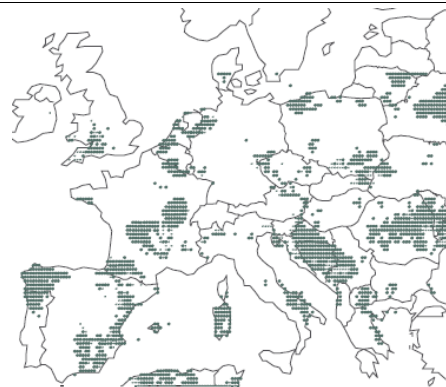
Chart 36: Projected changes in max. precipitation

* for events with a 1-in-20 year return period, in summer and winter
Source: Nikulin et al. 2011

Droughts and heat waves: Climatological events such as droughts, heat waves, forest fires and cold waves) represented 20% of overall losses over 1980-2011 but only 7% of insured losses due to low insurance penetration for these kinds of risks. The frequency of heat waves is likely to increase in Europe, with the number of heat stress days projected to double in Southern Europe. A recent study led by Swiss Re and ETH Zurich shows that loss potential due to soil subsidence damage to infrastructures following severe droughts may double by the 2030s in regions already impacted (e.g. **France**) and in new areas.

Chart 37: Projections of extreme high temperatures

Source: Fischer and Schär, 2010 © Nature Publishing Group, in EEA report

Chart 38: Projected increase in damage from droughts

*loss potential from soil subsidence by 2021-40 (grey shading >50% vs 1987-2006)
Source: Swiss Re, ETH Zurich

Based on these analyses, we built the following climate change risk rating of European countries.

Table 5: Exposure of european countries to the effects of climate change on extreme events

EUROPE	Floods	Heatwaves & droughts	Less frost and cold weather	Rising sea level	Extratropical storms	CC exposure
Ireland	3	2	-1	1	1	2.2
UK	3	2	-1	2	3	4.2
Norway	1		-1	1	1	1.4
Sweden	1		-1	1	3	2.0
Finland	3		-1	1	1	1.3
Denmark	2	2	-1	1	3	1.2
Baltic and Russia	3	1	-1	1	2	1.7
France	2	3	-1	2	2	0.8
Belgium	3	2	-1	2	2	2.3
Netherlands	3	2	-1	2	2	1.2
Germany	1	1	-1	2	3	1.8
Czech republic	3	2	-1		1	2.9
Poland	2	2	-1	1	2	3.2
Austria	2	2	-1		1	1.0
Switzerland	2	2	-1			1.8
Slovakia	2	2	-1			2.2
Romania	2	3	-1			1.5
Croatia/Serbia	2	3	-1			1.0
Italy	3	3		1		5.0
Spain	2	3		1	-1	0.5
Portugal	1	3		1	-1	0.4

Source: Kepler Cheuvreux

In order to ensure that we do not integrate into our analysis the type of perils covered by public insurance programmes or that are not covered by insurance, we have modulated these results based on the following two tables (main insured perils by country and penetration rate of insurance by country and by type of peril).

For instance, while Swiss Re's study shows that Denmark would be increasingly hit by drought-related subsidence damage, the peril is currently not covered.

Chart 39: Natural catastrophe insurance coverage across Europe

	Austria	Belgium	Czech Republic	Denmark	Finland	France	Germany	Greece	Italy	Netherlands	Norway	Poland	Portugal	Spain	Sweden	Switzerland	Turkey	United Kingdom
Storm	O	C ¹	O	O	O	C	O	S	N	O	P	O	O	P	O	C	O	O
Cyclone/hurricane	O	C ¹	N	O	O	C	O	S	N	O	P	N	O	P	O	C	O	O
Floods	O	C ¹	O	N	O	C	S	S	O	N	P	O	O	P	O	C	O	O
Hail	O	O	O	O	O	O	O	S	O	S	O	O	C ²	O	O	C	S	O
Landslides	O	C ¹	O	O	O	C	S	S	O	S	P	O	O	S	O	C	O	O
Snow	O	O	O	O	O	O	S	S	O	O	N	O	N	O	O	C	O	O
Frost	O	O	O	O	N	O	O	S	O	O	O	N	O	O	O	O	N	O
Avalanche	O	N	O	N	O	C	S	N	O	N	P	O	N	O	O	C	N	N
Drought	O	N	S	N	N	C	N	N	N	N	N	N	N	S	O	N	N	N
Subsidence	O	C ¹	O	N	N	C	S	S	N	N	N	O	O	S	O	N	O	O
Earthquakes	N	C ¹	O			C	O	O	N	N	P	O	O	P	O	O	C	O
Forest fires	S	N	N	O	O	S	O	S	O	O	O	O	O	S	O	N	S	N
Volcanic eruption	N	N	O			C	O	O	N	N	P	O	O	P	O		N	
Lightning	O	O	O	O	O	O	O	O	O	O	O			O	O	O	O	O

1 for simple retail risks only
2 only if hail results from a storm

Type of insurance cover

C = Compulsory cover by law
P = Obligatory pool
O = Optional cover
S = Cover offered but not widely taken
N = Non-existent

Rate of penetration of cover

= > 75%
 = 25-75%
 = 10-25%
 = < 10%
 = not known

Source: CEA

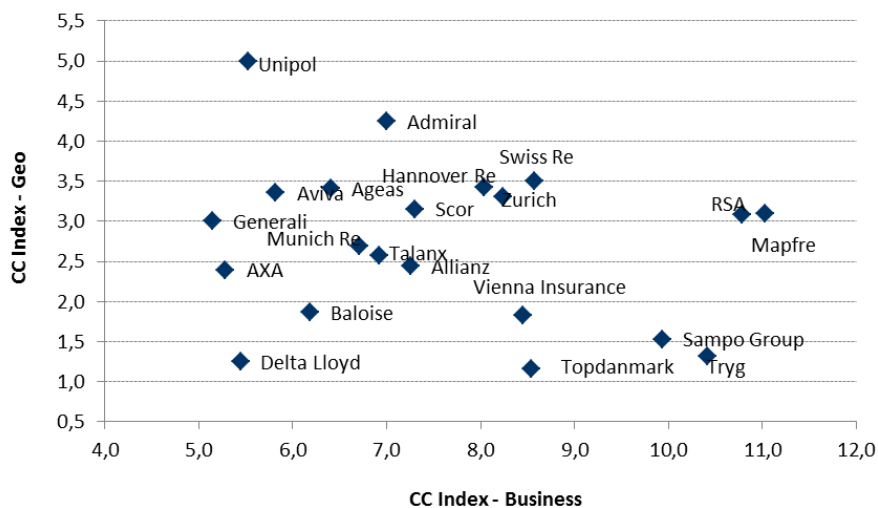
Table 6: QIS5 standardised scenario country "Q" factors

Country	Windstorm	Earthquake	Flood	Hail	Subsidence
Austria	0.08%	0.10%	0.15%	0.08%	
Belgium	0.16%	0.02%	0.10%	0.03%	
Bulgaria		1.60%	0.15%		
Croatia		1.60%			
Cyprus		2.12%			
Czech Republic	0.03%	0.10%	0.40%		
Switzerland	0.08%	0.25%	0.15%	0.06%	
Denmark	0.25%				
France	0.12%	0.06%	0.10%	0.01%	0.05%
Germany	0.09%	0.10%	0.20%	0.02%	
Greece		1.85%			
Hungary		0.20%	0.40%		
Iceland	0.03%				
Ireland	0.20%				
Italy		0.80%	0.10%	0.05%	
Luxembourg	0.10%			0.03%	
The Netherlands	0.18%			0.02%	
Norway	0.08%				
Poland	0.04%		0.30%		
Portugal		1.20%			
Romania		1.70%	0.40%		
Slovakia		0.15%	0.45%		
Slovenia		1.00%	0.30%		
Spain		0.03%			
Sweden		0.09%			
UK		0.17%		0.10%	

Source: Scor

We obtain the following mapping matrix on combining our indices of business and geographical exposure (% of P&C premiums) to the impact of climate change.

Chart 40: Mapping of climate change impact: exposure of (re)insurers

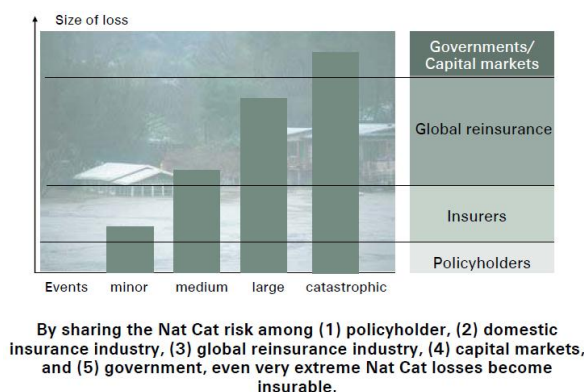


Source: Kepler Cheuvreux

Primary insurance vs. reinsurance

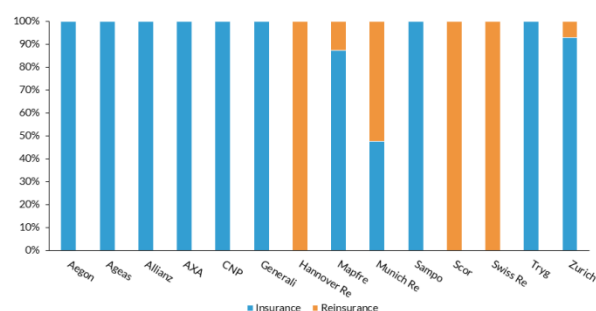
The nature of the business is also of import. Reinsurance bears the peak risk, and hence is more affected by a change in frequency of the most intense catastrophes, while an increase in the frequency of smaller events would be more of a concern for primary insurers, which tend to retain the losses associated to small and mid-sized catastrophes. Swiss re, Hannover Re and Scor are pure reinsurance companies.

Chart 41: Risk sharing – management of catastrophes



Source: Adapted from Swiss Re's OECD Hyderabad conference Feb. 2007

Chart 42: Exposure to insurance and reinsurance*



*% of premiums

Source: Kepler Cheuvreux, Company data

Mitigating the risks

The insurance industry has several options available to enable it to adapt to a changing climate risk:

- **Adjusting risk models for changing hazard situations:** Some companies have started to switch to internal models (e.g. Unipol). Allianz carried out a simulation of flood damage in Italy under a climate change scenario last year. Generali and Zurich have special climate change advisors.
- **Reinsurance, alternative risk transfer solutions:** Following the intense cloudbursts in Denmark in 2010 and 2011, Tryg reacted by increasing its reinsurance coverage both for peak risk and for the accumulation of smaller events in one year. In 2011, AXA further increased its nat cat bond cover to EUR455m.
- **Improved claims handling (loss adjustment):** This includes preventive measures with insurers.
- **Exclusion of particularly exposed areas:** This is linked with the nature of the insurance market. In France, for instance, where the nat cat public insurance programme imposes a flat rate across the country to cover nat cat risks, insurers have little room for action. In Germany, coastal floods are not insured as the risks are deemed too high. In the UK, extremely flood-prone areas are also left aside by private insurers.

In the table below, we propose a review of how climate change is integrated into companies' group risk management systems, their modelling capacities, along with potential participation in research associations or programmes, and their risk retrocession strategies.

Table 7: Integration of climate change in risk management, risk modeling, and retrocession strategies

	Governance Person in charge of climate change	Integration of climate change risk in ERM	Risk modelling Use of models	Research initiative	Retrocession
Aegon	Global Head of Sustainability	Climate change not identified as a trend that will have a significant impact on the business			
Ageas		Solvency capital: Stress events are calibrated to a '1 in 30' years event. 3.33% that the business will seek external capital.			Policy limits concentration management and reinsurance. Property highest retention per event at EUR351m
Allianz	Three Board members responsible respect. for Finance, Asset Management and for Global Lines	Climate change risk management procedures are integrated into group's RMF, incl. risk underwriting and identification. Nat cat limit (net basis) calibrated on occurrence with a probability of 0.4%	Either vendors or proprietary models. Recent work to better assess flood risk in Italy under climate change scenario. Sensitivity tests to deal with uncertainties of the model.	Climatewise (co-founder)	Risk swaps (exchange exposure to EU and US events for exposure to Japanese events). Cat bonds protect against US hurricanes (net loss potential EUR653mn for a 1:250yr event).
AXA	Ethics and governance committee	Climate Change risks are primarily managed within AXA's Group Risk Management (GRM). Climate Change-related risks exposure analysis mainly focuses on extreme weather events.	Use of several external catastrophe modelling software, regularly assessed within GRM	Climate Change is one of the three funding areas of the AXA Research Fund, a EUR100m initiative.	Reinsurance purchase is centralised. AXA Global P&C had a total cat bond cover of EUR455m at end 2011
CNP Assurances	CEO is in charge of the Sustainable Development approach	Direct risks relating to climate change remain marginal and are part of the watch established for emerging risks.			
Delta Lloyd		Integration of climate change risk seems to be a priority of sustainability strategy. The group seeks a holistic approach	Windstorm catastrophe scenarios simulated in a stochastic simulation model (RMS). Use of postal codes to assess exposure		Reinsurance contract protects against a 1:200yr storm (EUR390m covered vs. EUR410m in 2011 and retention limit of EUR50m)
Euler Hermes		Past experience show little impact on group's results from weather events, Euler Hermes cannot rule out the possibility that such events could affect its net income in the future			
Generali	CFO. Also, an independent Director of the Board has held a position as member of the bureau of the IPCC	Emerging risks which derive from internal or external environment changes, that may bring to increased exposures to risks already included in the Group Risk Map or risks that may require the introduction of new categories. They include the climate change risk.	Use of specific actuarial, stochastic or deterministic models.		Little detail

Source: Source: CDP, Company reports

Table 8: Integration of climate change in risk management, risk modeling, and retrocession strategies - continued

	Governance Person in charge of climate change	Integration of climate change risk in ERM	Risk modelling Use of models	Research initiative	Retrocession
Hannover Re	The Executive Board has the highest level of responsibility for Group-wide risk management including e.g. climate change.	The risk management procedures include performing qualitative assessment of Emerging Risks such as climate-change related risks	Use of licensed simulations models supplemented by internal expertise.		Issuance of cat bonds to transfer peak exposure (EUR100m for EUWS)
Mapfre	Corporate General Director of Resources and Media	A concern mostly for Mapfre America, Mapfre International, and Mapfre Re	Use of catastrophic event risk exposure estimates, usually made by independent experts		
Scor			Extensive use of external catastrophe modelling software (RMS and AIR). Access to local cat model expertise for Australia. Systematic sensitivity analyses are carried out to stress-test the key parameters of the models. For non-modelled perils, Scor kept its R&D capacity stable given the challenges in S-E Asia.	OASIS, Scor Global Risk Center constituted in 2011	Contingent capital equity lined increased from EUR75m to EUR150m in 2012.
Talanx		Analyses trends such as climate change in the various divisions with a risk management and product development view.	Use of licensed simulations models supplemented by internal expertise. Simulation models are used to analyse the worldwide implications of nat cat due to e.g. climate change.		Use of cat bonds against peak exposures from European storms. Net exposure to a 1:250 y loss Europe storm of EUR359m in 2012. Highest net exposure: US storm (USD796m)
Topdanmark	CSR Steering Committee	Topdanmark follows closely and constantly the trend in weather-related claims to adopt and enhance our risk analysis and risk management.	Uses an in-house risk model to calculate non-life risks. As example, in 2012 the group has started developing a geographical map used to forecast where rainstorms and storms are expected to happen.		Reinsurance covers storm claims of up to DKK 5,100m with a retention of DKK 100m. Further coverage if other storms happen the same year. Specific reinsurance coverage for rainstorms with maximum retention of DKK 75m.

Source: Source: CDP, Company reports

Table 9: Integration of climate change in risk management, risk modeling, and retrocession strategies - continued

	Governance Person in charge of climate change	Integration of climate change risk in ERM	Risk modelling Use of models	Research initiative	Retrocession
Tryg	CSR director.	Every year, Tryg carries out a risk mapping process, which aims to identify new risks that cannot be assessed using statistical analyses. These assessments are compiled in Tryg's risk database and form the basis of ongoing risk reporting. Selected risk scenarios based on this work are incorporated directly into Tryg's calculation of the necessary capital requirement (Individual Solvency Requirement) and in Tryg's 'Own Risk and Solvency Assessment' (ORSA).		Climatewise	Reinsurance coverage revised up following high cloudburst claims in 2010 and 2011. Aggregate cover for small-mid size events (DKK 500m with retention of DKK 400m) Cover sufficient to cope with up to 1:250y storm event
Unipol	Sustainability Committee is the highest level of direct responsibility for climate change within our company and it is under the supervision of the Chief Executive Officer.		The group adapts its risk management procedures to solvency II, incl. the development of an internal model. Stress-test scenarios led by the Risk management		Hail risk covered by non-proportional types of cover
Zurich		Group climate change Advisory Council is one of the four panels of external experts advising senior management.	Combination of external and in-house models. Continues its effort to include modelling or loadings for non-modelled lines (China, Brazil, South Africa, Mexico) were peril regions assessed for 2012 for climate-induced risks for instance)	Climatewise	Reinsurance both for unusually severe and unusually frequent nat cat events. Loss retentions of USD500m and USD320m respectively in US and Europe with 36%-39% co-participation to reinsurance catastrophe treaties. Use of cat bonds

Source: Source: CDP, Company reports

To conclude

Insurance companies with a high exposure to the projected impact of climate change, with low internal nat cat research capacities and low reinsurance coverage are the most at risk, in our view. Ageas and Mapfre seem to be one step behind, while Delta Lloyd compensates for low internal modelling capacities (use of only one model) with significant retrocession of peak risks associated with low probability storm events.

More generally, in a scenario in which climate extremes increase in frequency and intensity, the insurance sector is likely to transfer this additional risk to the reinsurance industry and/or to capital markets, hence eroding profitability in order to mitigate profit volatility and capital requirements under solvency rules.

Reinsurance, main winner, unless ...

Nat cat peak exposure is mostly retained by reinsurers. Can climate change-inflated events impact their capital, potentially creating a systemic risk? We apply a climate change stress test scenario to reported peak exposures of European reinsurers to 1-in-200yr US hurricane and EU windstorm perils. Hannover Re is the least exposed.

In a scenario wherein climate change would actually bring new extremes, insurers are likely to increase their exposure to extreme perils and their need to transfer risk. This trend would take a long time if changes in the assessment of exposure are made on an ex-post basis (i.e. following natural catastrophes), or may be more widespread if any of the three leading risk modelling companies start adjusting their model assumptions on the basis of more evidence and consensus regarding scientific research on the projected impact of climate change on the severity and frequency of key perils.

We would therefore expect reinsurance companies to benefit from further risk retrocession by primary insurers in a context of more uncertain losses, in a changing climate, combined with stricter Solvency Capital Requirements.

Although the reinsurance sector is the most exposed when a mega event occurs, the loss of profitability is generally covered on the short-to-medium term by subsequent hikes in reinsurance premium rates.

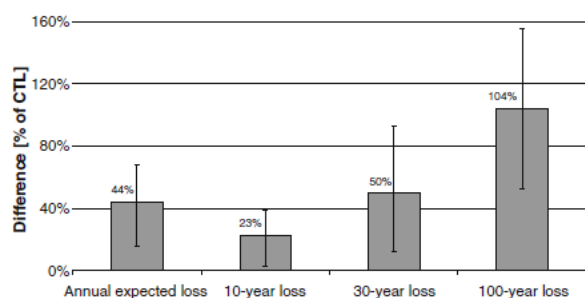
However, the question we raise below is whether climate change could inflate claims related to the most intense events to such a level that the capital base of reinsurers could be hit.

Testing reinsurers' resilience to climate change scenarios

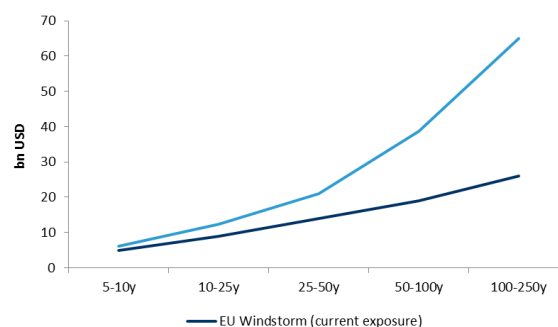
The high concentration in the reinsurance sector would tend to create a systemic risk in the event an accumulation of major events occurs the same year. Reinsurers provide estimates of their peak exposure for single events, with the main exposure areas often appearing to be US hurricanes and Europe windstorm.

In this section, we draw up a climate-change stress-test scenario in order to estimate to what extent the capital base of reinsurers might be at risk in the event of a low-probability scenario where 1-in-200 year US hurricane and EU windstorm events (i.e. with a probability of 0.05%) occur the same year.

We based our analysis on estimated loss distribution curves for European windstorm and US hurricane events (source: Hiscox). In order to reflect the impact that climate change may have on these estimates, we apply the results of recent scientific papers modelling the potential impact of climate change on European winter storm losses (*Schwierz and al., 2010*) and a simulation carried out by AIR Worldwide for the Association of British Insurers assessing the impact of a climate change scenario leading to a 6% increase in wind speeds on insured losses for US hurricanes.

Chart 43: CC impact on EU windstorm damage*

*Annual expected loss and 10, 30 and 100-year loss for Europe (climate impact on windstorms)
Source: Climate Change (2010), Schwierz et al.

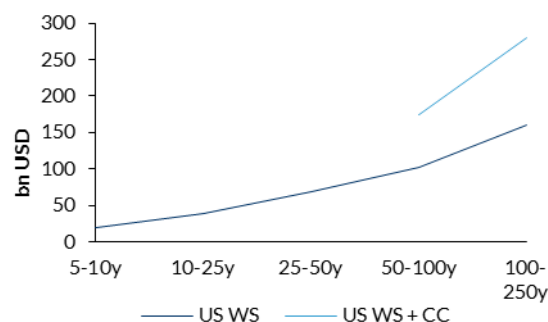
Chart 44: CC impact on the loss distribution curve

*current and climate change scenario (2080s) loss distribution curves for EU windstorm
Source: Hiscox, Kepler Cheuvreux

Chart 45: CC impact on US hurricane damage*

Scenario		Annual average insured loss	Annual average total loss	Insured loss with chance of occurring once every 100 years	Insured loss with chance of occurring once every 250 years
Current observed baseline ^a	-	\$5.5 bn	\$9.5 bn	\$60 bn	\$85 bn
	Increase in windspeed	Loss increase relative to baseline			
Lower bound sensitivity analysis	4%	45%	47%	45%	49%
Potential impact of climate change ^b	6%	75%	75%	70%	75%
Upper bound sensitivity analysis	9%	118%	116%	113%	115%

*Comparison of outputs of climate stress-tests to industry baseline losses for costs of storms (2005)
Source: AIR Worldwide, ABI report 2005

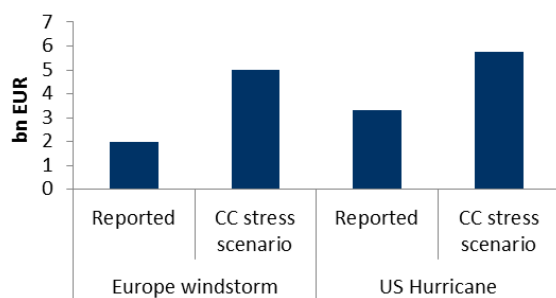
Chart 46: CC impact on the loss distribution curve

*Current and climate change scenario (2080s) loss distribution curves for us hurricane
Source: Hiscox, Kepler Cheuvreux

Stress tests for reinsurers

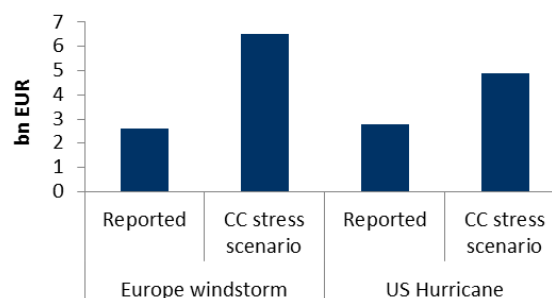
Based on peak exposures reported by reinsurers under our coverage, we apply similar climate change scenarios in order to tweak peak exposures.

There are of course significant caveats in applying average industry-wide estimates to single companies due to their different geographical exposures of insured assets and different tools to retrocede extreme risks. Companies may want to correct these rough assumptions and provide more company-specific sensitivity analysis of their peak exposures under climate change scenarios.

Chart 47: Munich Re: peak risk exposures*

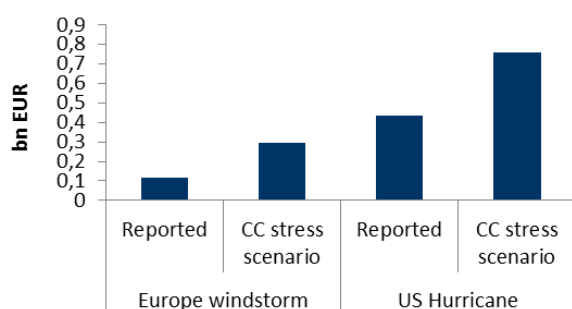
*(weather nat cat) – reported 2012 and climate change stress scenario (2080s)

Source: Munich Re, Kepler Cheuvreux estimates

Chart 48: Swiss Re: peak risk exposures*

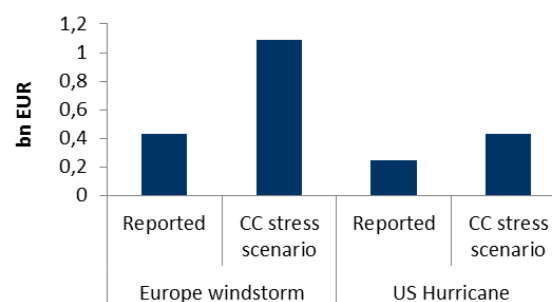
*(weather nat cat) – reported 2012 and climate change stress scenario (2080s)

Source: Swiss Re, Kepler Cheuvreux

Chart 49: Hannover Re peak risk exposures*

*(weather nat cat) – reported 2012 and climate change stress scenario (2080s)

Source: Hannover Re, Kepler Cheuvreux estimates

Chart 50: Scor: peak risk exposures*

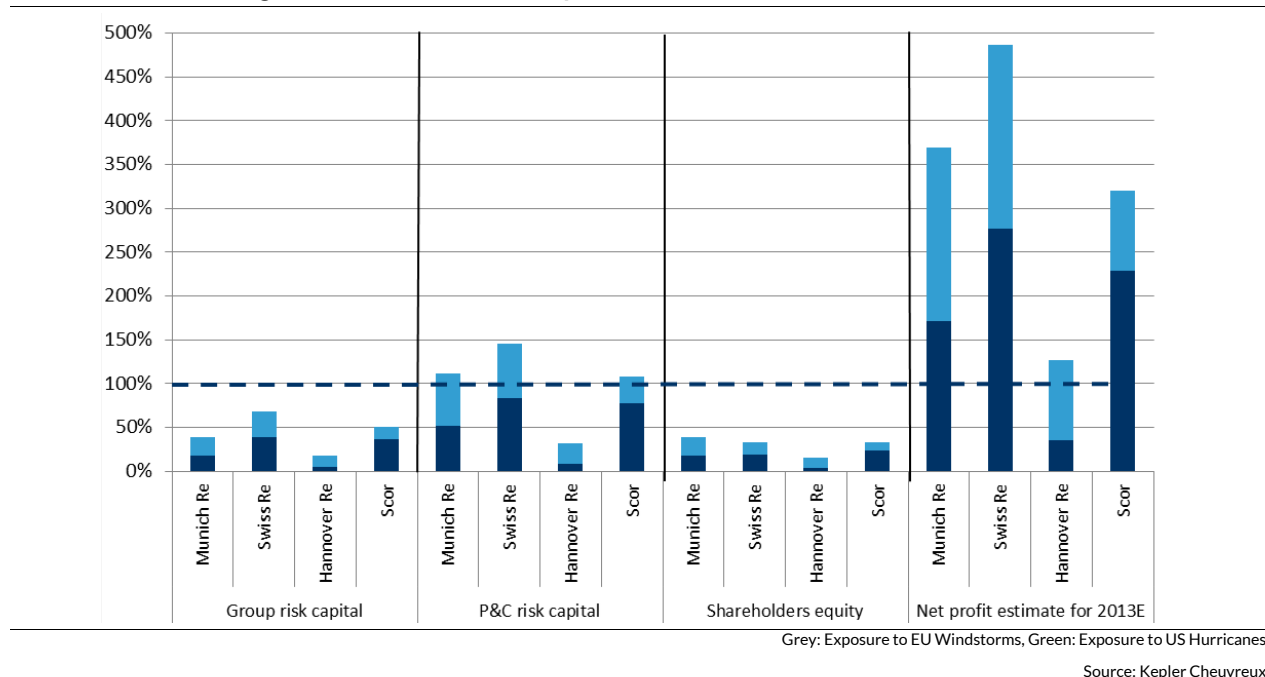
*(weather nat cat) – reported 2011 and climate change stress scenario (2080s)

Source: Scor, Kepler Cheuvreux

Can climate change create capital risks for reinsurers?

We then cumulate and look at these peak exposures against different financial metrics to assess the financial exposure of these companies under a climate change scenario.

This is a deliberate high-stressed scenario with extremely low probability (1:40,000, assuming the two events are independent), its results have to be viewed with this in mind. In other words, we would need to face a 0.025% probability scenario in which both climate change stressed 1-in-200yr EU windstorms and US hurricanes would occur in the same year to see the P&C risk capital of Swiss Re, Munich re, and Scor totally consumed by associated claims.

Chart 51: Climate change scenario stress test on key financial metrics for reinsurers

Even under climate-change-stressed scenarios, we believe that weather-related catastrophes are likely to remain profitability events for reinsurers. It is even more unlikely that capital can be seriously hit given that:

- **Climate change simulations are calibrated to provide results for the end of the century.** Hence we compare here potential losses in the 2080s vs. current capital bases. Reinsurers will have the opportunity to raise P&C risk capital over time or reduce exposure to peak perils. Swiss Re and Munich Re appear today particularly well positioned to understand the climate change risks thanks to the use of strong proprietary models. Consequently, they can adjust their exposure to perils when they consider that the actual level of risk is not adequately priced in. Munich Re notably decreased its exposure to EU storm risk in 2012 considering that rates were too low.
- They may further create capital shields through retrocession, or use of alternative risk transfer solutions such as cat bonds or contingent capital instruments, and transfer peak risk to capital markets.

A driver for alternative risk transfer solutions

Cat bond market back to pre-crisis levels

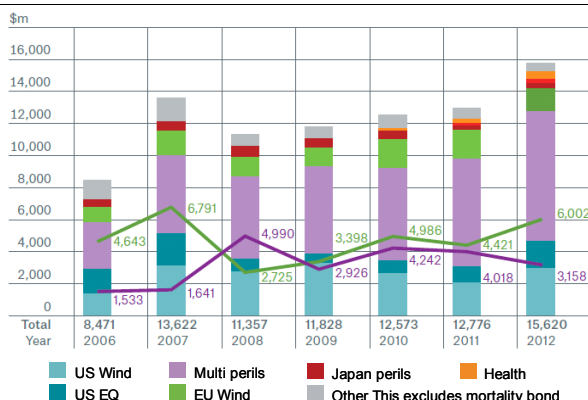
Insurance companies may use catastrophe bonds as an alternative to traditional catastrophe reinsurance. CAT bonds are multi-year risk securities usually structured as floating rate bonds. Rating agencies often rate them below investment grade (BB or B category).

The principal repayment is conditioned by the occurrence of natural catastrophes. On the one hand, if no nat. cat occurs, the insurance company would pay Libor plus a spread of between 3% and 20%. On the other hand, if a catastrophe happens, then the principal would be used by the insurance firm to pay its claim-holders, and the subscriber who takes on the natural catastrophe risk would lose his investment. This structure of potential loss of

principal may be triggered by four different techniques: 1) indemnity (if total claims add up to more than a contractual amount); 2) modelled loss (if total losses calculated through a catastrophe model are above the contractual amount); 3) indexed to industry loss (if total losses exceed a contractual amount); or 4) parametric (function of any parameter of the natural catastrophe type – e.g. wind speed and contractual level for hurricanes).

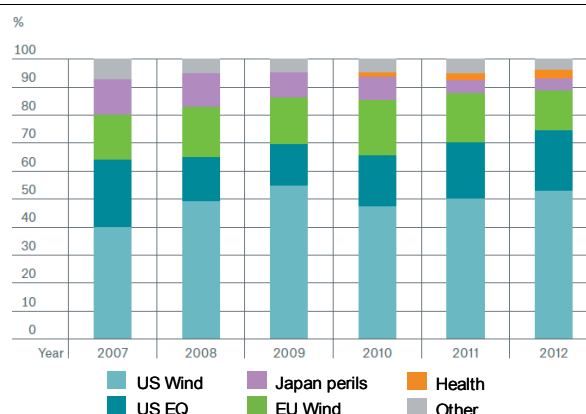
According to Munich Re, the outstanding cat bond capacity overshoot the pre-crisis level in 2012 with a market still clearly skewed towards US wind and US earthquake events.

Chart 527: Outstanding and issued cat bond volume (USDm)



Source: Munich Re

Chart 48: Outstanding cat bond capacity by peril



Source: Munich Re

Investors in such products may be catastrophe-oriented funds, hedge funds or classic asset managers who look for diversification and returns not closely correlated to those on equity or fixed-income markets as well as significant yields.

Clear Solvency rules may develop coco bond solutions

Contingent capital instruments are relatively similar risk transfer mechanisms where the (re)insurer issues debt which is written down or converted into equity when a trigger point such as a regulatory capital threshold is reached. This type of capital shield is also used by banks.

Scor, Allianz and Swiss Re notably have been using coco bonds to protect their capital position and solvency ratios in case of trouble.

Swiss Re recently (in March 2013) issued an 11.5-year USD750m coco bond to be triggered in the case Swiss Re's capital ratio falls to less than 125% of the value of its liabilities.

Table 10: Issuance of contingent capital bonds by insurers

Company	Amount issued	Date of deal	Period	Condition
Scor	EUR150m	December 2010	3 yrs	Nat cat losses exceed a certain threshold
Allianz	EUR500m	July 2011	10 yrs	N/A
Swiss Re	USD750m	March 2013	11.5 yrs	Capital ratio falls to less than 125% of liabilities

Source: Articles, Kepler Cheuvreux

Scor's coco bond was activated in 2011, adding 2.3% of new share.

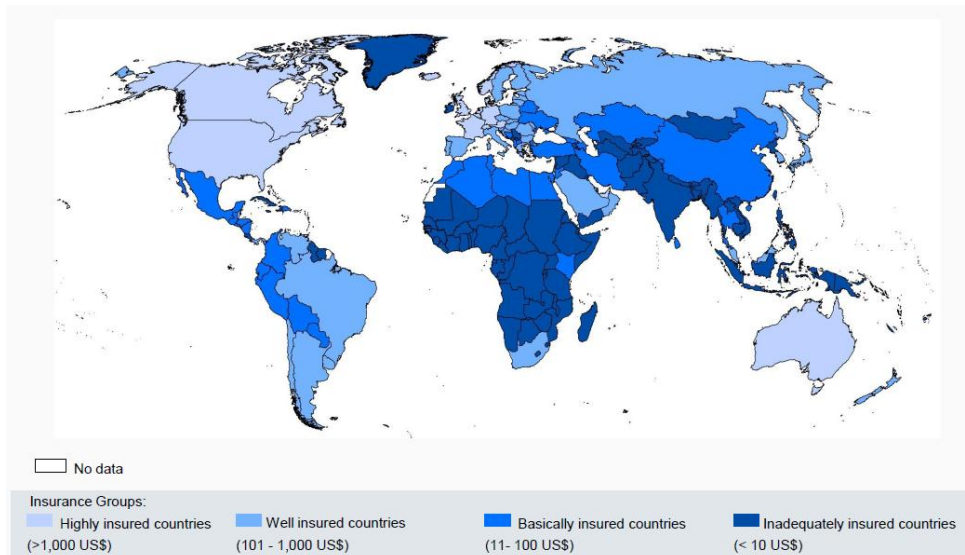
Beyond risks: market opportunities?

While emerging countries appear to be promising territories from a growth perspective and a market for climate change adaptation services, these regions are poorly covered by sophisticated nat cat model vendors. The use of parametric insurance contracts is a good way to mitigate the higher underwriting risk on these markets.

Will adaptation needs further boost the P&C insurance market?

The penetration of insurance remains particularly low in Asia and Africa. The demand for insurance coverage generally depends on economic growth, willingness to pay for insurance, political conditions, and insurability of nat cat risks.

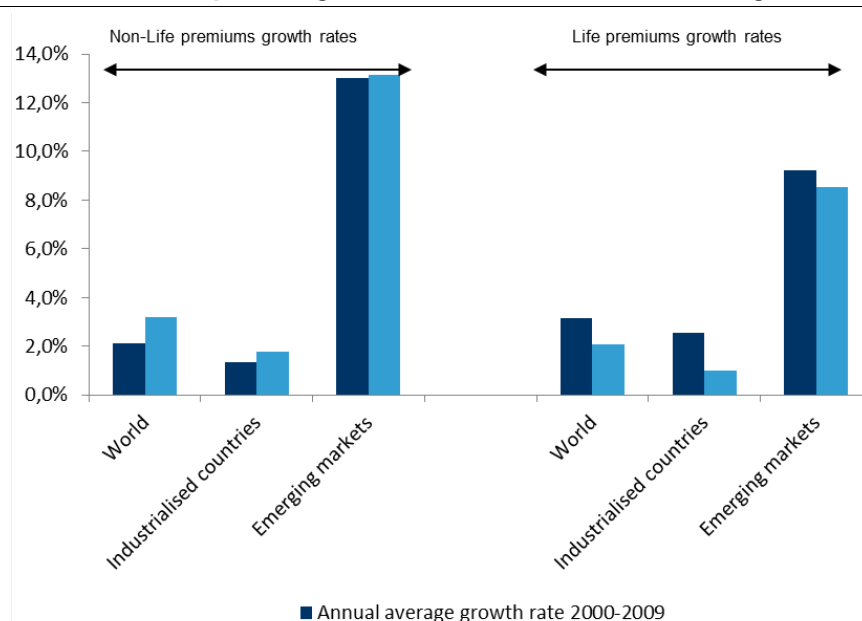
Chart 53: Property insurance premiums per capita



Source: Munich Re

Economic growth is already increasing the demand for insurance coverage, and notably non-life insurance, which saw annual average growth rates of ~13% over 2000-2010.

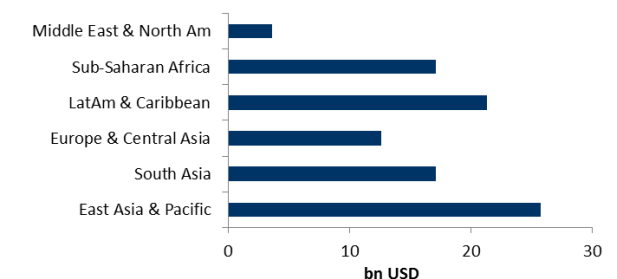
However, in 2008, weather-related insurance coverage was still very low in emerging countries at 6.7% (vs. 55% in developed countries).

Chart 54: Life and non-life premium growth rates 2010 vs. The 2000-2009 avg.

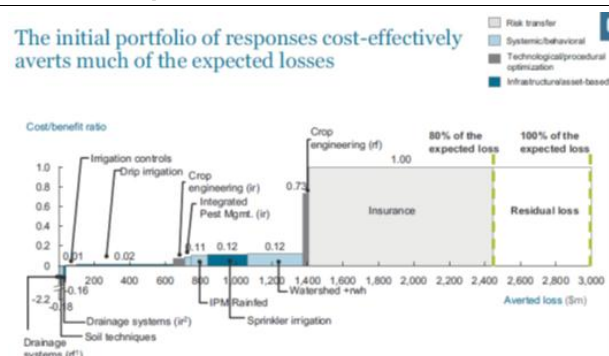
Source: Swiss Re, Kepler Cheuvreux

The higher frequency and severity of natural catastrophe is seen as a trigger for increased demand for insurance coverage, and Asia, LatAm & Caribbean and sub-Saharan Africa were flagged as most exposed to the effect of climate change costs, with annual costs of adaptation estimated at respectively USD43bn, USD21.3bn and USD17bn (in 2005 USDbn).

In an Economics of Climate Adaptation report, insurance is flagged as a cost-effective solution for mitigating expected losses due to climate change. In the example below, which looks at adaptation solutions in the Indian State of Maharashtra for instance, the report estimates that insurance can be an adequate solution for averting ~30% of expected losses due to climate change.

Chart 55: Adaptation costs under CC scenario

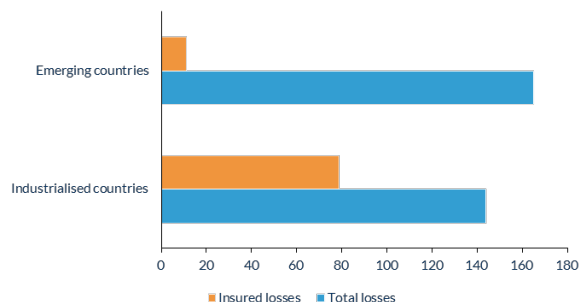
*Regionalised annual costs of adaptation under climate change scenario (excl. Benefits from climate change)
Source: World Bank 2010

Chart 56: Adaptation cost curve for Maharashtra, India

Source: ECA, Economics of Climate Adaptation, Swiss Re

Of the 35 respondents to the CDP having provided a view on how climate change may induce business opportunities, 40% estimate that climate change drivers are likely to increase the demand for existing or new (re)insurance products and that the magnitude of the impact on their business would be medium-to-high. This is particularly true for reinsurers, which tend to support the view expressed in the sections above that changes in extreme weather events are likely to benefit the reinsurance industry first and foremost.

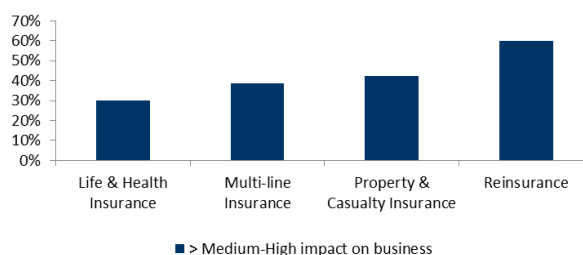
Chart 57: Total and insured weather catastrophe losses*



* 2008

Source: Swiss Re in CDP 2010

Chart 58: Perception of business opportunities*



*from increased demand for existing or new insurance products due to climate change

Source: CDP, Kepler Cheuvreux

Opening the markets

Swiss Re recognises in its CDP questionnaire (2010) that tapping into this market will require considerable resources. Products, such as natural catastrophe insurance and reinsurance, national catastrophe bonds, weather derivatives and weather index insurance could benefit from increasing demand for flood and crop protection insurance.

The company seems particularly well positioned with a 30% global market share in weather and weather contingent commodity structures in 2009.

During our climate change conference call in November 2012, Stéphane Hallegatte (a member of the IPCC and Senior Economist at the World Bank) hinted that insurers will be able to win market share in developing countries such as India if they can get involved in national adaptation plans and tweak their products into adaptation products.

He notably identified Munich Re as the most active in climate change adaptation, with concrete actions such as: 1) their research for enhanced risk assessment; 2) involvement in the development of insurance in developing countries where adaptation needs are higher; and 3) the launch of innovative products such as micro-insurance for farmers in Africa.

Overall, as seen in the table below, climate change adaptation services/products generate only a very small share of total premiums, and despite the perception of a growing market, most reinsurers do not expect these new products to generate enough premiums to serve as a growth driver in the mid-term.

Table 11: Opportunities in climate risk insurance products and product development

	Market Opportunity	Product development
Swiss Re	Difficult to predict. From several hundreds to millions of USD in the next 5-10 years, depending on growing interest from governments or multilateral organisations. Sees also a real possibility in micro insurance market, notably driven by the demand for coverage against severe weather. Potential from demand for parametric insurance coverage from states/municipalities.	Parametric insurance
Munich Re	Quantification of the financial implications is not possible at this point Munich Re founded MCII in 2005. Recent test project aimed at developing insurance solutions in 3 Caribbean countries to deliver CC adaptation benefits in developing countries through a public-private partnership approach	
Scor	N/A	Scor is involved in parametric product solutions in India (based on agricultural yield) and Mongolia (live-stock)
Hannover Re	Over the past five years Hannover Life Re has built up a profitable premium volume in the micro insurance segment currently approaching EUR10m. The growth prospects are favourable. Yet with micro insurance, too - or indeed particularly with such products -, the maxim must be "quality before volume".	Reinsurance coverage is geared to provide comprehensive protection against unpleasant surprises
Allianz	Sees opportunities through the demand from clients globally for products mitigating the effects of climate change. The overall share of business is still considered small, with increased client demand expected to materialise only in the mid- to long term	Investigates the creation of multi-peril micro insurance coverage for the agricultural sectors in developing countries, together the MCII

Source: CDP database, Climatewise database

But beware of blind growth!

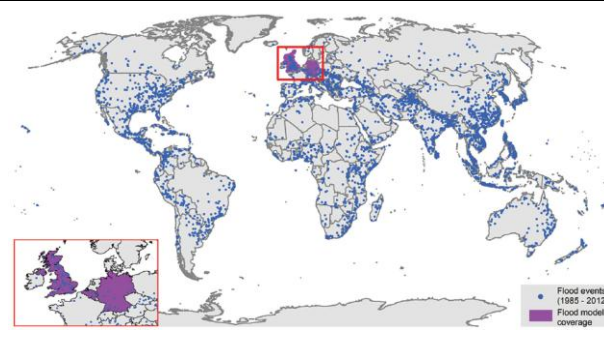
Although emerging markets offer interesting market potential for growth in P&C insurance, we note that this expansion may be profitable only to the most cautious and informed (re)insurers.

Following the floods in Thailand, Swiss Re launched a study to better identify other emerging countries in which flood events could prove dramatic in terms of economic and insured losses. The study concluded that other countries present even greater risks than Thailand, with China topping the ranking, followed by Brazil, Russia and India.

Ironically, these countries remain blind spots in terms of risk modelling for damage from floods as they are not covered by flood models of AIR, EQECAT and RMS.

Chart 59: Emerging markets "flood hot spots" rankings

Source: Swiss Re Cat Perils

Chart 60: Flood model coverage by modelling vendors*

* RMS, AIR, Egecat

Source: Guy Carpenter xxx

Depending on the pace of the expansion of (re)insurers to these countries and the capacity of external model vendors to extend the geographical coverage of their models, the portion of risk capital deriving from non-modelled perils may grow and accentuate the degree of uncertainty in the assessment of the risk capital base needed to cover nat cat risks.

The floods in Thailand were a good reminder of how wrong the estimates were of the country's exposure. The chart below shows how the underwriting risk appeared very high as claims consumed several years of the country's Non-Life premiums, while the underwriting risk for five of the other top 6 flood events in developed countries remained under control.

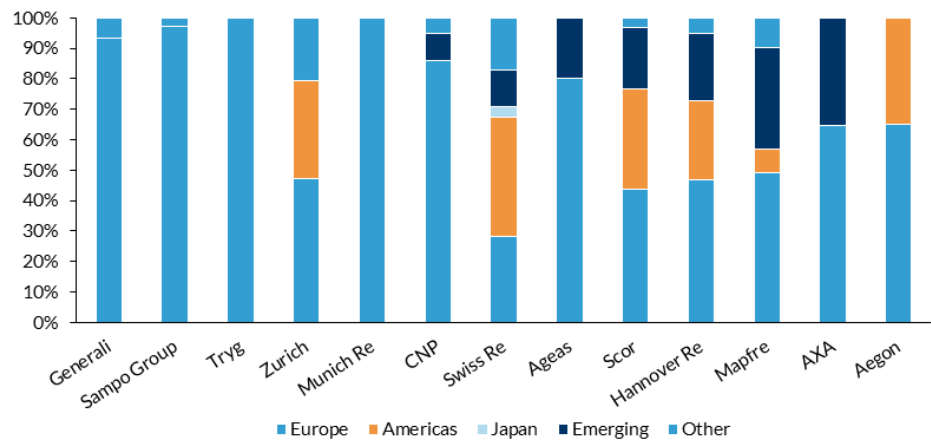
Chart 61: Top 6 insured fresh water floods in history

Source: Swiss Re Economic Research databases, Oxford economics

Parametric insurance products proposed by reinsurers therefore make it possible to tap the markets, while, at the same time, limiting the underwriting risk.

For (re)insurers exposed to emerging countries, investors may expect more disclosure on what share of their nat cat exposure comes from regions where they use deterministic models to estimate probable losses.

Chart 62: Exposure to emerging countries (net/gross premiums)



Source: company data, Bloomberg, Kepler Cheuvreux

Research ratings and important disclosures

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Stock	ISIN	Disclosure (See Below)	Currency	Price
Admiral Group	GB00B02J6398	nothing to disclose	GBP	1,312.00
Aegon	NL0000303709	nothing to disclose	EUR	5.07
Allianz	DE0008404005	nothing to disclose	EUR	120.60
Aviva	GB0002162385	nothing to disclose	GBP	333.00
AXA	FR0000120628	nothing to disclose	EUR	15.37
Baloise	CH0012410517	nothing to disclose	CHF	94.85
CNP Assurances	FR0000120222	nothing to disclose	EUR	11.81
Delta Lloyd	NL0009294552	nothing to disclose	EUR	14.89
Generali	IT0000062072	nothing to disclose	EUR	14.63
Hannover Re	DE0008402215	nothing to disclose	EUR	60.01
ING Group	NL0000303600	nothing to disclose	EUR	7.21
Legal & General	GB0005603997	nothing to disclose	GBP	182.20
Mapfre	ES0124244C36	nothing to disclose	EUR	2.79
Mediolanum	IT0001279501	14, 16, 18	EUR	5.50
Munich Re	DE0008430026	nothing to disclose	EUR	147.50
Old Mutual	GB00B77J0862	nothing to disclose	GBP	216.60
Prudential	GB0007099541	nothing to disclose	GBP	1,161.00
Sampo	FI0009003305	nothing to disclose	EUR	31.98
Resolutio	GG00B62W2327	nothing to disclose	GBP	293.70
RSA	GB0006616899	nothing to disclose	GBP	114.80
SCOR	FR0010411983	nothing to disclose	EUR	23.19
Standard Life	GB00B16KPT44	nothing to disclose	GBP	415.40
Swiss Re	CH0126881561	nothing to disclose	CHF	71.40
Talank	DE000TLX1005	nothing to disclose	EUR	25.52
TopDanmark	DK0060477503	nothing to disclose	DKK	149.00
Tryg	DK0060013274	nothing to disclose	DKK	489.50
Unipol	IT0004810054	nothing to disclose	EUR	2.68
Vienna Insurance Group	AT0000908504	nothing to disclose	EUR	39.21
Zurich Insurance Group	CH0011075394	nothing to disclose	CHF	256.10

Source: Factset closing prices of 28/05/2013

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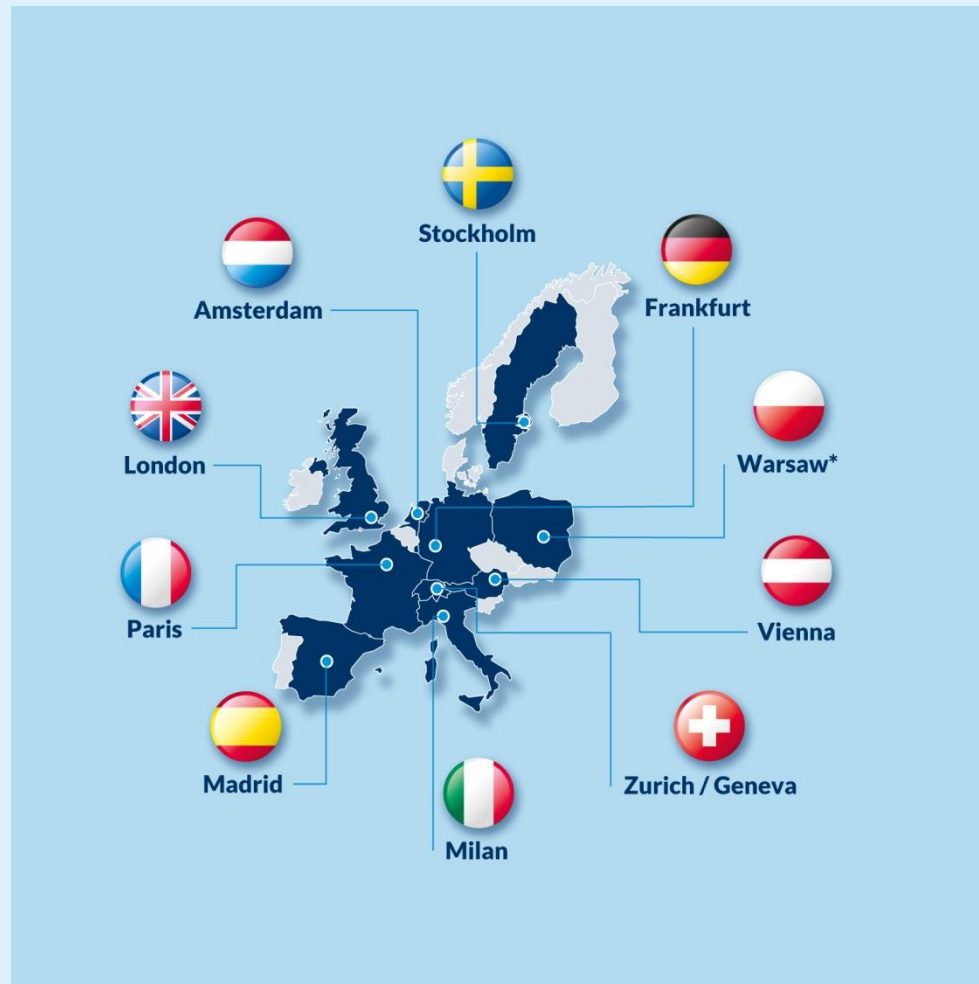
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