Climate Change and its impact on the Insurance/Reinsurance Industry

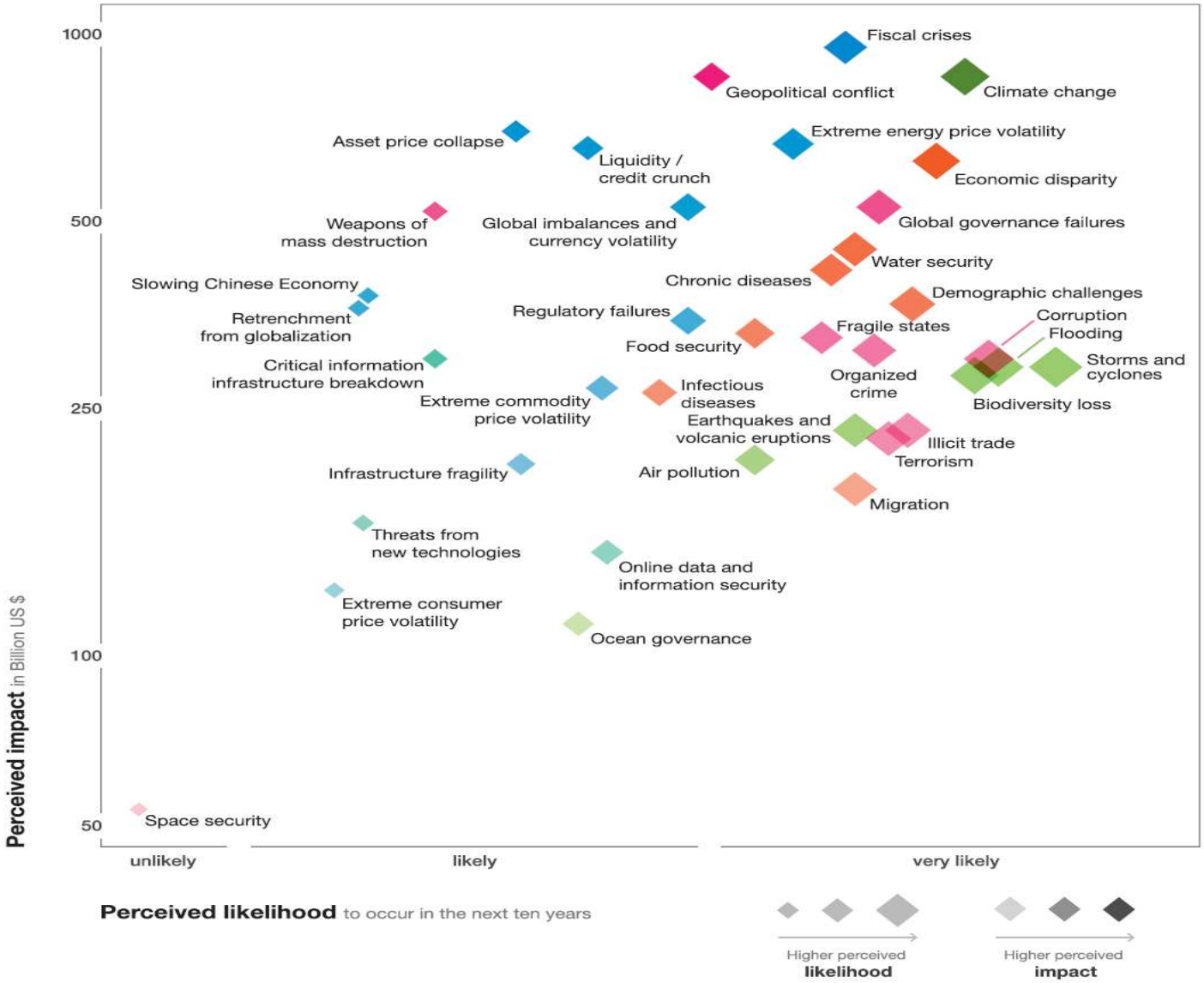
Vijay Manghnani
Exposure & Analytics Officer
Chartis Insurance

The Views and Opinions Expressed Here are Strictly Personal and do not represent those of my Employer/Other Affiliations

Antitrust Notice

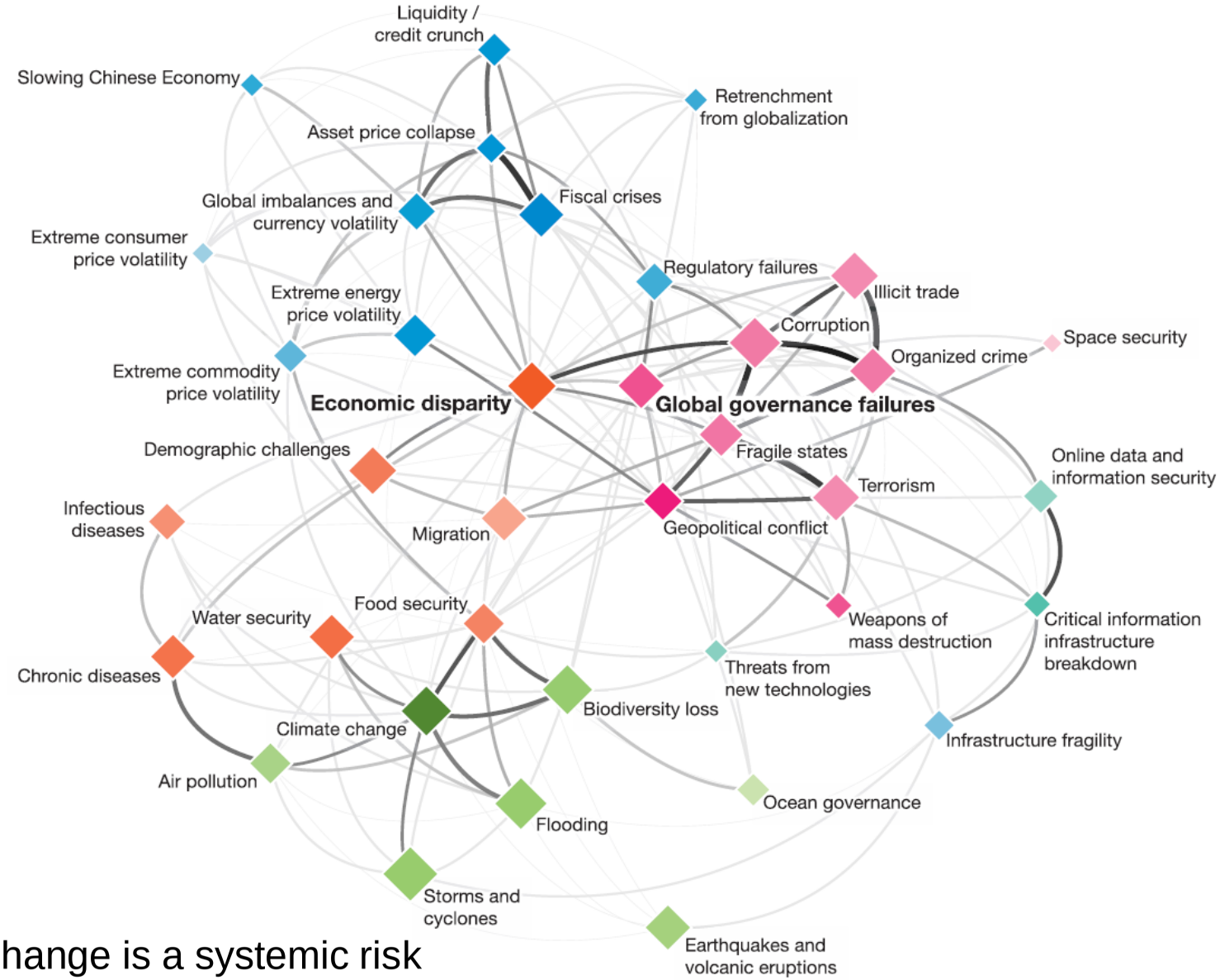
- The Casualty Actuarial Society is committed to adhering strictly to the letter and spirit of the antitrust laws. Seminars conducted under the auspices of the CAS are designed solely to provide a forum for the expression of various points of view on topics described in the programs or agendas for such meetings.
- Under no circumstances shall CAS seminars be used as a means for competing companies or firms to reach any understanding – expressed or implied – that restricts competition or in any way impairs the ability of members to exercise independent business judgment regarding matters affecting competition.
- It is the responsibility of all seminar participants to be aware of antitrust regulations, to prevent any written or verbal discussions that appear to violate these laws, and to adhere in every respect to the CAS antitrust compliance policy.

Global Risks Survey 2011: World Economic Forum



Survey of ~600 Risk Officers from private, government and non-profits

Risk Interconnection Map: WEF 2011



Climate Change is a systemic risk

NAIC Survey

- In early 2009, the NAIC unanimously approved a mandatory climate risk disclosure standard for insurers. That standard was later weakened, but numerous key states with significant market share, including Washington, California, New York and Pennsylvania, moved forward to use it.
- *Survey findings (CERES 2011)*
  - There is a broad consensus among insurers that climate change will have an effect on extreme weather events.
  - **Of 88 companies surveyed, only 11 reported having formal climate change policies**, and more than 60 percent of the respondents reported having no dedicated management approach for assessing climate risk.
  - The industry is focusing most of its attention on a **narrow set of risks, ignoring issues like non-coastal extreme weather and climate liability**, which may prove to be significant
  - While climate change poses significant financial risk for the industry, **few insurers provided meaningful information on the potential financial impacts** of more volatile weather losses
  - **Only a few insurers have explicit investment policies** in place for managing climate change.

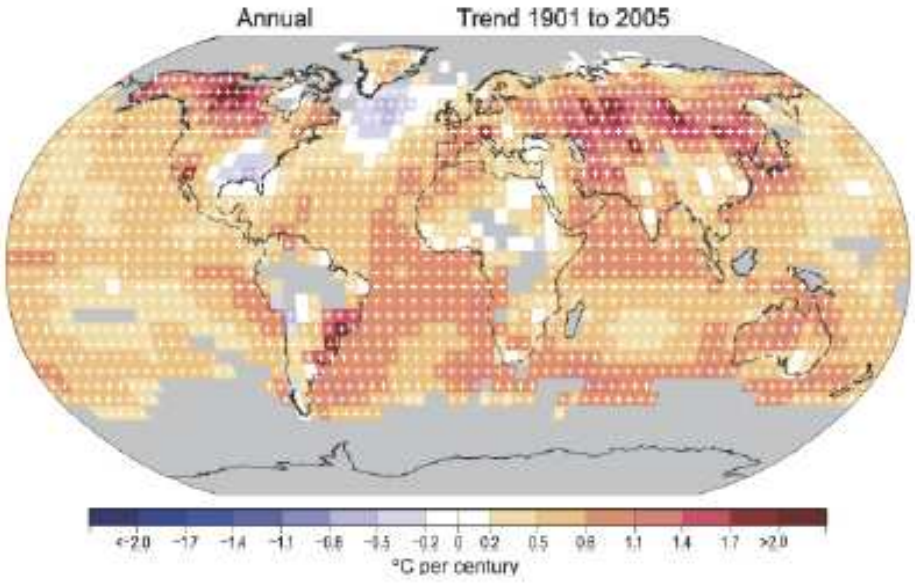
What stance should the (re)insurance industry take on climate change?

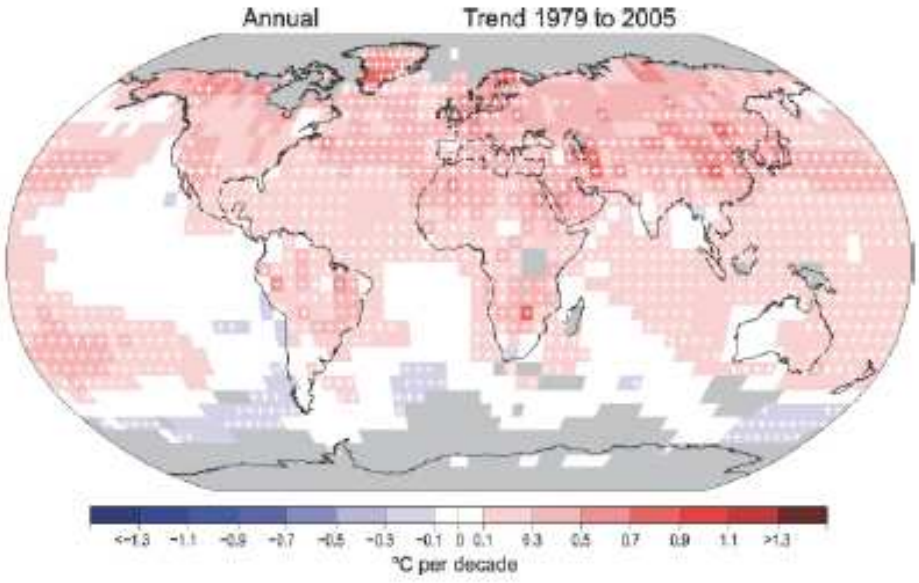
Proactive, Reactive
Or
Indifferent?

Overview

- Climate Change Indicators
  - Temperature
  - Precipitation
  - Sea Level Rise
  - Co-panelist will talk about other perils
- Impact on the Insurance Industry
- Challenges/Opportunities

Global Surface Temperature Trends

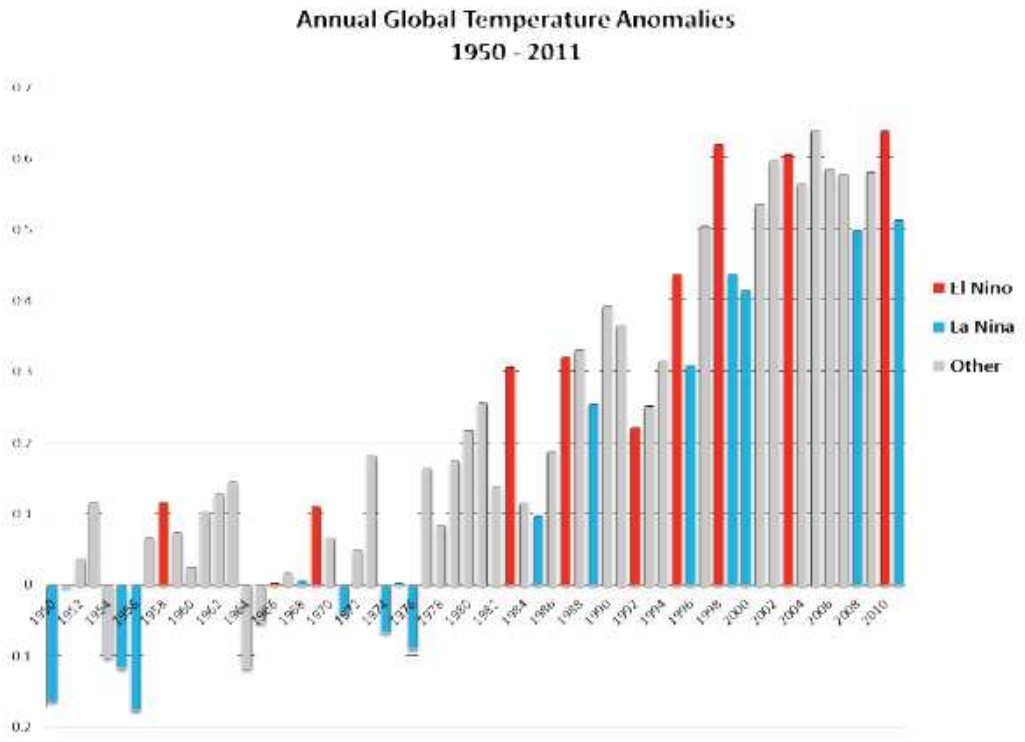




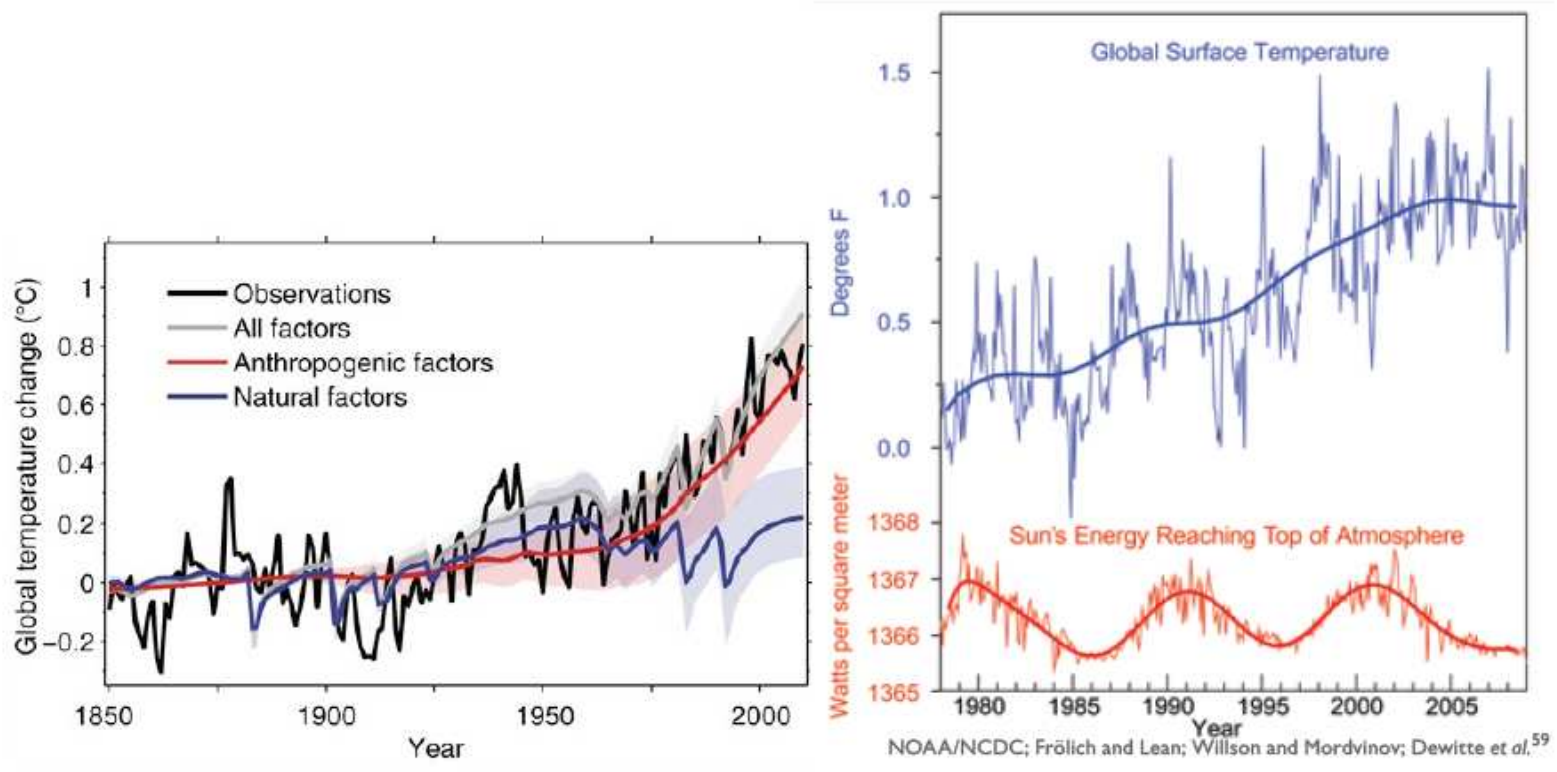
- Linear trend of annual temperatures. Trends significant at 5% level are indicated by white +. Grey areas don't have enough data for reliable trend calculation. Source IPCC AR4

Global Temperature: Key Observations

1. The 16 warmest years on record occurred in the 17-year period from 1995-2011
2. The rate of warming in the last 50 yrs is double that of the last 100 yrs (0.13C/decade vs 0.07C/decade)
3. Land regions have warmed at a faster than the oceans
4. Urban heat island effects are real but local, and have not biased the large-scale trends
5. Average Arctic temperatures increased at almost 2x the global average rate in the past 100 yrs.

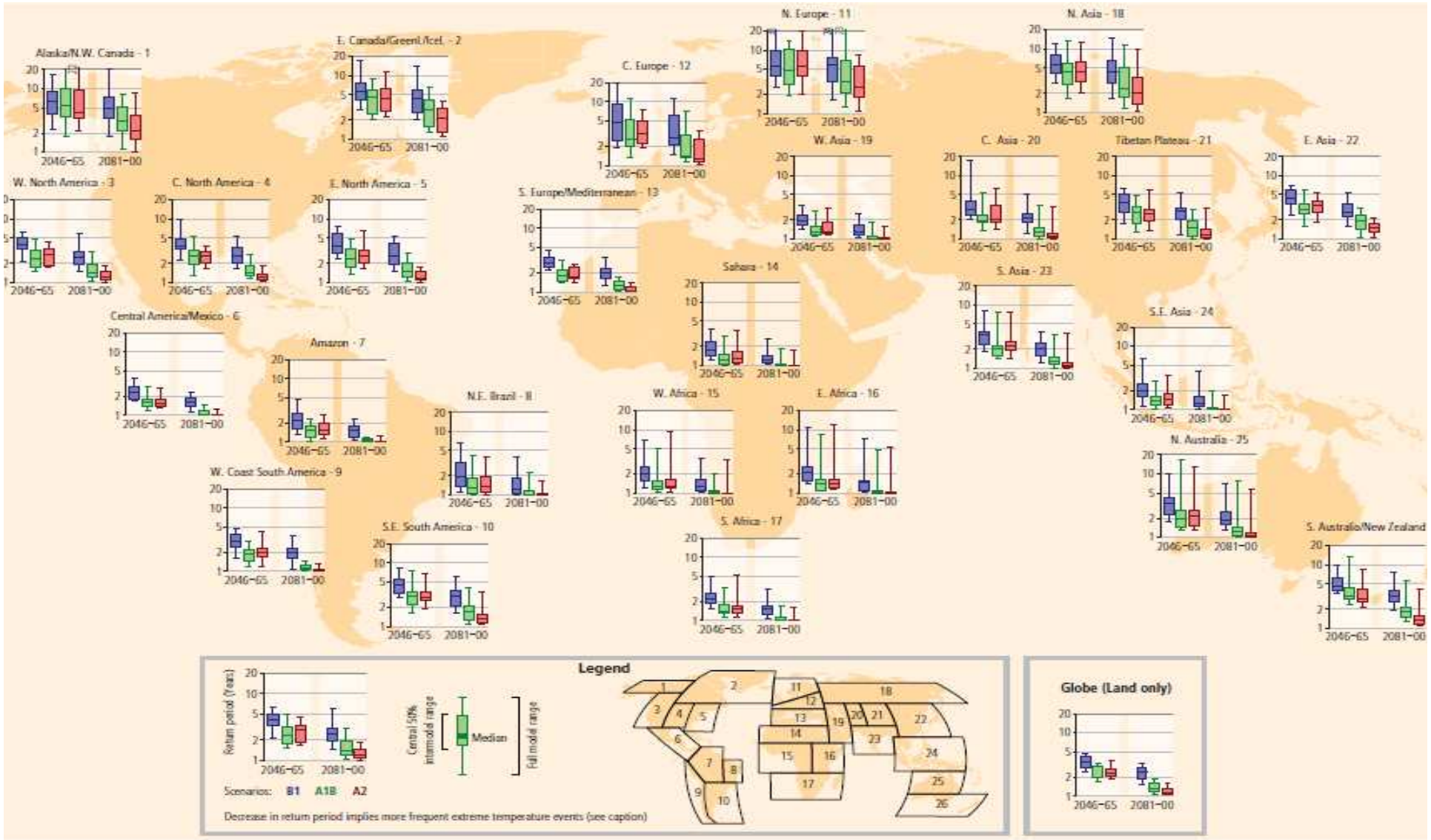


What is causing the Temperature Trends?



- There is a clear warming trend in surface temperatures and it can't be explained solely due to natural factors, hence it is not a long term climate cycle.
- Source: Global Climate Change Impacts in the United States. Karl et al 2009

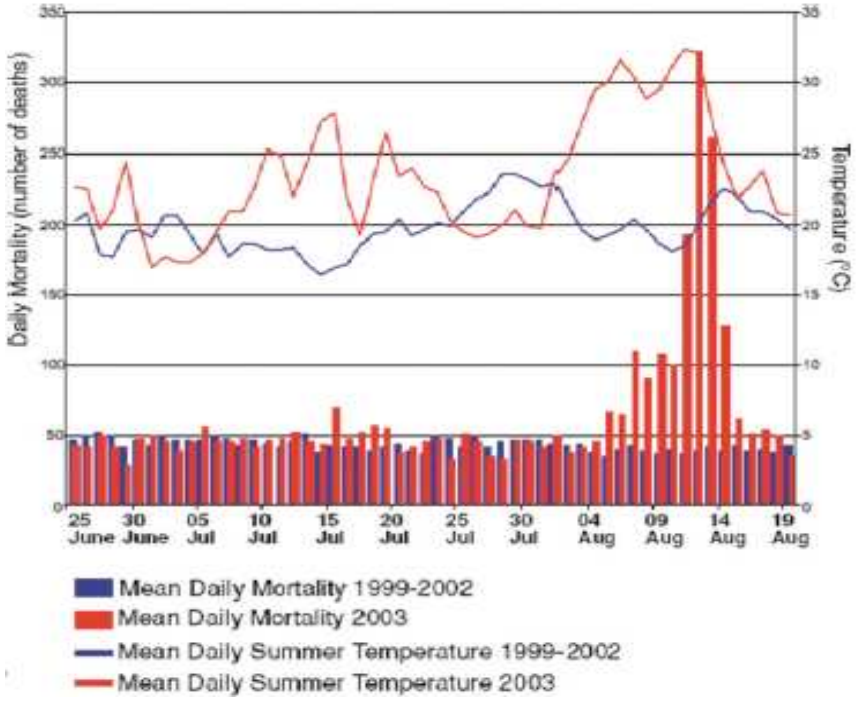
Extreme Temperature Projections



Source: IPCC SREX (2011); Projected Change in Likelihood of 1 in 20 yr events

Warming Temperature Impacts

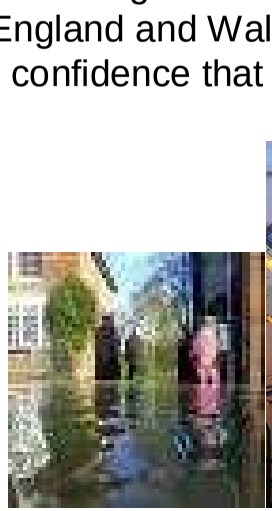
- Heatwaves:
  - Increased mortality - especially to vulnerable population
  - European heatwave (2003) and Russian heatwave (2010): likelihood increased 2-4x due to anthropogenic influence on climate
- Increased Wildfire frequency
- Agriculture Stress
  - Reduced yields on crops beyond a certain temperature – by upto 50% in some areas like northeastern China
  - Pest migration from tropics to mid-latitudes. Also, early Spring and longer summers increases pest population
- Human Disease vectors migration and more frequent outbreaks.



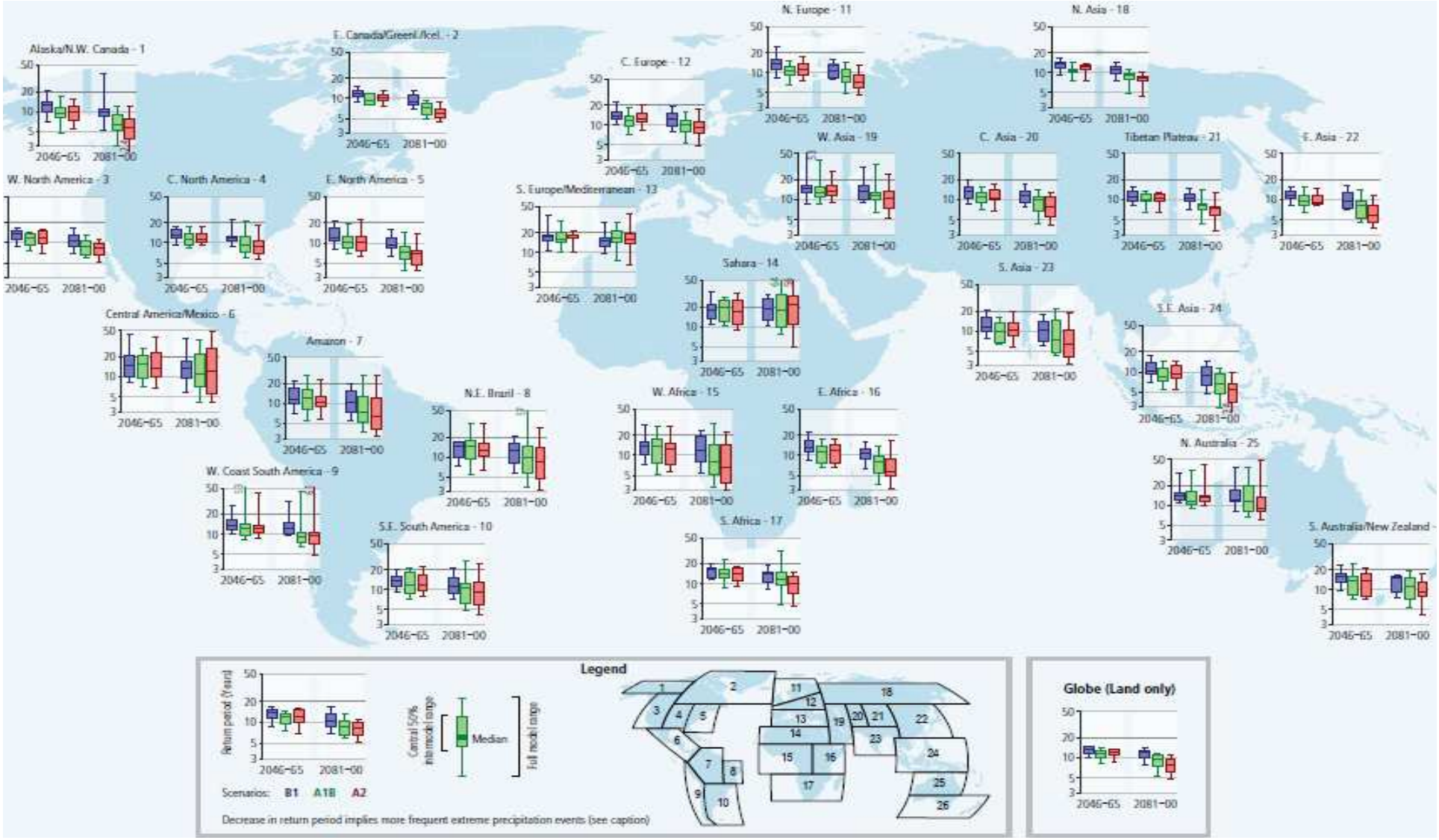
Increase in daily mortality in Paris during the heat wave in August 2003 (Source: IPCC AR4-WG2)

Precipitation Extremes

- A series of long term rainfall records are being broken leading to devastating floods (Dimcoumou & Rahmstorf 2012):
  - Germany (2002), England & Wales (2000, 2007, 2009), Pakistan (2010), Australia (2010), Japan (Typhoon Talas – 2011)
  - The frequency of 0.1% of daily rain events have increased in mid-latitudes, particularly n the US by 33%.
  - Europe winter precipitation beyond 98th percentile has increased eightfold
  - That said, attribution of a particular extreme event to climate change is challenging task
- Human-induced increases in greenhouse gases have contributed to the observed intensification of **heavy precipitation events found over ~2/3rd** of data-covered parts of **Northern Hemisphere** land areas - Min et al (Nature, 2011)
  - Changes in extreme precipitation projected by models may be underestimated
- **England & Wales 2000 Flood**
  - Wettest Autumn on record since 1766
  - Pall et al (Nature, 2011) : 90% confidence that twentieth century anthropogenic greenhouse gas emissions increased the risk of floods occurring in England and Wales in autumn 2000 by more than 20%, and 66% confidence that the risk increased by more than 90%.

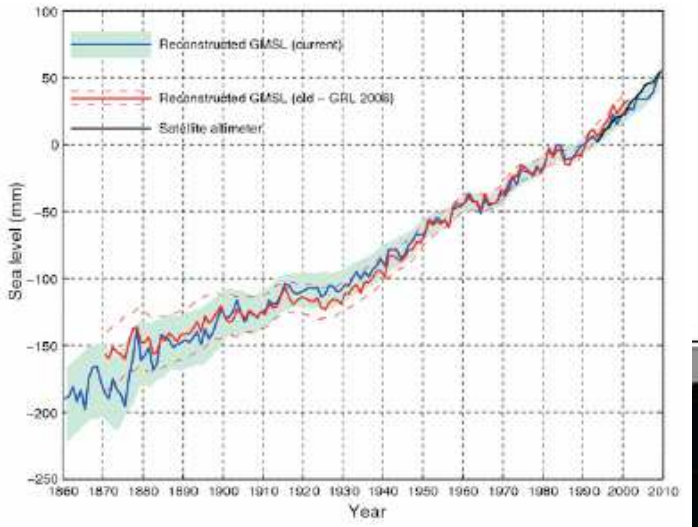


Extreme Precipitation Projections

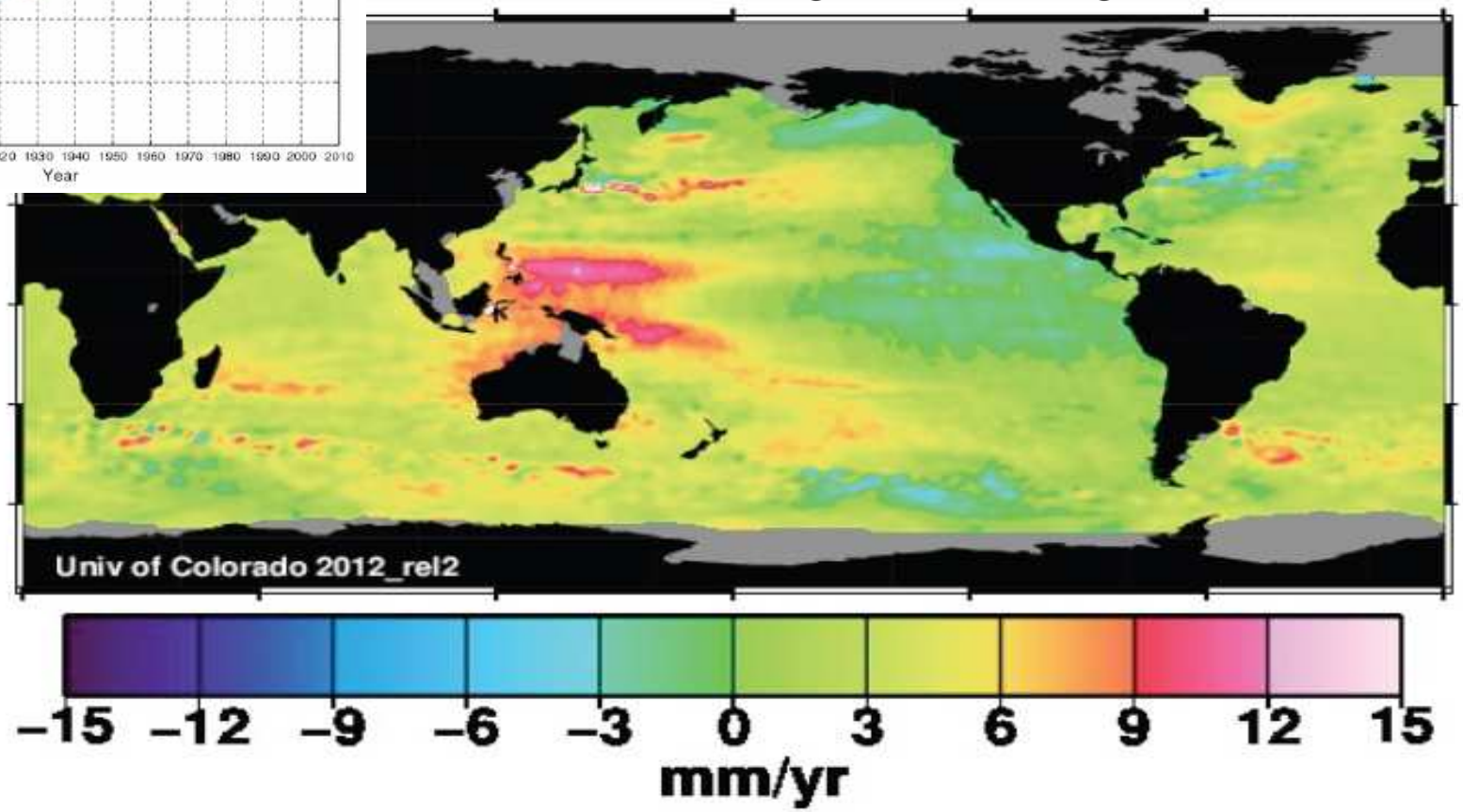


Source: IPCC Special Report on Extremes (2011): **Projected increase in likelihood of 1 in 20 yr events**

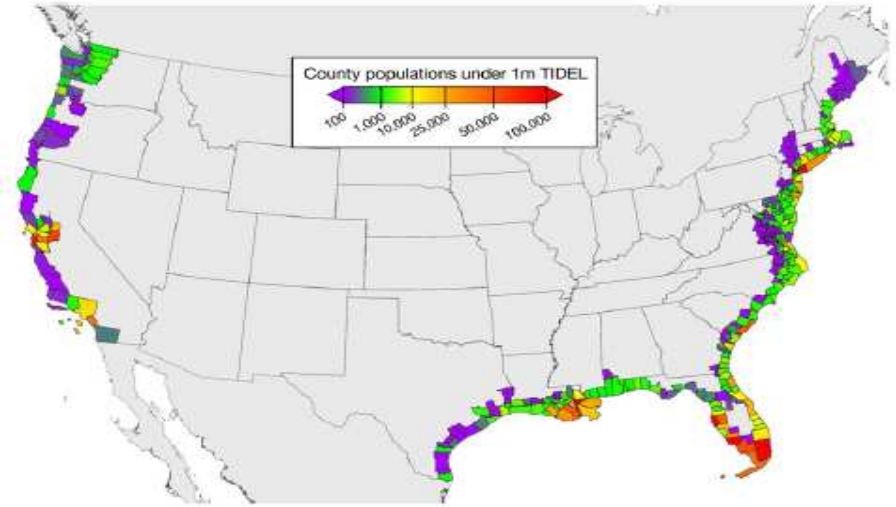
Sea Level Rise



- Absolute Sea-level has increased ~25 cm in the last 150 yrs
- Mainly driven by thermal expansion, melting of glaciers and ice sheets
- The trend is stronger in some regions than others

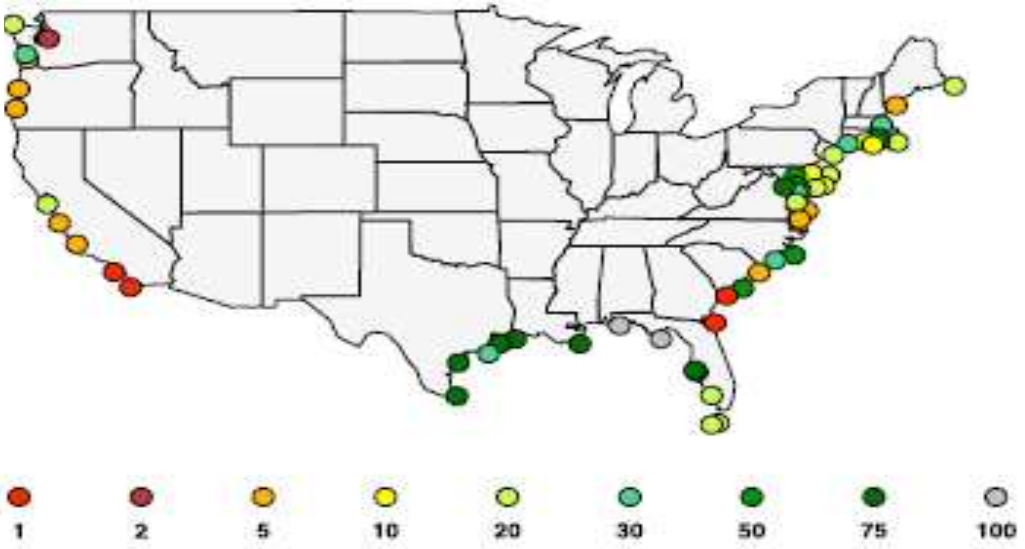


Relative Sea Level Rise: US Coastal Flood Risk



County Population below 1m of maximum Tidal elevation

Relative Sea Level Rise is a combination of Absolute SLR plus the subsidence of land due to underground water depletion and/or oil exploration

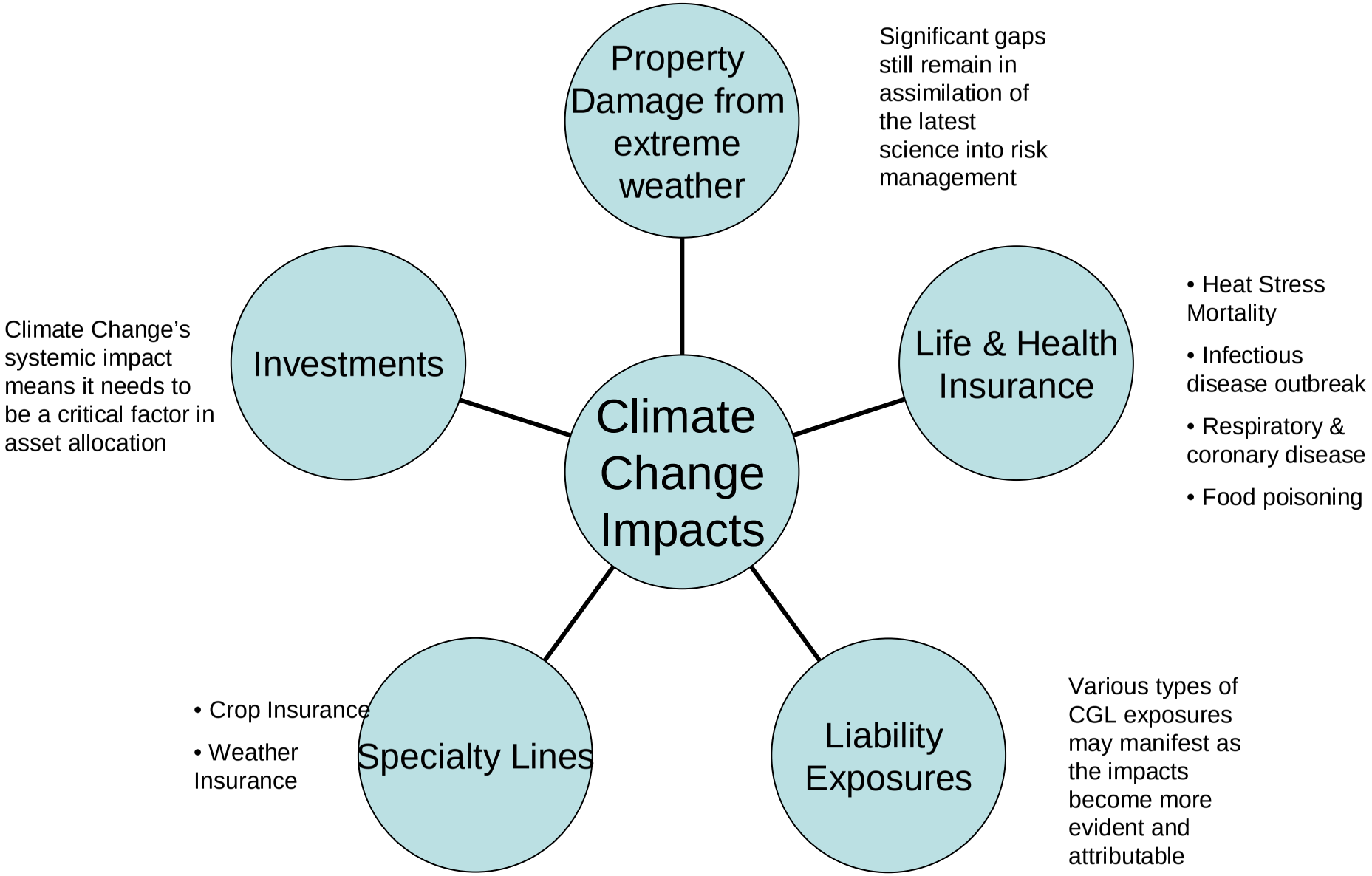


Ensemble average estimate of relative SLR at each gauge, projected return periods, by 2050, for floods currently qualifying as 100 yr events.

Source: Tebaldi et al (2011)

Odds of Extreme Coastal floods by 2030

Impacts on the Insurance Industry & Implications


Property Damage from extreme weather
Significant gaps still remain in assimilation of the latest science into risk management
Investments
Climate Change's systemic impact means it needs to be a critical factor in asset allocation
Climate Change Impacts
Life & Health Insurance
• Heat Stress Mortality
• Infectious disease outbreak
• Respiratory & coronary disease
• Food poisoning
Specialty Lines
• Crop Insurance
• Weather Insurance
Liability Exposures
Various types of CGL exposures may manifest as the impacts become more evident and attributable

Climate Change & Property Risk

- Property insurance is exposed to enhanced exposure due to changing characteristics of extreme events
  - Tropical Cyclones, Sea level rise, Floods, Drought (Wildfires), Permafrost melt etc
- Key challenges
  - (Re)Insurance rating/reserving is based on stationarity of weather – climate change is changing the ball game.
    - The past is no longer a good predictor of the future
  - Global correlation of extreme events – reduction of diversification benefit => more capital to support business
  - Frequency of moderately severe events will rise
    - Forcing a change in the prevalent “Occurrence” based risk management towards an “Aggregate” approach (capital focus to earnings preservation)
    - Needs a fresh look at how models handle aggregate curves
    - Greater focus on international regions
  - Risk models don’t explicitly account for climate change
    - Certain perils are not yet modeled
    - May need to incorporate “Climate model” projections with its various future scenarios
  - Need a consistent appreciation of the evolving risk across all stakeholders

Climate Change Induced Liability Exposure

- Example: Kivalina vs Exxon Mobil et al: Common Law nuisance claim filed Feb 2008
  - Alaskan village depends on protection from sea ice (melting away due to warming). Winter waves have pummeled village. Damages $95M-$400M.
  - Court dismisses case ruling GHG regulation political not legal issue. In appeal to reinstate
  - **April 25, 2012**: Virgina Supreme Court upholds circuit court's ruling insurance company does not owe defense or liability coverage under CGL
  - Steadfast Ins Co (indirect subsidiary of Zurich Financial Services) Coverage under 5 policies issued 2003-2008 to AES Corp (an energy company).
  - Civil complaint vs AES Corp does not allege an ”occurrence” as defined in insurance contracts between AES and Steadfast
- Potential Liability exposures
  - Environmental Liability for greenhouse gas emitters
  - Product Liability claims on products contributing to the greenhouse effect
  - Professional liability claims e.g. corporate D&O
  - Political Risk Liability triggered by new government policies (e.g. carbon levels)
- Various legal liability theories could be tested: Negligence, Nuisance, Sarbanes-Oxley Act, breach of fiduciary duty, fraud or misrepresentation claims, Tort, CERCLA etc

Climate Change Risk

What makes it Unique?

- It has already been set in motion and is irreversible
  - CO2 already in atmosphere will be around for decades
- Climate Change is a ‘chronic’ risk as opposed to a ‘shock’/’acute’ risk
  - It will impact us for decades to come and may get worse over time
- Global Impact
  - Correlated across geography, product lines, assets/liabilities
  - Impacts are non-linear and complex
- Non-stationarity: Needs a fresh modeling approach
- Potential for unpredictable consequences – tipping points
- Natural Climate Variability & Weather
  - Complicates detection of climate change signal and attribution of specific events.

Trends to Watch

1. Increasing severity of Climate Change Impacts
2. Greater acceptance of Climate Change
   - This is linked to the frequency of extreme events (even though not all such events can't be attributed to climate change)
   - Public opinion polls in late 2011 showed increasing acceptance
3. Improvements in attribution skills
   - Time Horizon - Implies that the impacts are already being observed instead of far out in future
   - Proves a direct link – may trigger liability claims
   - May mandate explicit consideration of the climate change signal in rating, reserving and broader risk management

Climate Change Committee

- A ~30 member committee from CAS, SOA, CIA
  - support from AAA and international Actuarial organizations
- Purpose
  - Educate members and stakeholders on climate change and its impacts
  - Assess risk management implications of climate change
  - Conduct and support sponsored research to develop tools/techniques to incorporate climate change into (re)insurance decision making
- Actuaries Climate Change Index
  - Vision: To create a series of indices that will enable actuaries and the general public to track, monitor and project risks evolving with climate change.
  - Will include aspects of hazard and vulnerability for various climate induced perils
  - The indices will be peril, geography, sector/product line specific
  - Allow a common framework to be used in ERM, pricing, reserving, capital modeling, etc
  - Will be maintained in real time and frequently updated by a neutral party – the Actuarial Societies

(Re)Insurance Industry's Role?

- (Re)Insurance Industry is at the forefront of Climate Change Risk.
  - It will bear the brunt of the consequences
  - An indifferent attitude may pose serious threat to the future health of the industry
- An opportunity and need to take a leadership and proactive role
- Key Actions areas
  - Internal
    - Stay current on the science
    - Incorporate climate change factors/scenario into ERM, rating, reserving etc
    - New product development and solutions to encourage climate change mitigation and adaptation
  - Industry wide
    - Encourage transparency on how climate change is incorporated in decision making
    - Initiative to create a comprehensive Loss and Exposure data collection and analysis
    - Engage with regulators and peers to encourage the adoption actuarially sound pricing both in the interest of solvency and of encouraging safety
    - Raising the bar on Catastrophe models and handling of non-modeled CATs in a more robust way
    - Encourage development of open-source Climate based risk models
  - Societal
    - Leadership role in encouraging mitigation efforts
    - Encourage building domestic and international political consensus
    - Sponsor Climate Change impacts science and research
  - Investor
    - Understand how climate change may impact $23 trillion of invested assets
    - Make investments climate change proof. Send a strong signal to the climate sensitive industries.