Month Day, Year / Location

Climate Change & Insurance Risk

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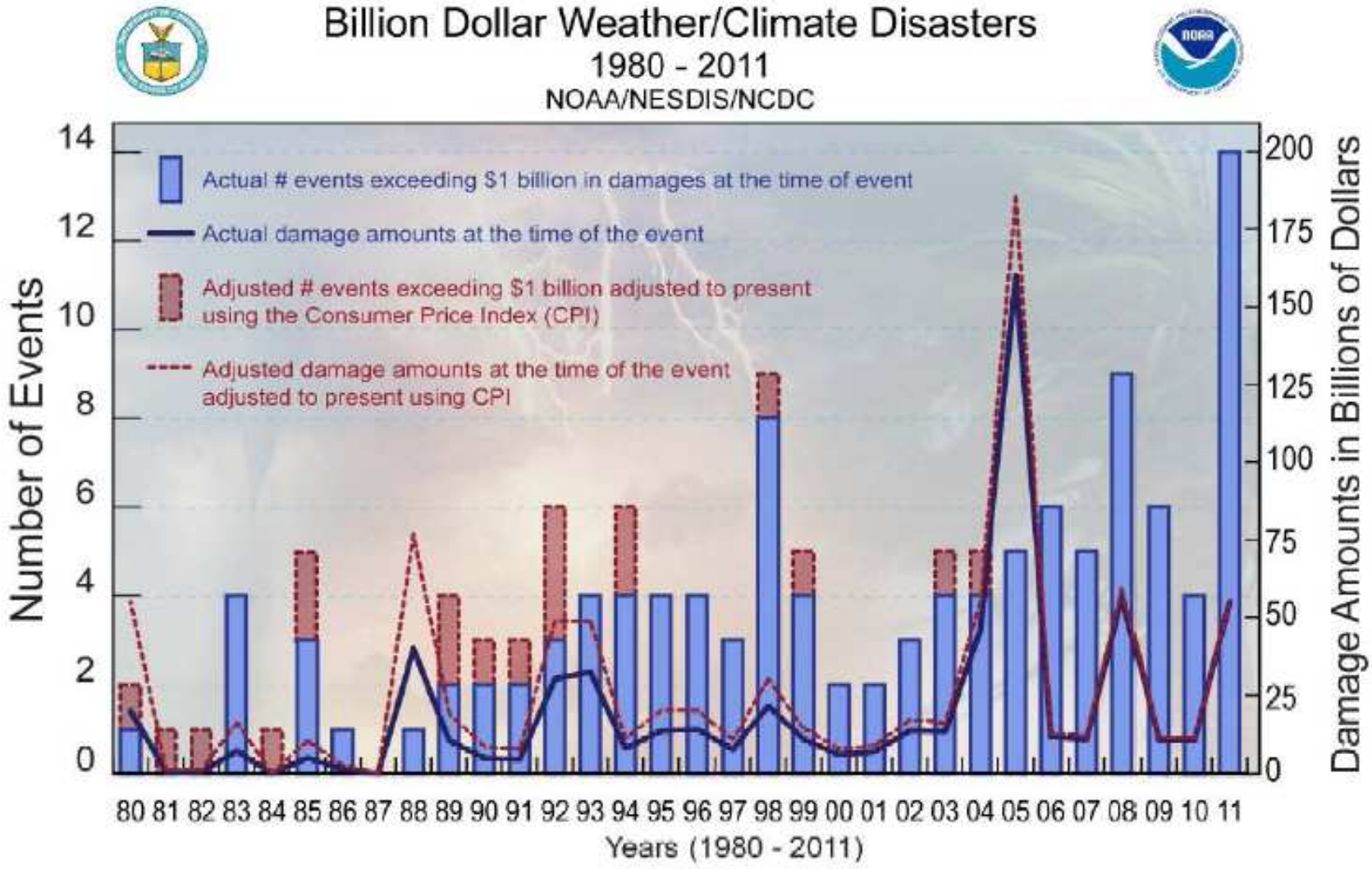
Overview

1. Severe Weather Trends
2. The Climate Change Imprint
3. Risk management in a changing climate

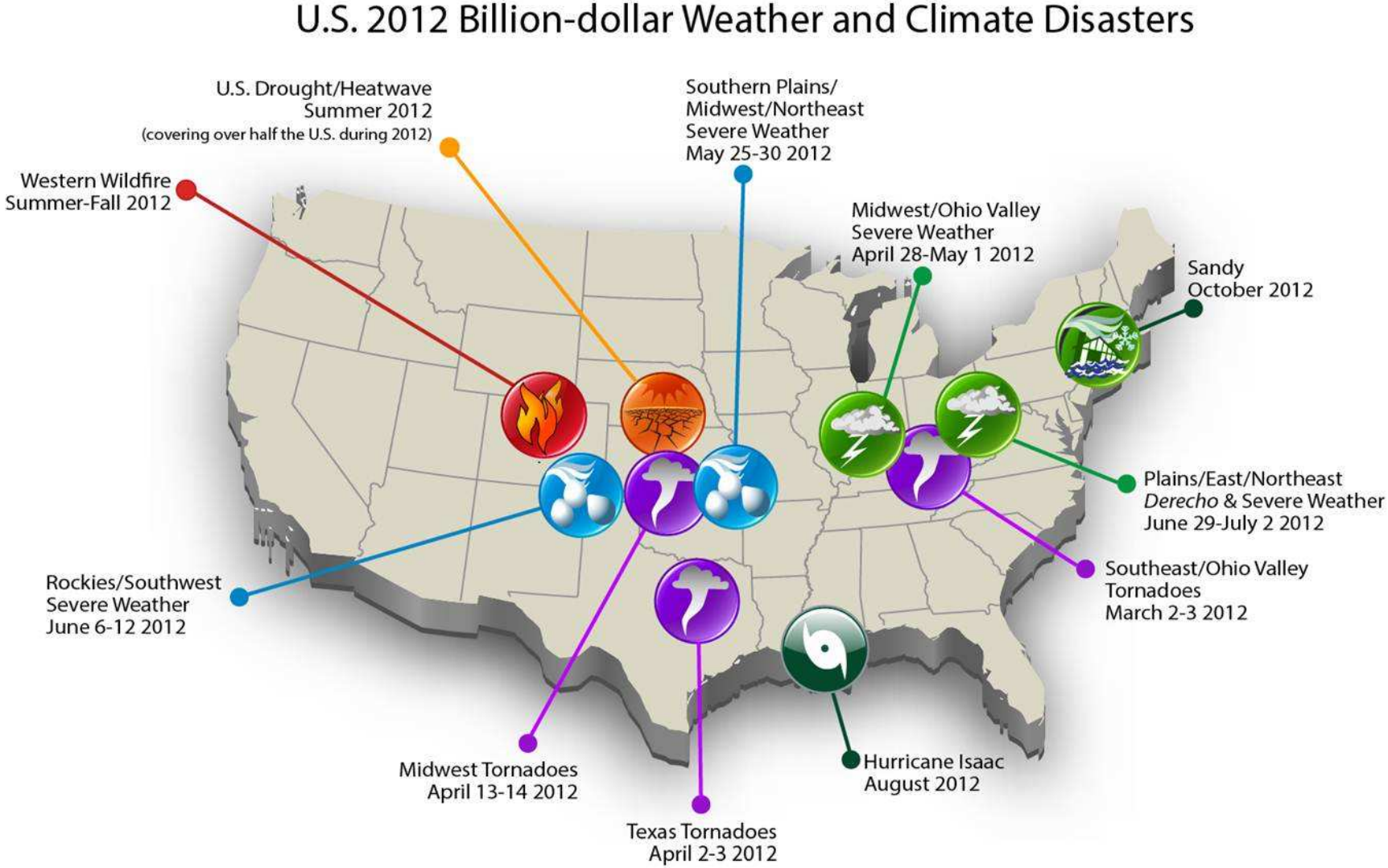
Actuaries Climate Change Committee

- A ~30 member committee from CAS, SOA, CIA
  - With 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

Severe Weather Trends - US



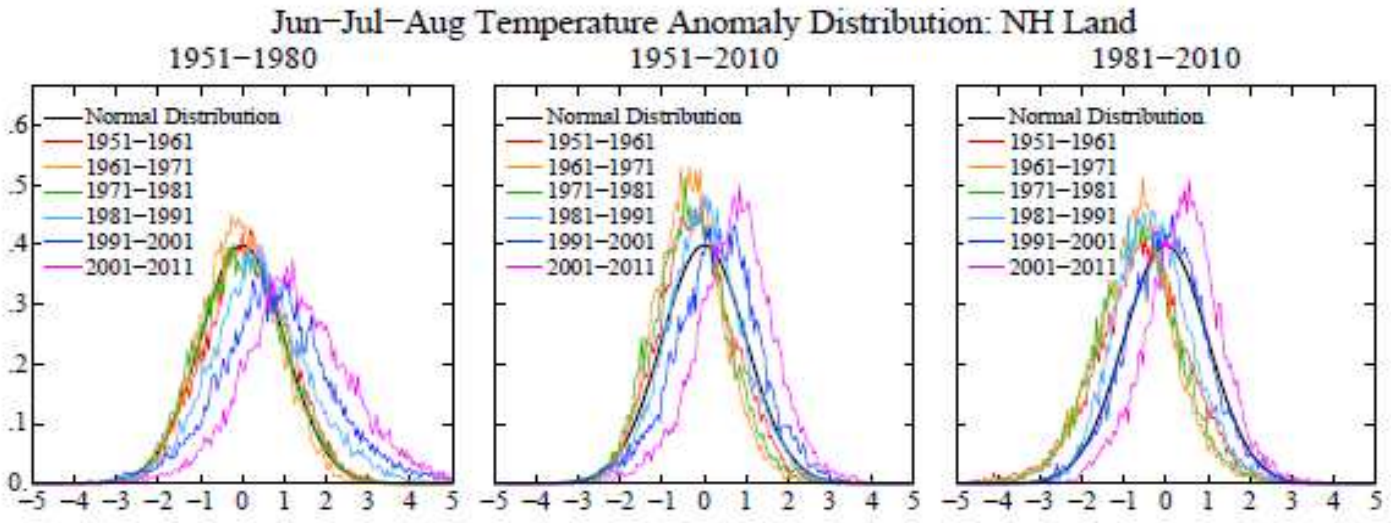
2012 US Billion $ Disasters



- 2012 is the 2nd costliest in disaster costs (unofficial estimates)
- 2012 is also the warmest year on record for Continental US

Extreme Events:
Climate Change or Natural Variability?

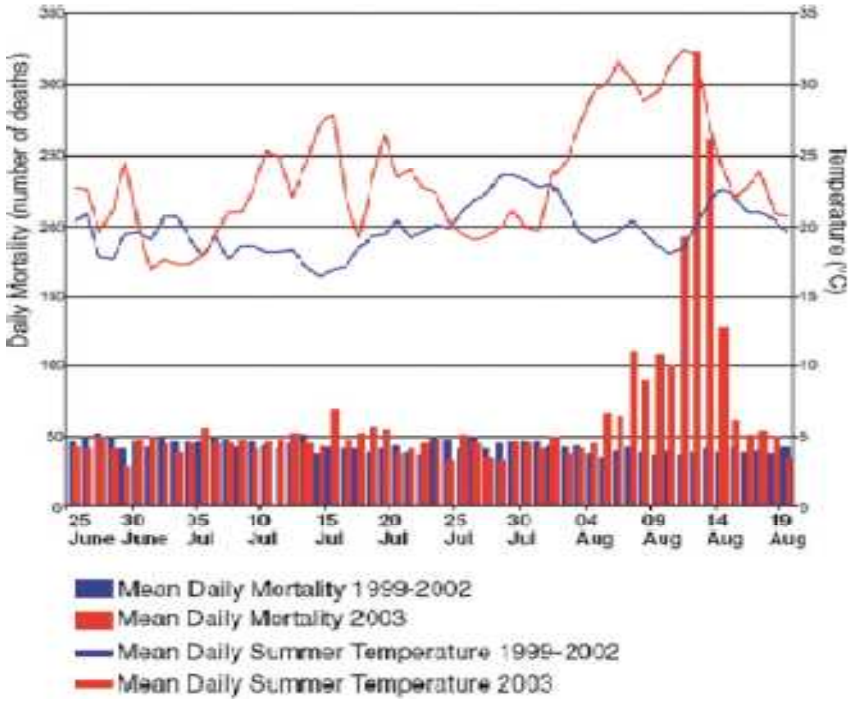
- Weather is naturally chaotic – so no single extreme event can be solely attributed to climate change. Some dynamic weather events don't have a short causal chain.
- However, global warming is changing the background environment in which weather happens.
- The mean, volatility and dynamics of weather events is being affected in complex ways.
- Climate Change is 'loading the dice' in favor of extreme events



Hansen et al (2012)

Warming Temperature Impacts

- Heatwaves and droughts:
  - 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)

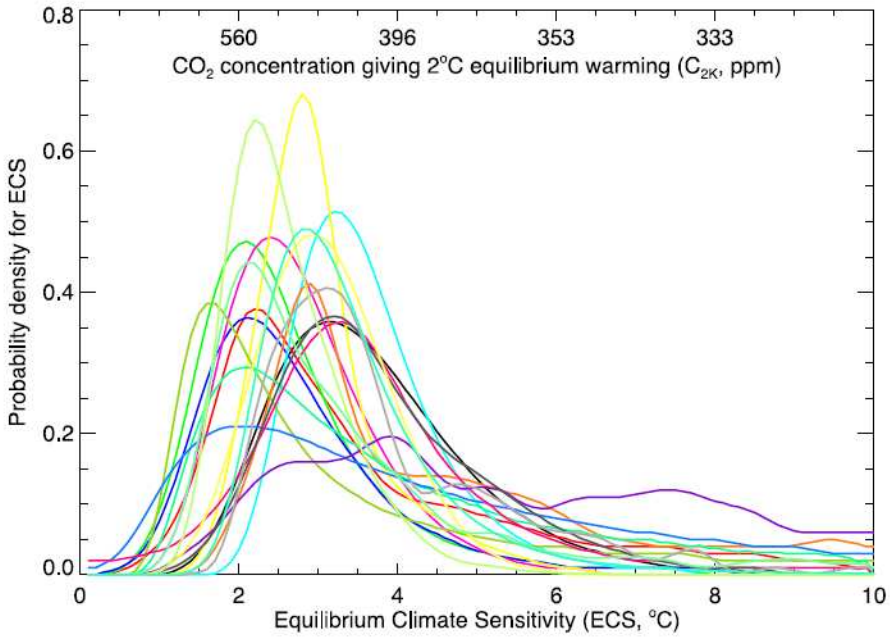
Precipitation Extremes

- A warmer atmosphere holds more moisture
- 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%.

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
- Non-stationary and a ‘chronic’ risk as opposed to a ‘shock’/’acute’ risk
  - It will impact us for decades to come and may get worse over time – requires a fresh modeling approach
- Deep Uncertainty or Ambiguity
  1. Model projections depend on scenarios of adaptation or mitigation of climate change in the decades to come
  2. Parameter uncertainty in the underlying physics
  3. Potential for tipping points in the dynamics
  4. Payoff functions can be non-linear and complex - Correlated across geography, product lines, assets/liabilities



Estimated probability distributions for (bottom axis) Equilibrium Climate Sensitivity (warming due to doubling of CO2) from various published studies, collated by ref. 16, and (top axis) corresponding concentrations of CO2 consistent with a long-term CO2-induced warming *Tmax of 2C*

Ratemaking & Risk Management in a Changing Climate

- Popular (mis)perceptions about Climate Change risk
  1. Too much uncertainty to make concrete decisions
  2. Significant Climate Change is too far in the future – beyond the corporate time horizon.
     - > Adopt a wait & watch approach
     - > How are long term liabilities discounted?
  3. Climate Change will be gradual – the underlying change in the hazard will be baked into rates based on loss experience.
     - > Is this true if the trend is upward?
  4. Cat Models adequately handle climate change risks
- Robust decisions under Deep Uncertainty – needs to emerge as an active focus area
  - Leverage the latest in the climate change science
  - Drive the change for sophisticated CAT models to embed Climate Model projections
    - > Evaluate not the mean but the tail risk in climate model projections
  - Adopt an explicit "Climate Change Ambiguity Aversion load" in pricing and capital allocation?
  - Leverage research being done in the economics arena around robust decisions & discounting
  - Develop reinsurance and primary underwriting strategies that will address the increased frequency of weather extremes and global aggregation of risks.