Isaac Newton Institute for Mathematical Sciences

Mathematical and Statistical Approaches to Climate Modelling and Prediction

11 August - 22 December 2010

Knowledge Transfer Network

Financial Services

Engagement with business- What are the barriers to the use of climate data, where should future research be taken?

December 2010

Dickie Whitaker- Financial services Knowledge Transfer Network

Technology Strategy Board

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Financial Services KTN? Our Mission

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Financial Services

To identify practical issues and challenges from the financial services sector and connect the sector both within itself and with Government and the research base to deliver measurable impact

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E·S·R·C
ECONOMIC & SOCIAL RESEARCH COUNCIL

Agenda

- Where does finance use climate data and information and does it matter
  - Insurance
  - Banking (sell side)
  - Asset management (buy side)

- Why uncertainty is important
- Where next for research activity

Does it matter?

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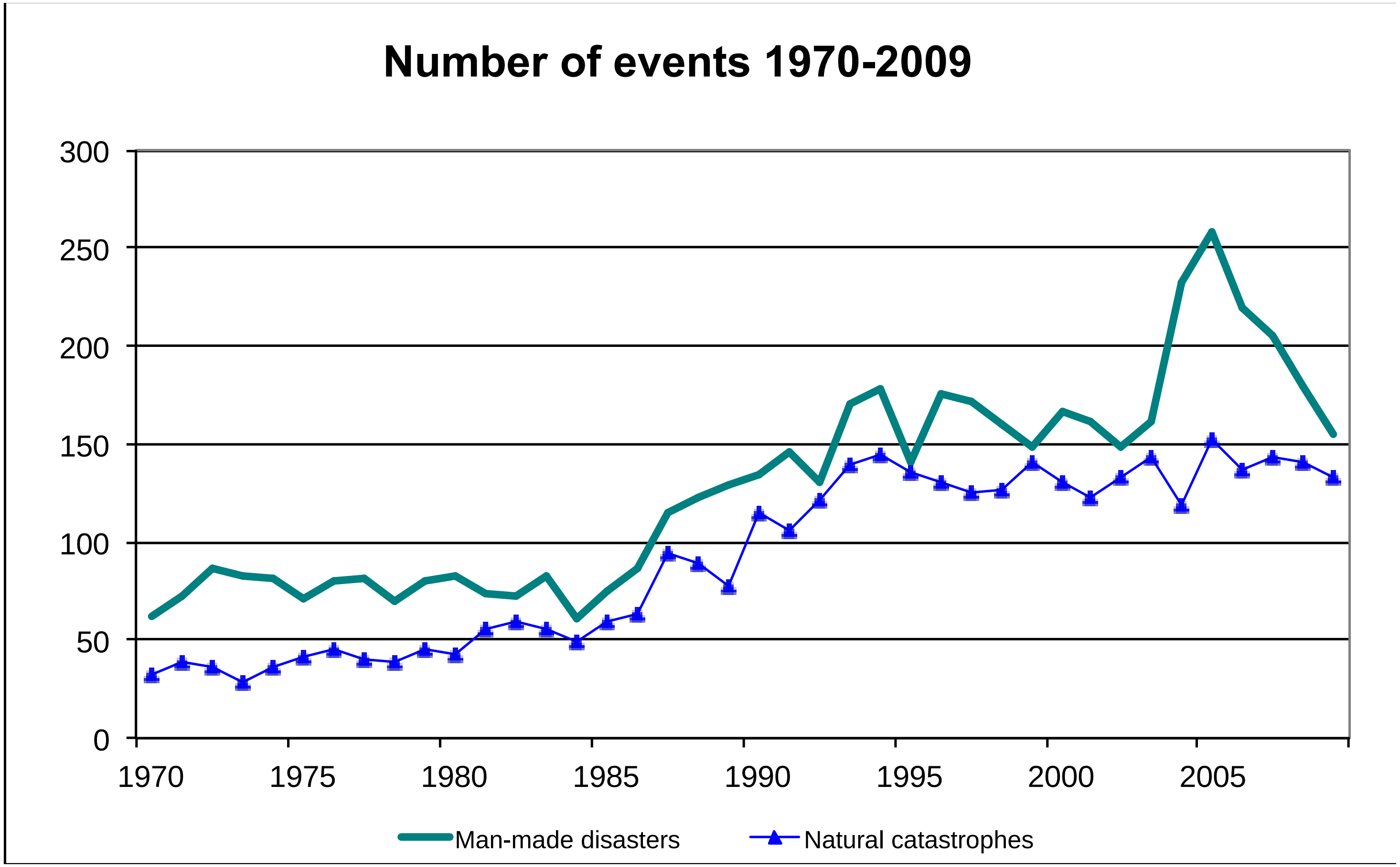
Insurance impacting events

According to initial estimates from Swiss Re's sigma team, worldwide economic losses from natural catastrophes and man-made disasters were USD 222 billion in 2010, more than triple the 2009 figure of USD 63 billion. The cost to the global insurance industry was USD 36 billion, an increase of 34% over the previous year



Insurance

- By 2050 the annual cost of weather claims will double to 3.3 billion euros, while an extreme year might cost 20 billion euros (Source ABI)?
- Insurance is all about understanding and pricing for uncertainty in risk.
- Environmental risks are key and climate change will play a key role….at some point.

Questions we would like to know the answers to.

- What is the changing frequency and severity of tropical cyclones and extra tropical cyclones
- Quantify correlation/ clustering for these events
- What predictions (with meaningful skill levels) are available for future weather patterns (3 months-5 years?)
- What is the changing patterns of rainfall by country or region

- Uncertainty for all, clearly stated..
- If uncertainty is too high or unclear or change is too small then do we care?

Banking

- Identifying and evaluating climate change risks by sector and factoring such risks into the lending decision-making process.
- Developing lending strategy and policy by sector so as to balance support for traditional essential products/services (e.g. oil) with support for new low carbon technologies.
- Determining appropriate portfolio balance and lending appetites in a ‘low carbon’ world.
- Understanding the indirect emissions of corporate banking activity and the carbon intensity of the current loan book.
- Engaging with existing customers to reduce climate-related risks.

Asset management

- Engage with company management to under- stand how climate change is impacting their business and what strategies they are employing to minimize its risks or maximize opportunities from it; educate clients about the benefits and processes being used to incorporate extra-financial issues in the management of their assets.
- Request and reward external research providers e. g. brokers to produce consistent, quality papers and information

Its concern has lead to awarding a prize

CATEGORY WINNERS

Global hydrology modelling and uncertainty: running multiple ensembles with a campus grid
By Simon N. Gosling

Climate change will alter the present-day exposure of people and business to global hydrological risk, including specific risks from water scarcity, river flooding and drought. For some regions of the world freshwater availability will decline and droughts will become more frequent and longer-lasting, whilst for other regions river floods will increase in frequency and magnitude. The environmental, social and financial costs from these changes in the global hydrological cycle, due to climate change, are likely to be high.

For a number of reasons it is beneficial to the insurance industry to understand and attain knowledge on how the present-day distribution of global hydrological-risk will change in the future. Firstly, such knowledge and understanding can be used to inform which regions are likely to experience the greatest changes in hydrological risk. This can facilitate the appropriate proportioning of resources to deal with the changing spatial structure and magnitudes of the risk. Secondly, within the insurance market place, such knowledge can be considered as a considerable competitive advantage. Thirdly, an understanding of the projected changes in risk can allow for insurers to prepare for the demands on the insurance industry that will be evident

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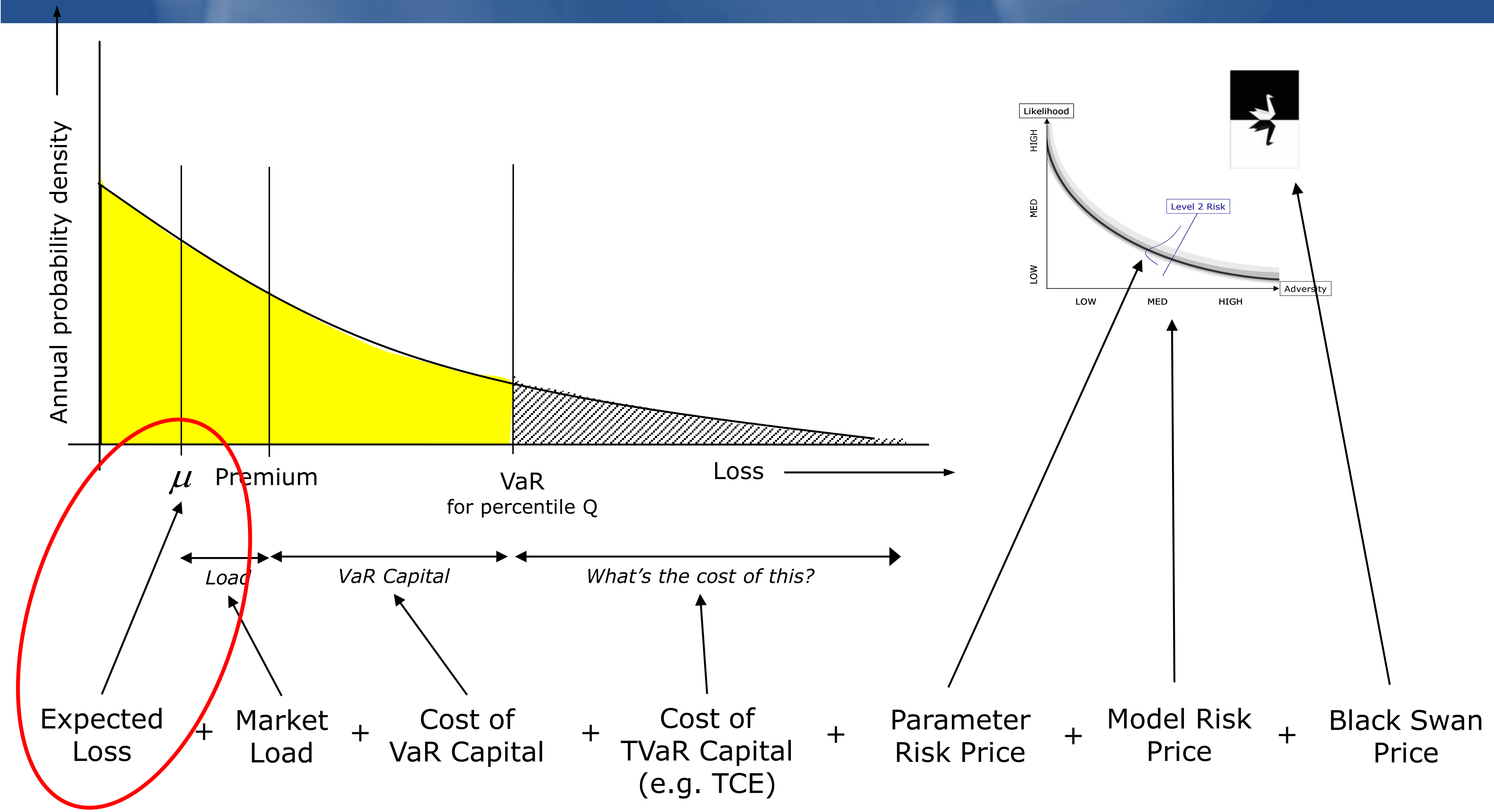
Components of Price- Dealing with uncertainty



Components of Price- Dealing with uncertainty

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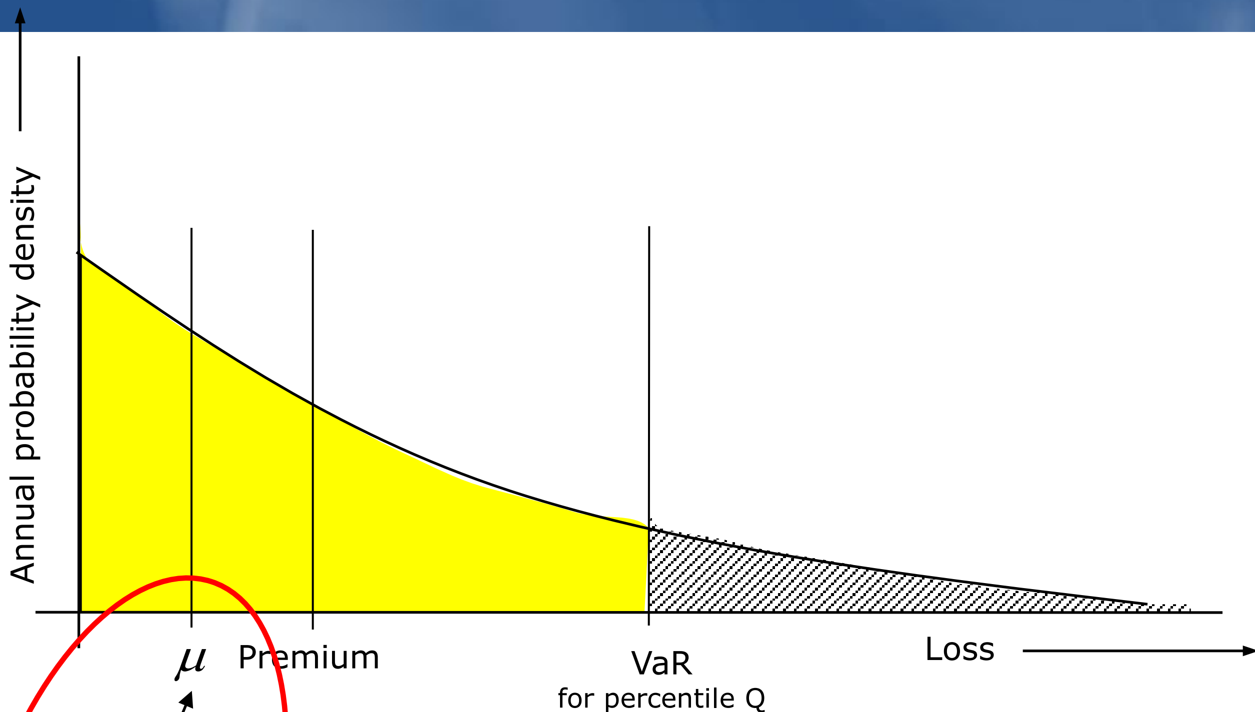
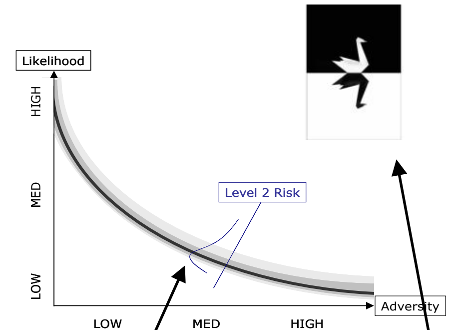


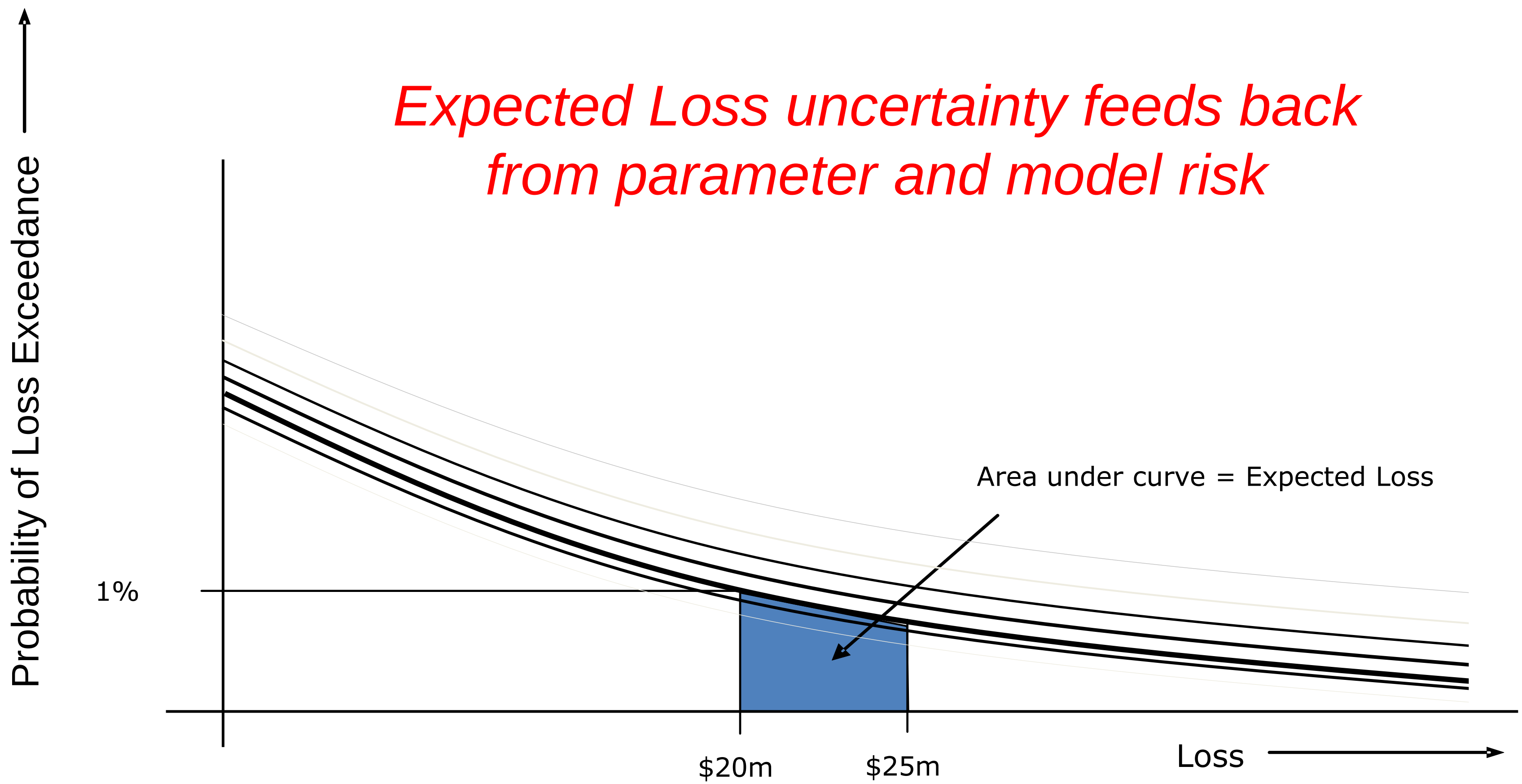


Load | *VaR Capital* | *What's the cost of this?*

Key issues to address

Expected Loss + Market Load + Cost of VaR Capital + Cost of TVaR Capital (e.g. TCE) + Parameter Risk Price + Model Risk Price + Black Swan Price

But it's pretty fuzzy down there



Slides 10,11 and 12 from EP Curves New Clothes–Peter Taylor- James Martin 21st Century School

Insurance best practice in using models

- Always get as much data as practical
- Try to understand and quantify uncertainty
  - -confidence bounds
  - -sensitivity testing
  - -Multi model use
- Use models with Caution!
- Adapt to the changing world with flexible decision criteria and policy. (adapted at least annually)

Dealing with uncertainty & gaining confidence

Possibly a key issue for the public

Definitely a key issue for business.

For Insurance uncertainty drives price and capital requirements.

(too many caveats and too much uncertainty render the results almost useless.)

Ie Thorpe 2005

"In addition we may need to wait for some time before we can test fully the predictions of future climate change. But this does not mean the predictions are necessarily either inaccurate or not credible as is sometimes implied "

Dealing with uncertainty & gaining confidence

"Decision makers, including most of us as individuals, have enough experience with weather forecasts to be able to reliably characterize their uncertainty and make decisions in the context of that uncertainty. In the U.S., the National Weather Service issues millions of forecasts every year. This provides an extremely valuable body of information experience for calibrating forecasts in the context of decisions that depend on them. The remarkable reduction in loss of life from weather events over the past century is due in part to improved predictive capabilities, but just as important has been our ability to use predictions effectively despite their uncertainties. "

Roger Pielke Jr.

Do we have the right validation process's for global circulation models?

Dealing with uncertainty & gaining confidence

- The climate community has been lax in grappling with the issue of establishing formal metrics of model performance and reference datasets?
- Where datasets used in the model evaluation process are the same as those used for calibration, which gives rise to circular reasoning (confirming the antecedent) in the evaluation process.
- Extensive use of peer review
- “There are many more ways to be wrong in a 10^6 dimensional space than there are ways to be right.” Lenny Smith

Is it time for climate models to have a more formal evaluation process that is suitable to the nature of climate models and the applications for which they are increasingly being designed for?

Future research and activity

- Communicate clearly
- Deal with uncertainty
- Make data available

(where it has an impact)

- [Probability, Uncertainty and Risk, NERC competition 2011 2.4m]

How can we help

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- Use open access catastrophe models ?
- We can link research to practical use
- We can get data
- We can place students
- We can help raise finance

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Appendix Met office / AIR study on climate change impacts

The main findings, expressed in 2008 £ values and focusing solely on the impact of climate change1, are:

The inland flood component of insurance premiums could increase by around 21% across Great Britain assuming a global temperature rise of 4° C. The average annual insured flood losses in Great Britain could rise by 14% to £633 million assuming a global temperature rise of 4° C.

The insured inland flood loss in Great Britain occurring on average once every 100 years could rise by 30% to £5.4 billion. The insured inland flood loss occurring on average once every 200 years could rise by 32% to £7.9 billion. The estimates assume a global temperature rise of 4° C.

The average annual insured wind losses in the UK could rise by 25% to £827 million assuming a 1.45° southward shift in storm track across the UK. The insured wind-related loss from winter season windstorms in the UK occurring on average once every 100 years could rise by 14% to £7.3 billion. The insured wind loss occurring on average once every 200 years could rise by 12% to £9.7 billion. The estimates assume a 1.45° southward shift in storm track.

Within Great Britain, the results vary by region. For example, while the average annual insured flood losses for Great Britain as a whole could rise by 14%, regional increases range from less than 10% to nearly 30%, assuming a global temperature rise of 4° C.

The average annual insured losses from typhoons affecting China could increase by 32% to £345 million; the 100-year loss could increase by 9% to £838 million, and; the 200-year loss could increase by 17% to £1.1 billion. The estimates assume a global temperature rise of 4° C.

Appendix

The study uses three key metrics to measure the financial impacts. These are:

Average annual loss (AAL): AAL refers to the aggregation of losses that can be expected to occur per year, *on average*, over a period of many years. Clearly, significant events will not happen every year; thus it is important to emphasise that AAL reflects the *long-term* average.

The 100-year loss: The 100-year loss has a 1% probability of occurring in any given year; that is, it is the loss that can be expected to occur or be exceeded on average once every 100 years. *The 200-year loss:* The 200-year loss has a 0.5% probability of occurring in any given year; that is, it is the loss that can be expected to occur or be exceeded on average once every 200 years.

Note that the financial metrics discussed above are defined in the context of a given climate regime. That is, the 100-year loss in the current climate regime, which defines the baseline, may be different from the 100-year loss in a future climate regime, in particular when the loss is sensitive to changes in climate.