Windstorms and insured loss in the UK

Richard Hewston, Dr Stephen Dorling and Dr David Viner

School of Environmental Sciences, University of East Anglia, Norwich, United Kingdom, NR4 7TJ.
Email r.hewston@uea.ac.uk

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Introduction

Worldwide, the costs of catastrophic weather events have increased dramatically in recent years, with average annual insured losses rising from a negligible level in the 1950s to $17.6bn over the last decade (Munich Re 2006). When losses from non-catastrophic weather related events are included this figure is almost doubled. A similar trend is exhibited in the UK with claims totalling over £6bn (~$10bn) for the period 1998-2003, more than twice the value for the previous five years. More than 70% of this loss is associated with storms.

In this research a windstorm model is constructed for the UK using observed daily maximum wind gust speeds and a variety of socioeconomic datasets, and verified against actual insurance claims data.

The increased frequency and intensity of extreme events which are anticipated to accompany climate change in the UK will have a direct effect on general insurance, with the greatest impact being on property insurance (Dlugolecki 2004). Regional Climate Model output data will be used in conjunction with the windstorm model to simulate possible future losses under climate change, assuming no change in the vulnerability of the building stock.

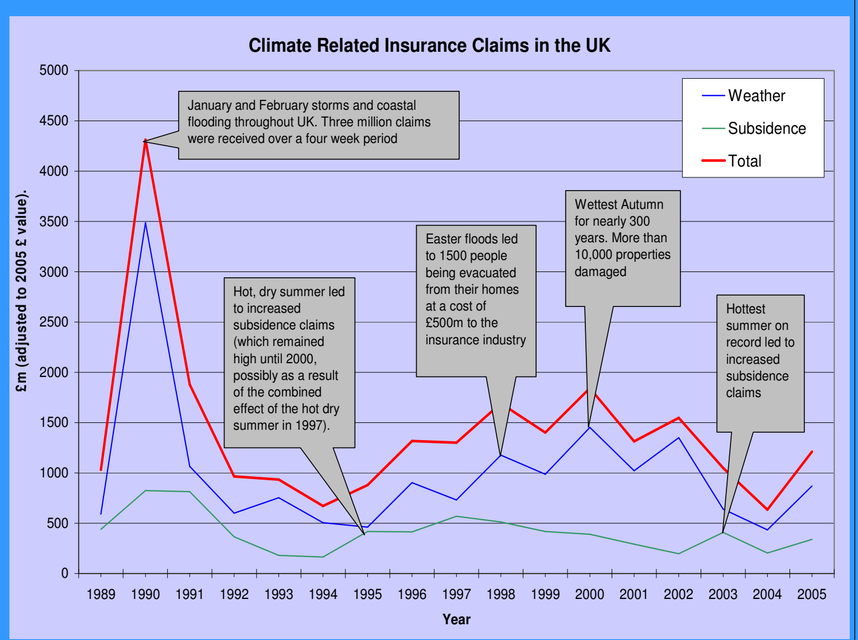
1 Background

Weather related insured loss

Insured loss data may be broken down into domestic and commercial (including business interruption) claims. Domestic claims make up 70-85% of the total value of claims, while business interruption claims account for 8-18% of commercial claims (equivalent to 1-6% of total weather related claims).

Recent Trends

The six-year average for weather related insurance claims in the UK has increased by 67% for the period 1998-2003, compared with the period 1992-1997. Extrapolating this into the future, at a similar increase, the average UK annual claims total in 2009 could top £1.8bn, three times the 2003 figure for insured losses.



Above : Climate related insured losses in the UK for the period 1988-2003. Figures are adjusted to constant values (2005 £). Source: ABI (2006)

Insurance and Climate Change

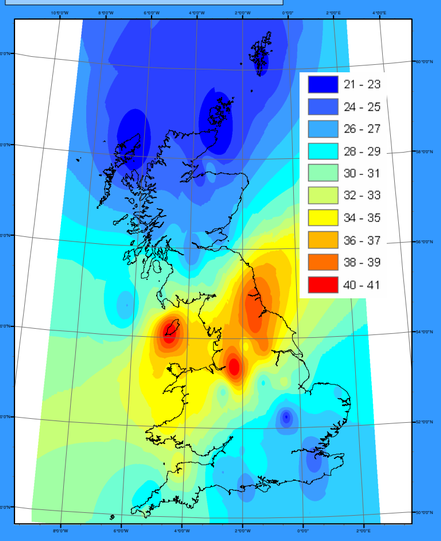
Although it is clear that socioeconomic shifts, like increasing values of insured assets or population changes, play a large part in increasing losses, the effects of climate change are already being seen according to the Association of British Insurers (ABI). Dlugolecki (2004) believes we are currently seeing an annual increase in losses of 2-4% directly resulting from a changing climate.

2 Windstorm Erwin, January 2005

An example of a recent damaging extratropical cyclone came when windstorm Erwin swept across Northern Europe in January 2005

- Windstorm Erwin struck Northern Europe on January 7-9th, 2005, killing at least 17 people and causing widespread property damage.
- Erwin brought torrential rain and sustained winds in excess of 85mph and was one of the most severe storms to hit Northern Europe in more then 15 years.

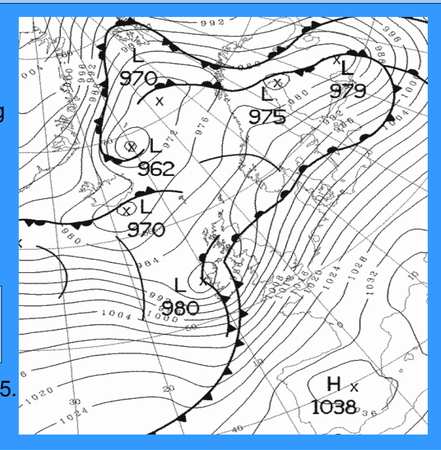
Above : Thousands of houses are damaged during windstorm Erwin



Left : Max gust speeds (ms^{-1}) during Windstorm Erwin (8 January 2005).

- In Britain three people died, while 70,000 homes lost power. Extensive flooding hit Carlisle, causing 3000 evacuations. Insurance losses totalled £250m.
- Sweden saw unprecedented damage to the forestry industry, with an estimated 75 million cubic metres of trees falling at a cost of £1.6-2.3bn (Guy Carpenter 2005).

Industry wide, the estimated total insured losses relating to Erwin stands at £1.1bn



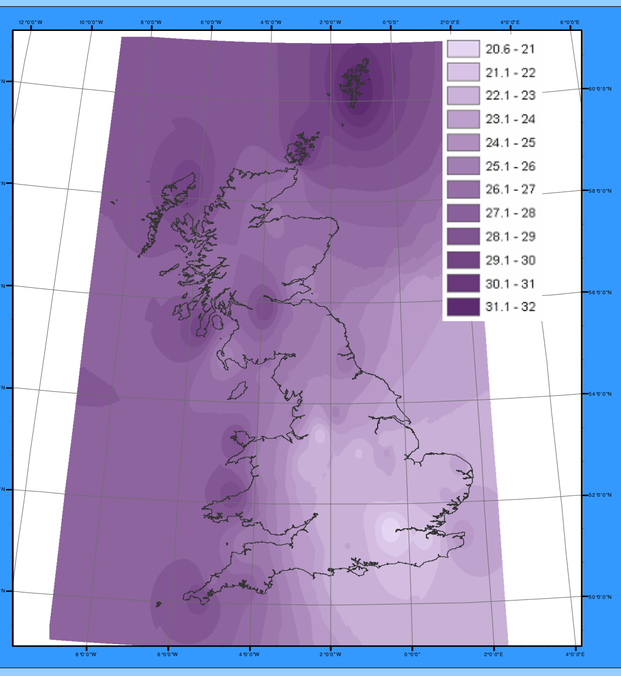
Right : Analysis chart for 8 Jan 2005. Source www.wetterzentrale.de

3 Developing a Windstorm Loss Model

At present very little publicly available information on windstorm loss models exists. Several Catastrophe Modelling companies have developed windstorm models (for example AIR, RMS and EQECAT) for both Europe and North America. The data used in such models, and indeed the structure of the model itself, are commercially sensitive and therefore not detailed in the literature.

The following work is being carried out at UEA, under the supervision of Dr Stephen Dorling and Dr David Viner, and funded by the Worshipful Company of Insurers.

Windstorm damage is the result of wind loads exceeding the resistance of the structure, affecting parts of the building such as roofs, envelopes and openings. Building on work by Klawa and Ulbrich (2003) a windstorm loss model is developed to simulate annual and interannual variability in losses in the UK. Meteorological data is coupled with socio-economic data, and the model is calibrated against insurance claims information.



Left : Map of interpolated 98th percentile values of daily maximum gust speeds (ms^{-1}) for 1980-2005.

Wind Data

- It has been shown that damage is correlated with wind gust speeds, rather than mean wind speeds (Hanson *et al* (2004), Dorland *et al* (2000)).
- A network of 44 UK Met Office stations has been established, with hourly wind gust records back to 1980.
- In this model the 98th percentile of maximum daily gust speed is used to incorporate "wind climate". Thus, values exceeding the 98th percentile are a measure of storm intensity independent of non-meteorological conditions such as topography.
- Typical values of the 98th percentile of maximum gust speeds for southern stations are around $20ms^{-1}$, rising to $30ms^{-1}$ in northern Scotland.

Socio-Economic Data

- Various socio-economic information, including population and household number and density, is available from the last three censuses (1981,1991 and 2001).
- In addition, data from Experian provides information on "wealth indicators" such as property types and values and car ownership.

The top 2% of daily maximum gust speeds are combined with the socio-economic data to give a storm function for each day. These are aggregated to give annual storm functions, which are in turn aggregated over the total period of study and fitted to the total insured loss over that period. A multiple regression analysis will be carried out to establish which variables and which model best describe the observed loss. A relationship between wind gust speed and insured loss will subsequently be created which will facilitate estimates of insured loss directly following major storms and allow an analysis of loss patterns of historic storms.

4. Future Work – Potential Impacts of Climate Change

Once the windstorm model is complete it will be possible to simulate the potential effects of climate change on the insurance industry.

The Hadley Centre's PRECIS (Providing REgional Climates for Impacts Studies) model, driven by reanalysis data, will provide hourly wind data on a 50km grid which can be incorporated into the windstorm model, providing not only another source of wind information for 1980-2005, but also information back to 1958.

Future simulations of the UK climate may be made using PRECIS. Boundary conditions are available from the Met Office's HadAM3 model for the 2070-2100 period, while it is hoped the Max Planck Institute's ECHAM4 model can provide boundary conditions for 2020-2050, in addition to 2070-2100. The wind data from these model runs can be used in conjunction with the windstorm model to provide estimates of futures losses. By using data from two GCMs in the windstorm model, some measure of uncertainty in future losses can be achieved. Future losses in climates with different IPCC emissions scenarios will also be examined.

Acknowledgements
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Corresponding Author
Richard Hewston
r.hewston@uea.ac.uk
www.uea.ac.uk/~e0470848