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Current and Future Windstorms in Scotland

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Summary

Multiple sources of uncertainty and variability make future climate projections of extreme wind speed highly ambiguous, with no clear evidence available. Some projections suggest that the return periods of all extreme storms may shorten over the next 50 years, implying high associated costs. In this context, even studies with uncertain results may be worth consideration.

Evidence

The International Panel on Climate Change (IPCC) suggests that over the last half of the 20th century wind storms have globally decreased in number but become more intense. This is particularly evident over the North Atlantic as storm tracks have shifted polewards. UK observational records show that daily maximum gust activity has strengthened through the 1960s and 90s before declining slightly in more recent years (Hewston and Dorling, 2011). The most intense storms on record all occurred in the 1990s, but over the last century the range of decade-to-decade, and even month-to-month, variability in the storms that produce extreme wind speeds is itself high (Allan et al., 2009). Circulation models can reproduce daily mean gust speeds fairly successfully for the past, but if only extreme values likely to cause structural damage (the highest 2%) are considered, the results are not encouraging (Hewston and Dorling, 2011). No statistically significant trend can be recreated using a (relatively well regarded) regional model such as PRECIS. All it tells us with certainty is that extreme wind gusts have been likely to come from south west of Scotland, and are stronger for northern and western sites than southern or eastern ones (Hewston and Dorling, 2011).

The general idea that mid- to high-latitude storms will become less frequent but more intense in the future seems to be roughly borne out in model projections (Yin, 2005). There is, however, a lack of consensus regarding UK based work, not least because of differing definitions of what constitutes a wind storm, or even extreme wind conditions (Ulbrich et al., 2009). Most models tend to agree on strengthening North Atlantic atmospheric circulation and instability in the future coupled to a continuing polewards shift in storm tracks and an increase in the intensity of storm-like conditions (IPCC, 2007). Even so, the uncertainty remains high in predictions of future storminess (McDonald, 2010). Some researchers project an increase in UK winter extreme windspeeds (Leckebusch et al., 2006), a specific shift in storm tracks towards Britain (ABI research paper 19, 2009), an increase in the number of systems classed as extreme (Pinto et al. 2007), or a reduced return period for extreme storms (Della-Marta and Pinto 2009). Some return-period based work explicitly suggests higher frequencies for all intensities of storm across the British Isles by the 2040s (Della-Marta et al., 2009).

Recent HadAM3 work[1], designed to investigate storms directly, seems to suggest an increase in enhanced levels of wind damage over the coming century (McDonald, 2010). Other storm-focussed studies and older HadCM3 work, however, show no significant or consistent change for the UK. The UKCP project has shown inconclusive results for mean wind speed over Scotland (UKCP09 executive summary, 2010), and little additional information on extremes. Taken together, these results lead to an uncertain picture of the future.

Follow-up

There appears to be scope for a study to use model results from the IPCC Fifth Assessment Report in a wide ensemble to narrow this particular debate, but multiple definitions of a 'storm' or 'extreme wind speed' must be used (McDonald, 2010).

With regards to the audience for this enquiry, the 100-250 year return period data that could be used to underpin storm-relevant changes to building design codes are currently unavailable. However, in terms of insurance claims, even very small increases in extreme windspeed could produce highly significant damages and costs (IPCC, 2007): Up to a 37% increase in storm-related losses by the end of this century (Leckebusch et al., 2007). Despite their high level of uncertainty, predictions of increased storm intensity and windspeed may therefore be of interest to policy and construction. This summary suggests that any change to building standards should be considered not on the basis of inconsistent evidence, but in terms of cost versus a range of potential exposure.

Sources

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1 This study makes an excellent point about the reliability of extreme wind projections being dependent on a whole host of technical choices during the modelling and analysis process, particularly in the choice of model and the measures of storminess used.

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