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Extreme Precipitation and Climate Change: A Storm's Perspective

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Extreme precipitation events have the potential of causing widespread damage and are a common issue to address for insurance companies. There are many challenges facing the prediction of extreme precipitation events, including the ability to forecast the intensity of the events with high-resolution forecast models and to determine the projected change in these events is in a warmer climate.

This talk examines these two challenges from a storm's perspective. The floods during the summer of 2007 in the UK were caused by the presence of a persistent upper-level cut-off low providing a continuous moisture supply over the UK. This allowed the development of a series of convective systems embedded within the synoptic system, causing persistent extreme rainfall for several hours.

A 12km and a 4km UK Met Office Limited Area Model (LAM) with ECMWF re-analysis boundary conditions was run to investigate whether the LAM was able to predict the intensities and distribution observed through raingauge and radar data. The results suggest that whilst the large-scale distribution of the rainfall is similar to that observed by the radar, the intensity of the rainfall does not equate to the raingauge observations. This intensity error is not reduced at the higher resolution, however the distribution is improved.

The effect on the precipitation of synoptic scale events in a warmer climate has also been investigated. The TRACK software was used to track storms in the ECHAM5 T319 Global Climate Model (GCM) to determine whether the intensity and frequency of such events will change under the IPCC A1B warming scenario. These results were compared to the results from the T213 resolution run presented in Bengtsson et al (2009).

The effect of a warming climate is for the number of extreme events to increase, and for the intensity, for the precipitation and vorticity fields, to increase. These are the same conclusions as for the T213 run. The effect of a warmer climate has a consistent response across all the seasons, however the increase in resolution does not have a uniform response across the seasons.

The increase in resolution predicts more extreme events, and an increase in the intensity of these events, for precipitation and vorticity, for all seasons and both climates, with the exception of 20C DJF in the precipitation which shows no change due to resolution.

This peculiarity in the response of the ECHAM5 model to an increase in resolution has been investigated and the results are given in this talk. Future work relating the increase in the intensity of extreme precipitation events with climate change, and the results from the LAM runs will also be discussed.

References:

Bengtsson, L, K. Hodges, and N. Keenlyside, 2009: Will Extratropical Storms Intensify in a Warmer Climate? J. Clim., 22, 2276-2301.