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The CONVEX project - Using Observational Evidence and Process Understanding to Improve Predictions of Extreme Rainfall Change

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During the last decade, widespread major flood events in the UK and across the rest of Europe have focussed attention on perceived increases in rainfall intensities. Whilst Regional Climate Models (RCMs) are able to simulate the magnitude and spatial pattern of observed daily extreme rainfall events more reliably than Global Circulation Models (GCMs), they still underestimate extreme rainfall in relation to observations. Particularly during the summer a large proportion of the precipitation comes from convective storms that are typically too small to be explicitly represented by climate models. Instead, convection parameterisation schemes are necessary to represent the larger-scale effect of unresolved convective cells.

Given the deficiencies in the simulation of extreme rainfall by climate models, even in the current generation of high-resolution RCMs, the CONVEX project (CONVective EXtremes) argues that an integrated approach is needed that brings together observations, basic understanding and models. This should go hand in hand with a change from a focus on traditional validation exercises (comparing modelled and observed extremes) to an understanding and quantification of the causes of model deficiencies in the simulation of extreme rainfall processes on different spatial and temporal scales. It is particularly true for localised intense summer convection.

CONVEX therefore aims to contribute to the goals of enabling society to respond to global climate change and predicting the regional and local impacts of environmental change. In addition to an improved understanding of the spatial-temporal characteristics of extreme rainfall processes (principally in the UK) the project is also assessing the influence of model parameterisations and resolution on the simulation of extreme rainfall events and processes. This includes the running of new RCM simulations undertaken by the UK Meteorological Office at 50km and 12km resolutions (parameterised convection) and comparing these with new 1.5km resolution (convection-permitting) model simulations for the southern UK. The project is also seeking to develop a process understanding of the relationships between large-scale predictors and extreme rainfall on different spatial and temporal scales to provide improved understanding of the strengths and limitations of climate models and uncertainty estimates derived from model ensembles. It is also believed that this could also lead to an improved estimation of changes to local scale convective rainfall and thus flash floods.

Current results from the simulation of a “baseline” climate and future work undertaken by CONVEX will allow us to understand which extreme rainfall situations benefit from higher resolution. It is envisaged that this will provide valuable quantitative information regarding deficiencies in the coarser model output. Further, as well as providing improved process-understanding vital for future climate model development and better forecasts from NWP models, these results will ultimately provide valuable insight into the characteristics of convective-scale models and into the relationship between models of different resolution that can be applied in the context of climate change predictions.