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

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During the last decade, widespread major flood events in the UK and across 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 and do not capture the properties of sub-daily events that may lead to flooding in urban areas. In the UK and Europe, particularly during the summer, a large proportion of 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.

The CONVEX project (CONVective EXtremes) argues that an integrated approach is needed to provide improvements in estimates of change in extreme rainfall, particularly for summer convective events. As usable predictions require the synthesis of observations, understanding of atmospheric processes and models, a change in focus from traditional validation exercises (comparing modelled and observed extremes) to an understanding and quantification of the causes for model deficiencies in the simulation of extreme rainfall processes on different spatial and temporal scales is needed.

By adopting this new focus CONVEX 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 on timescales from days to decades. 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. Under the project the UK Meteorological Office has run new RCM simulations at 50km and 12km resolutions and compared these with new 1.5km-resolution model simulations for the southern UK. At this fine resolution convection may be explicitly represented in the model rather than parameterised as at coarser resolutions. 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 and in particular has investigated the links between temperature and extreme rainfall. A further key part of the project has been the simulation of a high-resolution climate change experiment using “baseline” climate and future simulations which are being compared with coarser model projections.

It is thus envisaged that CONVEX will provide valuable quantitative information regarding deficiencies in the coarser model output. 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 projections. Recommendations to the user community will also be provided by the project, including qualitative guidance for the use of projections from coarser resolution models.