Geophysical Research Abstracts
Vol. 19, EGU2017-17780, 2017
EGU General Assembly 2017

Impact of different convection permitting resolutions on the representation of heavy rainfall over the UK

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Previous studies (e.g. Ban et al, 2015; Fosser et al, 2015 and 2016; Kendon et al, 2015) have shown that convection permitting models are able to give a much more realistic representation of convection, and are needed to provide reliable projections of future changes in hourly precipitation extremes. In this context, the UKCP18 project aims to provide policy makers with new UK climate change projections at hourly and local scales, thanks to the first ensemble of runs at convection permitting resolution. As a first step, we need to identify a suitable UK domain, resolution and experimental design for the convective-scale ensemble. Thus, a set of 12-years long simulations driven by ERA Interim reanalysis data has been carried out over the UK using the Met Office Unified Model (UM) at different convection permitting resolutions, namely 1.5 km, 2.2 km and 4km. Different nesting strategy and physical adjustments are also tested. Two observational gridded datasets, based on rain gauges and radar, are used for validation.

The analysis aims to identify the impacts of the different convection permitting resolutions (as well as domain size and physical settings) on the representation of precipitation, especially when convection is a predominant feature. Moreover, this study tries to determine the physical reasons behind the found differences and hence to determine if there are any benefits of increasing the horizontal resolution within the convection permitting regime in a climatological context.

First results show that the 4km model realises many of the benefits of convection-permitting resolution, namely the rainfall fields are much more realistic and the daily timing of rainfall is better captured compared to convection-parameterised models. For mean precipitation metrics, including precipitation conditioned on circulation type, there is little benefit in moving to resolutions finer than 4km. However, there are some key deficiencies at convection-permitting resolution which are notably worse at 4km, namely the tendency for the heaviest events to be too intense and convective showers to be too “blobby”. The use of different nesting strategy seems to have a big impact on the results.

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