Geophysical Research Abstracts
Vol. 16, EGU2014-12605, 2014
EGU General Assembly 2014

Atmospheric rivers in a hierarchy of high resolution global climate models: results from the UPSCALE simulation campaign

Marie-Estelle Demory (1), Pier-Luigi Vidale (1), Reinhard Schiemann (1), Malcolm Roberts (2), and Matthew Mizielinski (2)

(1) University of Reading, NCAS-Climate, Meteorology, Reading, United Kingdom (p.l.vidale@reading.ac.uk, +44-(0)118-3788316), (2) Met Office Hadley Centre, UK

A traceable hierarchy of global climate models (based on the Met Office Unified Model, GA3 formulation), with mesh sizes ranging from 130km to 25km, has been developed in order to study the impact of improved representation of small-scale processes on the mean climate, its variability and extremes. Five-member ensembles of atmosphere-only integrations were completed at these resolutions, each 27 years in length, using both present day forcing and a future climate scenario. These integrations, collectively known as the "UPSCALE campaign", were completed using time provided by the European PrACE project on supercomputer HERMIT (HLRS Stuttgart).
A wide variety of processes are being studied to assess these integrations, in particular with regards to the role of resolution. It has been shown that the relatively coarse resolution of atmospheric general circulation models (AGCMs) limits their ability to represent moisture transport from ocean to land. Understanding of the processes underlying this observed improvement with higher resolution remains insufficient.

Atmospheric Rivers (ARs) are an important process of moisture transport onto land in mid-latitude eddies and have been shown by Lavers et al. (2012) to be involved in creating the moisture supply that sustains extreme precipitation events. We investigated the ability of a state-of-the art climate model to represent the location, frequency and 3D structure of atmospheric rivers affecting Western Europe, with a focus on the UK. We show that the climatology of atmospheric rivers, in particular frequency, is underrepresented in the GCM at standard resolution and that this is slightly improved at high resolution (25km): our results are in better agreement with reanalysis data, even if sizable biases remain. The three-dimensional structure of the atmospheric rivers is also more credibly represented at high-resolution.

Some aspects of the relationship between the improved simulation in current climate conditions, and how this impacts on changes in the future climate, with much larger atmospheric moisture availability, will also be discussed. In particular, we aim to quantify the relative roles of atmospheric transport and increased precipitation rates in the higher quantiles.