Geophysical Research Abstracts
Vol. 15, EGU2013-2876, 2013
EGU General Assembly 2013

A seamless assessment of the impact of deep convection on predictions of the West African Monsoon and the continental-scale water cycle

Cathryn Birch (1), John Marsham (1), Nick Dixon (1), Luis Garcia-Carreras (1), Grenville Lister (2), Peter Knippertz (1), and Douglas Parker (1)

(1) School of Earth and Environment, University of Leeds, Leeds, UK (jmarsham@env.leeds.ac.uk), (2) National Centre for Atmospheric Science (NCAS), University of Reading, UK

Global models struggle to represent the water cycle of West Africa and the reliability of numerical weather predictions of the monsoon is very limited. Organised deep moist convection is a key component of the monsoon. Global models all use parameterisations of deep convection and generally provide poor representations of both the diurnal cycle and the upscale organisation of the convection.

Here, we use multi-day continental-scale convection-permitting simulations over West Africa in summer, run using the Met Office Unified Model, to evaluate how convection affects the modelled synoptic-scale meteorology and the implications for weather and climate prediction. The convection-permitting simulations give a more realistic distribution and diurnal cycle of convection with upscale organisation. The explicit convection has a significant impact on the mean Sahel-Sahara pressure gradient, and the resultant monsoon flow; this impact is explained by the differences between the heating from parameterised and explicit convection. The explicit versus parameterised differences are consistent with the forecast bias exhibited in this region by global model forecasts. These process errors are relevant to all climate models and many varied aspects of the Earth system modelling.

The parameterised model under-predicts Sahelian rainfall. These rains are over-predicted in the explicit model, although this simulation gives more realistic rainfall totals overall. The increased rainfall leads to more evapotranspiration, but the loss of atmospheric water caused by the rain is largely compensated for by increased moisture flux convergence in the Sahel, which can be understood in terms of the impacts of the explicit convection on the monsoon. The heavier and more realistic Sahel rains in the explicit run are therefore self-sustaining in that they interact with the monsoon flow to bring more moisture into the Sahel.