Geophysical Research Abstracts
Vol. 20, EGU2018-14569, 2018
EGU General Assembly 2018

Convection-permitting modelling in Europe and West Africa : changes to the precipitation climatology

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We investigate the effect of using convection-permitting models (CPMs), for domains spanning both Europe and West-Africa, on the representation of precipitation at a climatic scale. Over Europe, we compare two 2.2 km models with two 12 km models run by ETH Zürich and the Met-Office. Over West-Africa, we compare a 4.5 km model with a 25 km model run by the Met-Office.

We highlight that CPMs show an increased number of moderate to intense short-lasting events and a decreased number of longer-lasting low-intensity events everywhere, correcting (and sometimes over-correcting) biases in the coarser resolution convection-parameterised models. In Europe, the CPMs give the largest differences compared to 12 km models in the hourly precipitation distribution in regions and seasons where convection is a key process: in summer across the whole of Europe and in autumn over the Mediterranean Sea and coasts. The overall hourly distribution and the intensity of the most intense events is improved over Switzerland and to a lesser extent over the UK but deteriorates over Germany. At the daily time-scale, the greater Alpine region stands out with the largest differences and Mediterranean autumnal intense events are better represented. In West Africa, the improvement is very clear at all time-scales (daily/hourly): the representation of the monsoonal precipitation in July-September is largely improved in the CPM. The timing of the peak in the diurnal cycle of precipitation is improved everywhere.