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Pseudo-global-warming experiments for West Africa

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With a rapidly growing population, West Africa is particularly vulnerable to the effects of climate change. While results from the Coupled Model Intercomparison Project (CMIP) experiments cannot agree on the sign of the end-of-century mean precipitation change over West Africa, there is consistent agreement that the most extreme precipitation events will become more intense. Indeed, an increase in the intensity of the most extreme events has already been observed in rain gauge and satellite datasets. These events are vital to understand since heavy rain can cause flooding as well as resulting property, infrastructure and crop damage, spread of disease and ultimately loss of life.

In West Africa, the majority of rainfall is delivered via Mesoscale Convective Systems (MCSs). Convection associated with the land–sea breeze circulation is also significant along the Guinea Coast. It is well understood that coarse climate models are unable to accurately represent systems on the meso- and local-scale and that high-resolution 'convection-permitting' models are required to represent the diurnal cycle, intensity, and organisation of convection. However, such models are expensive to run, especially for the long periods required for climate simulations. One solution is to run pseudo-global-warming (PGW) simulations, where 4D (x,y,z,t) climate 'deltas' from CMIP models are added to high-resolution reanalysis. The resulting dataset is then used as a boundary condition for high-resolution model runs of case study events in the future climate. In this work, the ERA5 reanalysis is used as the base, and the simulations are performed using the ICOsahedral Nonhydrostatic (ICON) model.

Initial results from bespoke PGW case studies for West Africa will be presented to show how the character of present-day extreme events might change if they were to occur in a future climate. In particular, the work will look at the thermodynamic and dynamic contributions to changes in intensity. Furthermore, changes in storm evolution, propagation and organisation will be analysed.