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The present-day precipitation climate in a series of GCM experiments at different horizontal resolution

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It is notoriously difficult to correctly represent precipitation in General Circulation Models (GCMs), and the horizontal resolution of the model grid is one of several factors known to have a pronounced impact on the simulated precipitation. Our longer-term aim is to describe and understand how various aspects of the precipitation climate, including extreme floods and droughts and their links to other phenomena (e.g., ENSO, tropical and extratropical cyclones), are represented across different model resolutions.

Here, we present early-stage results from this work. We carry out a systematic evaluation of basic characteristics of the precipitation climate (mean, interannual variability, seasonal cycle) with a focus on large spatial scales (global/continental and zonal-mean). We evaluate multi-decadal simulations of present climate from the UK MetOffice Hadley Centre's HadGEM1 and HadGEM3 model families, with model grid spacings ranging from $\sim$300 km to $\sim$40 km. Both Atmospheric Model Intercomparison Project (AMIP)-style GCM experiments and coupled simulations are taken into consideration. Several global monthly gridded datasets based on raingauge and remotely-sensed measurements (provided by the University of Delaware, the Climate Prediction Center, and the Climate Research Unit) are used as observational references.

Preliminary analyses show that high-resolution models tend to represent the spatial distribution of precipitation more accurately, especially along coastlines and over orography. The high-resolution models also tend to simulate less frequent but more intense precipitation events, although the results are biased by too much drizzle precipitation and too little dry events, a common issue amongst CGMs.