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Comparing the diurnal cycle of precipitation in models and observations at different spatial scales over China

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Climate models have a long-standing bias in the diurnal cycle of precipitation over land - they produce peak rainfall at local midday, when insolation is at its maximum. As part of the COnvective Scale Modelling In China (COSMIC) project, we investigate this bias over China using high-resolution (13 km) global simulations with the HadGEM3 model. We compare the diurnal cycle of summer precipitation with satellite observations of precipitation from CMORPH. The simulations are run with and without a convection parametrization scheme, as this scheme has been shown to be important for controlling the timing of precipitation. We analyse the amount, frequency and intensity of the precipitation, investigating their diurnal cycle and spatial distribution.

The analysis is performed on a grid-point scale, as well as at larger scales based on the catchment basins across the region. Catchment basins provide a natural way of linking the meteorological precipitation data to the underlying physical geography of the region, in a way which is useful for decision makers and could be used to provide information to hydrological models in the future. We present a simple Python tool for performing the analysis: BAsin-Scale Model Assessment ToolkIt (BASMATI).

In line with previous studies, we find that the simulation performed with parametrized convection produces precipitation over land which peaks too early in the day. The simulation performed with explicit convection generally produces peaks in precipitation which occur later in the day - closer in time to the observed peak. By comparing our results with published work, we find that the presence or absence of a convection parametrization scheme is more important for determining the spatial distribution of the time of peak precipitation than the resolution of the simulations. We present comparisons of precipitation in the simulations and observations performed at grid points and over catchment basins using BASMATI. The catchment basins are chosen based on their size, which allows for the comparison to be done as a function of spatial scale.