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The Asian Monsoon in a 0.3 degree climate AGCM

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Many GCMs show significant systematic biases in their simulation of monsoon rainfall and dynamics that spin up over very short time scales and persist into the climate mean state. Using high-resolution climate AGCM data generated by the UPSCALE programme, we study changes in Asian monsoon precipitation when horizontal resolution is increased from 200 to 40 km at the equator (N96 to N512) in a configuration of the UK Met Office Unified Model (MetUM, HadGEM3 GA 3.0). We find a consistent pattern of precipitation changes as resolution increases, including increased precipitation at the southern foothills of the Himalayas, decreased precipitation in the South China Sea and north of the Maritime Continent, increased precipitation in the eastern Arabian Sea and decreased precipitation in the equatorial Indian Ocean. To explore which aspects of the increased resolution are causing these changes we compare the changes seen in this study to published sensitivity experiments investigating the effects of changing regional orography and coastlines. We analyze a series of synoptic, seasonal, intraseasonal and interannual diagnostics to determine how increased resolution affects variability on many timescales. We conclude that, while increasing resolution does not solve the many monsoon biases that exist in GCMs, it has a number of small beneficial impacts.