



Projections of extreme hourly precipitation in high-resolution models - caveats in model physics

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The ERA-Interim reanalysis and control/future-climate HadGEM3 GCM simulations are downscaled with the Met Office's 12-km parameterised-convection and 1.5-km explicit-convection regional climate models. The UK summertime hourly precipitation extremes in the downscaling simulations are characterised by the Generalised Pareto Distribution, and the two simulations show considerably different climate change signal. The 1.5-km simulation shows up to ~10% increase in the return levels across a wide range of return periods (1-100 years), yet the 12-km simulation selectively intensifies the long returns with weakening short returns. The 12-km model-simulated extremes are found to display a different probability distribution when hourly intensities exceed ~20 mm/hr, and this behavior cannot be found with the 1.5-km simulation. At high precipitation intensities, the 12-km model sub-grid "convective" precipitation aliases to the grid box scale – an unphysical behavior that cannot occur with the 1.5-km simulations. Both the 12- and 1.5-km simulations show consistent large decreases in event frequency in the future climate, and the decreases are consistent with decreases of wet hours and lengthening of dry spells in both simulations.