Fine-Scale Climate Projections for Africa: What Additional Robust Spatial Detail is Provided by a Convection-Permitting Model?

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Regional climate projections using ultra-high resolution convection-permitting (CP) models are now increasingly available, with recent endeavours also focussing on vulnerable tropical regions. A number of recent studies have examined a pair of pan-Africa integrations of the Met Office CP model (CP4A), run at 4.4km resolution with 10 years of both a present-day simulation and a circa-2100 projection. However, experience from inter-disciplinary discussions has revealed different perspectives on the value of such experiments, with climate scientists emphasising the importance of an improved representation of convection, whereas applied scientists emphasise the importance of the unprecedented spatial scale of the available climate data. This raises critical questions about the usable spatial scales of such projections. Can CP models really provide robust information about future climate change at finer scales than parameterised regional climate models? We address this question with a focus on projected changes in rainfall, both seasonal means and daily extremes, both of which may be expected to exhibit heterogeneous climate responses in regions of large surface forcing. Although the capacity for statistically significant detail is found to be small in this short projection, detectable sub-25km variability is indeed apparent in regions of high topographic variability. Coastal regions, such as lakes and marine bays are also examined, along with urban boundaries. Furthermore, where no significant fine-scale detail is apparent (spatial heterogeneity is only due to sampling variability), we also examine the extent to which the robustness of climate information (better signal-to-noise ratios) can be enhanced for users by the spatial aggregation of model data.