



The value of high-resolution prediction of weather and crop productivity

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Global climate and weather models are a key tool for the prediction of future crop productivity. Convective rainfall systems are too spatially small to be resolved by any current global model and must therefore be parameterised. Parameterisations of convection, however, all exhibit common deficiencies in the spatial and temporal variability of rainfall when compared to observations. Generally, rainfall peaks too early in the day (midday as opposed to the evening) and is too weak and widespread compared to the intense, localized storms which occur in reality. Because the simulated cloud cover is maximized at a different time of day compared to reality there are also knock-on effects on the mean incoming radiation and surface temperatures. Previous modelling studies over West Africa have also shown that these errors can upscale to affect the intensity and structure of the entire regional-scale monsoon circulation. All these factors constitute a significant source of error for any crop model that depends on inputs from global models in order to determine regional scale yields. Furthermore, as these errors are likely to be similar in all global models, they will not be captured in the uncertainty derived from existing climate model intercomparisons.

In this study the General Large Area Model for annual crops (GLAM) is driven by Met Office Unified Model atmospheric data from regional-scale simulations of one cropping season over West Africa at different resolutions (40 and 12km with parameterised convection, 12 and 4km with resolved convection). These are used to assess the impact of both model resolution and the use of a parameterisation of convection on the prediction of groundnut yields. The use of two runs with the same resolution but a different representation of convection allows us to separate the impact of resolution from the parameterisation. Observed regional crop yield returns are used to evaluate the skill of the crop model output from the different runs.