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# Process-based climate model evaluation in the Congo Basin: how credible are future projections?

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The Congo Basin is one of three global convective hotspots, and supports the world's second largest rainforest. Despite its climatological importance, it is critically understudied, in part due to the severe scarcity of observational data in the region. This limits traditional methods of model evaluation, which compare model climatologies to observed data, and has resulted in a wide divergence between numerical model simulations of the Congo Basin. Mean monthly rainfall can different by up to a factor of five amongst coupled models in the CMIP5 ensemble, and the distribution of rainfall in the basin also varies considerably; some models have rainfall maxima over the eastern Congo Basin, while others place most of their rainfall over the Atlantic coast, some 2500km to the west. These differences between models remain in the future, limiting our understanding of likely future (end of century) changes.

To circumvent the issue of data scarcity, this study uses a process-based assessment to evaluate CMIP5 models. Models are assessed on their ability to represent processes known to be related to rainfall; this helps determine which models may be producing credible rainfall climatologies, and casts doubt on models where rainfall is related to spurious processes. For example, in the September-November rainy season, models which are wet in the west Congo Basin have a significantly warmer SST bias in the tropical east Atlantic, which is related to increased evaporation and localised convection. This casts doubt on the credibility of wet model climatologies here, as rainfall is related to a known bias. In the east Congo Basin, SSTs are not a strong differentiating factor between wet and dry models. Instead, dry models are characterised by a stronger and more equatorward African Easterly Jet, which exports moisture out of the basin to the west. Where such processes can also be identified in the future period, we can begin to determine which models offer the most credible future projections, for use in decision-making contexts.