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Investigating the factors affecting Monsoon precipitation under climate change

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The Monsoons produce some of the largest levels of uncertainty in projected precipitation change across the globe, and addressing this uncertainty is a key issue that must be faced in order to allow correct adaptation policy to be put in place.

A set of CMIP6 GCM experiments, that allow the full effect of CO_2 forcing to be decomposed into individual components, highlight the leading factors that produce changes in monsoon precipitation. The results reveal a high spatial variability in these factors, with changes in the Indian Monsoon dominated by the effect of sea surface temperatures and the direct radiative effect of increased CO_2, and changes in the South American Monsoon governed by the plant physiological effect and the direct radiative effect of increased CO_2. The processes behind these precipitation changes are also investigated by looking at variations in atmospheric circulation and surface temperature. Results of the patterned sea surface temperature experiment demonstrate a slow-down of the Indian Monsoon circulation possibly driven by an anomalously warm Indian Ocean.

This analysis has been performed for all land monsoon regions, decomposing the full CO_2 forcing into; uniform and patterned sea surface temperature change, the plant physiological effect, the direct radiative effect and the impact of sea-ice melt. These results can help identify emergent constraints, as well as indicate which aspects of climate models need to be improved in order to reduce model uncertainty.