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Extratropical SST: a key to understand the discrepancy in future Sahel rainfall projections

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Future development of Sahel rainfall is highly uncertain. Previous results of Coupled Model Intercomparison Project Phase 3 (CMIP3) show opposite rainfall trends among different coupled general circulation models (GCMs). The twenty-century cross-model consensus in linking Sahel rainfall to certain tropical sea-surface temperature (SST) patterns breaks down for the twenty-first century. Such uncertainties have not been improved even in a new generation of GCMs, i.e. CMIP5. Here we found, for the first time, that different amplitudes of future extratropical SST warming could be a crucial driver for the discrepancy in the projected Sahel rainfall. The relationship between SST and Sahel rainfall that holds for the twenty-century can persist into the twenty-first century when the extratropical SSTs are taken into account. A suite of SST-sensitivity experiments with an atmospheric GCM confirms that strong extratropical warming induces a significant increase in Sahel rainfall, while warming in the tropics reduces rainfall. This result suggests an emerging role of extratropical SST in a trustworthy projection of future Sahel rainfall.