



Influence of Tropical South Atlantic Sea Surface Temperatures on the Indian Summer monsoon in CMIP5 models

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In this study the teleconnection from the tropical south Atlantic to the Indian monsoon has been assessed in observations and in 32 models from the World Climate Research Program (WCRP) Coupled Model Intercomparison Project Phase 5 (CMIP5). All models show that the regression pattern of tropics-wide Atlantic sea surface temperature (SST) anomalies onto the tropical south Atlantic index correlates well with that in observations, even though with varying spatial standard deviations. However, only about half of the 32 models considered show the correct sign of rainfall response over India to a warm anomaly in the south tropical Atlantic, which is a reduction of rainfall. On the other hand, models generally do show large-scale responses broadly consistent with the observations, and the signal over India depends on relatively subtle changes in the response. This response to a tropical south Atlantic warm (cold) anomaly is a low-level quadrupole in streamfunction with an anticyclonic (cyclonic) anomaly over the Arabian Sea and India. This anticyclonic (cyclonic) anomaly leads to a weakening (strengthening) of the Somali jet and low-level divergence (convergence) over India, both inducing a reduction (increase) of Indian rainfall. The models which do not show the correct rainfall response over India also show a response similar to the one indicated above, but with maximum of the anticyclonic (cyclonic) response shifted to the western Pacific. The large-scale Walker circulation adjustment to the tropical south Atlantic SST anomalies is identified as one of the factors which account for the differences in the low-level streamfunction response. Models (and the observations) with the correct sign of the rainfall signal over India show the dominant upper-level convergence (divergence) as response to a warm (cold) tropical south Atlantic in the western Pacific region, whereas models with the wrong sign of the rainfall signal show it predominantly in the central-eastern Pacific. The fact that such relatively subtle changes in the response lead to a reversal of the rainfall signal over India raises the question about the robustness of the tropical south Atlantic-Indian monsoon teleconnection.