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Revisiting the role of global SST anomalies and their effects on West African monsoon variability

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The West African Monsoon is a significant component of the global monsoon system, delivering the majority of annual precipitation for the Sahel and varying on timescales from seasons to decades and beyond. Much of the internal variability of this system is driven by sea surface temperature (SST) anomalies and their resulting atmospheric teleconnections linking oceanic changes to land-based precipitation. Previous idealized studies have identified the role of particular ocean basins in driving monsoon variations on a number of key timescales, including the Atlantic basin as the main driver behind decadal-scale changes and the Pacific basin for interannual variability. However, understanding of how the monsoon responds to global SSTs remains incomplete because the system can be affected by moisture availability locally as well as tropical atmospheric stability, both of which are influenced by ocean temperatures. Furthermore, the complexity of how the global ocean basins change in relation to one another (what we refer to as superposition of anomalies) can result in Sahel precipitation anomalies that are contrary to what one might posit when considering the state of a single basin alone (e.g. the 2015 El Niño event and a relatively wet Sahel). The aim of this work is to revisit the role of global SSTs in driving Sahel rainfall variability over the recent past using a blending of observations and new model output. We seek to disentangle the state of various basins in combination with each other in driving normal or anomalously dry or wet years, resolving the ways that remote and local ocean forcings affect the movement of convection from the Guinea coast inland and northward into the Sahel, and include the study of circulation and stability components of the atmosphere. Preliminary diagnostic work suggests that varying SST conditions across ocean basins could imprint distinctly different precipitation responses in the Sahel. For example, precipitation anomalies are strongest (with rates above 0.75 mm/day) in years of differing anomalies in the Atlantic and Pacific that favor the same response in Sahel precipitation (El Niño/Negative North Atlantic and La Niña/Positive North Atlantic). During years when the basins exhibit the same sign of their anomalies (El Niño/Positive North Atlantic and La Niña/Negative North Atlantic), the precipitation response is less clear with greater spatial variability in addition to a large range in the anomaly rate. Results have particular relevance for informing seasonal forecasting applications in the region, a topic that will also be briefly touched upon.