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Examining Intraseasonal Variability in the West African Monsoon Using the Superparameterized Community Climate System Model

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In West Africa, the ability to predict intraseasonal variations in rainfall would have important social and economic impacts for local populations. In particular, such predictions might be useful for estimating the timing of the monsoon onset and break periods in monsoon rains. Current theory suggests that on 25-90 day timescales, the West African monsoon (WAM) is influenced by intraseasonal variations in the Indo-Pacific region, namely the Madden Julian Oscillation (MJO) and the Asian summer monsoon. Unfortunately, most general circulation models (GCMs) show weak skill in simulating the seasonal variations in the WAM as well as intraseasonal variability in the Indo-Pacific. These model limitations make it difficult to study the dynamical links in variability across the tropics.
Unlike traditional GCMs, models that have implemented the superparameterization (where traditional convective parameterizations are replaced by embedding a two dimensional cloud resolving model in each grid box) have been shown to be able to represent the WAM, the MJO and the Asian Summer Monsoon with reasonable fidelity. These model advances may allow us to study the teleconnections between the Indo-Pacific and West Africa in more detail.
This study examines the intraseasonal variability of the WAM in the Superparameterized Community Climate System model (SP-CCSM). Results from the SP-CCSM are consistent with observations where intraseasonal variability accounts for 15-20% of the total variability in rainfall over West Africa during the monsoon season. We also show that on 25-90 day timescales, increases in precipitation over West Africa correspond with a northward shift of the African easterly jet and an increase in African easterly wave activity. Lag-composite analysis indicates that intraseasonal variations in WAM precipitation correspond with the North-South propagation of the MJO during boreal summer as well as the active and breaking phases of the Asian summer monsoon. Preliminary results suggest that West African precipitation may be lagged behind changes in the Indo-Pacific by 15-20 days. Currently work is being done to examine the dynamical links between these two regions in the SP-CCSM. This includes the potential for Rossby wave propagation out of the Indo-Pacific region that subsequently excites convection over West Africa.