Two 20-year simulations with coupled general circulation models (CGCMs) are analyzed for their ability to simulate the Asian monsoon system. The first simulation is based on the Community Climate System Model (CCSM), which employs a traditional cumulus parameterization. The second simulation replaces the cumulus parameterization with an explicit, two-dimensional cloud-resolving model embedded in each CGCM grid column. CCSM produces a weak and disorganized Asian monsoon, while SP-CCSM successfully simulates many components of the monsoon, including the NW-SE tilted rainband structure and the intraseasonal northward propagation of precipitation anomalies over the Indian Ocean and Southeast Asia.

We analyze the structure and propagation characteristics of equatorial Rossby (ER) and Yanai waves and their relationship to the northward propagation of monsoon convection. Lag-correlation analyses reveals that in SP-CCSM both wave types exhibit NW propagation across the Indian Ocean and appear to be initiated by eastward-propagating MJO convection. In CCSM, however, westward-propagating ER waves appear to be excited farther north, and both ER and Yanai waves propagate either due westward or slightly southwestward.

Wave number-frequency distributions indicate significant spectral power for ER OLR anomalies in both CCSM and SP-CCSM. Large-scale eddy structures differ substantially between CCSM and SPCCSM, with SP-CCSM eddies bearing a distinct similarity to observed ER wave structures. For the Yanai wave, dynamical fields regressed onto a West Pacific base point bear a reasonable resemblance to observations for both models, especially SP-CCSM.