Investigating the component of the eastward shift of the MJO explained by the seasonal transition of SST though a case study on the pre-YMC MJO

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The Madden-Julian Oscillation (MJO) is the dominant mode of intraseasonal variability in the tropics characterized by slow eastward propagation of convective active region from the equatorial Indian Ocean to the equatorial Western Pacific (Madden and Julian 1972). However, its complex composition of interacting convective activities of various space and temporal scales has made it difficult to determine the principal dynamical mechanism explaining the phenomenon. Therefore, here we investigate for a component of the MJO which is independent from the atmospheric dynamics that can be explained solely by the lower boundary condition given by the sea surface. In Neelin and Held (1987; NH87), they make a simple two-layer model of climatological tropical convergence and precipitation diagnosed from sea surface temperature (SST) and surface latent heat flux. As the NH87 model is intended to estimate climatological precipitation means from the SST, by making an assessment of an MJO event in the NH87 framework we investigate for a component of the MJO dominated by the seasonal transition of the SST. The event assessed here is the observed MJO event during the pre-YMC observation campaign from Nov. to Dec. 2015.
During the pre-YMC campaign, an MJO event was observed as an outburst of low level westerlies around Dec. 13, 2015 from radiosonde observations from R/V Mirai stationed at 4-04S, 101-54E. This MJO is observed to initiate over the Indian Ocean around Dec.12, 2015 and propagate to the Western Pacific in around 30 days. Following NH87, we estimated the low level moisture and precipitation means using NOAA OISST V2 and latent heat flux values from NCEP NCAR reanalysis1. The NH87 model succeeds in capturing buildup of low level moisture before the MJO initiation, and the following eastward propagating precipitation pattern of the MJO with a major event at the end of December to some extent. The results suggests that the seasonal warming of the Western Pacific SST is preconditioning region eastward of the Maritime Continents favorable for MJO convection, and that there are indeed components of the MJO that can be at least partially explained by the seasonal change of the sea surface conditions.

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