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Improving MJO Prediction and Simulation Using AGCM Coupled Ocean Model with Refined Vertical Resolution

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Precipitation in Taiwan area is significantly influenced by MJO (Madden-Julian Oscillation) in the boreal winter. This study is therefore conducted by toggling the MJO prediction and simulation with a unique model structure. The one-dimensional TKE (Turbulence Kinetic Energy) type ocean model SIT (Snow, Ice, Thermocline) with refined vertical resolution near surface is able to resolve cool skin, as well as diurnal warm layer. SIT can simulate accurate SST and hence give precise air-sea interaction. By coupling SIT with ECHAM5 (MPI-Meteorology), CAM5 (NCAR) and HiRAM (GFDL), the MJO simulations in 20-yrs climate integrations conducted by three SIT-coupled AGCMs are significant improved comparing to those driven by prescribed SST. The horizontal resolutions in ECHAM5, CAM5 and HiRAM are 2-deg., 1-deg and 0.5-deg., respectively. This suggests that the improvement of MJO simulation by coupling SIT is AGCM-resolution independent. This study further utilizes HiRAM coupled SIT to evaluate its MJO forecast skill. HiRAM has been recognized as one of the best model for seasonal forecasts of hurricane/typhoon activity (Zhao et al., 2009; Chen & Lin, 2011; 2013), but was not as successful in MJO forecast. The preliminary result of the HiRAM-SIT experiment during DYNAMO period shows improved success in MJO forecast. These improvements of MJO prediction and simulation in both hindcast experiments and climate integrations are mainly from better-simulated SST diurnal cycle and diurnal amplitude, which is contributed by the refined vertical resolution near ocean surface in SIT.

Keywords: MJO Predictability, DYNAMO