Multi-scale Interactions in a High-Resolution Tropical-Belt Experiment using WRF Model

Ricardo FONSECA[1,2], Tieh-Yong KOH[3,2], and Chee-Kiat TEO[4,5]

[1] *Department of Computer Science, Electrical and Space Engineering, Luleå University of Technology, Kiruna, Sweden*

[2] *Earth Observatory of Singapore, Nanyang Technological University, Singapore*

[3] *Core Curriculum, Singapore University of Social Sciences, Singapore*

[4] *Centre for Applied Research, Singapore University of Social Sciences, Singapore*

[5] *School of Physical and Mathematical Sciences, Nanyang Technological University, Singapore*

The Weather Research and Forecasting (WRF) model is used to dynamically downscale 27 years of the Climate Forecast System Reanalysis (CFSR) in a tropical belt configuration at 36 km horizontal grid spacing. WRF is found to give a good rainfall climatology as observed by the Tropical Rainfall Measuring Mission (TRMM) and to reproduce well the large-scale circulation and surface radiation fluxes. The impact of conventional and Modoki-type El Niño-Southern Oscillation (ENSO) and the Indian Ocean Dipole (IOD) are confirmed by linear regression in the model. Madden-Julian Oscillation (MJO) and Boreal Summer Intra-seasonal Oscillation (BSISO) are also well-simulated. However, WRF does not capture well the diurnal cycle of precipitation over the Maritime Continent. For the investigation of multi-scale interactions through the local diurnal cycle, TRMM data is used instead.

The WRF simulation shows that in the boreal summer, conventional ENSO modifies the MJO amplitude while Modoki-type ENSO and IOD impacts are MJO-phase dependent; in boreal winter, inter-annual variations have little impact on MJO amplitude. The TRMM observations show that in the Maritime Continent, moderate ENSO modifies the MJO's influence on the diurnal cycle in specific ways; strong ENSO leads to non-linear impacts on the diurnal cycle..

Key words: ENSO, MJO, diurnal cycle, multi-scale interaction, WRF