Abstract

Proposal Title: High-Resolution Precipitation Product and Analysis for YMC

PIs: Chidong Zhang (NOAA/PMEL), Ping-Ping Xie (NOAA/CPC)
BMKG collaborators: Reza Bayu Perdana, Iddam Hairuly Umam

The barrier effect of the Indo-Pacific Maritime Continent (MC) on the MJO is one of the major problems challenging the MJO study and prediction. Reasons for the weakening of the MJO over the MC and for some MJO events to fail to propagate through the MC remain unknown. Recent observations and model simulations suggest two factors that may play key roles in this problem. One is the diurnal cycle of precipitation, the other the distribution of precipitation over land vs. water in the MC region. They are related. Satellite observations have shown that MJO events propagate through the MC only when their convection over water in the MC region is sufficiently developed, and they would stall over the MC and fail to reemerge on the Pacific side if land-locked convection dominates. Numerical simulations have demonstrated that a strong diurnal cycle would promote land-locked convection and enhance the barrier effect of the MC on the MJO. Precipitation data of fine temporal/spatial resolutions and high accuracy are needed for observational diagnostics and validation of cloud-permitting model simulations to further our understanding of these and other possible mechanisms for the MC barrier effect.

We propose to produce a precipitation dataset for the MC region at high resolutions in time (30 min) and space (8 km x 8 km) (potentially 15 min and 0.05 degrees latitude/longitude). This new precipitation data will be based on satellite passive microwave (PMW) trievals augmented by ground measurement of rain gauges and quantitative precipitation estimate (QPE) from radar observations in the MC region. With incorporated ground observations and satellite retrievals, this product will provide more accurate estimate of the diurnal cycle and land-sea distribution of precipitation than any currently available precipitation data.

We will use this data set to diagnose the diurnal cycle and land-sea distributions of convection over the MC during YMC. The diagnosis would identify individual precipitating cloud clusters (their sizes, height, and rain rates) within and outside MJO large-scale convective envelopes, their diurnal cycle, and their spatial variability in the MC. The proposed precipitation data and their analysis in this project will provide powerful tools for evaluations of cloud-permitting model simulations for YMC, as well as for advancing our understanding of potential roles of the diurnal cycle and land-sea distributions of precipitation in the MC barrier effect on the MJO. The proposed data will be made available for YMC PIs as they are produced and for public use one year after the end of YMC.

The proposed research directly responds to the CVP solicitation for proposals “that aim to improve understanding of processes that affect the propagation (speed, intensity, disruption, geographic placement) of intraseasonal oscillations in the Maritime Continent and broader region by using a combination of in situ and remote observations, data analysis, modeling, and/or theoretical understanding of local and remote processes”.