Atmospheric Radiation Measurement-Diurnal Cycle Interactions with Madden-Julian Oscillation Propagation (ARM-DIMOP)

Contact point:
Samson Hagos (Pacific Northwest National Laboratory)

Overview:

In this campaign, we plan to investigate radiative and turbulent flux processes before, during and after the passage of MJO episodes with the aim at explaining why some events of the MJO successfully cross the MC while others do not. Specifically we will explore the mechanism that controls the strength of the diurnal cycle over the MC. We hypothesize that land surface conditions (ground moisture) and cloudiness (deep clouds) ahead of MJO convection centers modulate the diurnal cycle in land convection and hence subsequent MJO propagation across the MC. Paired with operational ground radar, satellite observations and measurements from the broader International YMC field observations, the surface-based data collected by our deployment of US Department of Energy's Atmospheric Radiation Measurement Program instruments will help quantify the comparative roles of these and possibly other processes key to the barrier effect of the MC on MJO propagation. The field campaign will collect measurements of precipitation, soil moisture, surface radiation and turbulent fluxes for a one-year period. As the first step in testing the proposed hypothesis, MJO events during the observation year will be grouped into propagating and disrupted based on whether they successfully cross the MC. We will use the collected observations to make composite diurnal cycles of the various variables for the two types of MJO events to examine their possibly distinct features during all the phases of the MJO events. The surface flux and soil moisture measurements will be used to identify those features. The second task is to extend the analysis to about 50 MJO events initiated over the Indian Ocean during the TRMM era by examining the relationship between the one-year-long point measurements of surface radiation with (i) areal mean precipitation (~220 km diameter) estimated from the BMKG C-Band radar, (ii) TRMM precipitation, and (iii) geostationary satellite infrared brightness temperature measurements. A correlation of the point measurement with these spatial and long-term measurements would allow us to generalize the findings from the first step via satellite proxies to a large number of MJO episodes.

Observations:
We propose to deploy the following instruments at BMKG weather station in Pontianak, Kalimantan for one year.

- Upwelling Radiation (GNDRAD)
- Down-welling Radiation (SKYRAD)
- Eddy Correlation Flux Measurement System (ECOR)
- Surface Energy Balance System (SEBS)
- Surface Meteorology Systems (MET)
- Tipping Bucket Rain Gauge (RAIN)
- Ceilometer (CEIL), particularly the newer Vaisala model CL31

Period:
September 2018 - September 2019