

Diurnal cycle of precipitation in the western coastal area of Sumatra Island observed in Pre-YMC and YMC-Sumatra2017 field campaigns

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Over tropical coastal waters, offshore migration of convective systems during nighttime is frequently observed and characterizes diurnal cycle of precipitation. There have been lots of studies that discussed mechanisms responsible for this migration. As these mechanisms were generally proposed based on analysis of satellite observations and numerical experiments, it seems necessary to test them against direct observations of the offshore atmosphere. With one of the aims being to obtain such observations, we conducted Pre-YMC (Years of the Maritime Continent) field campaign in the western coastal area of Sumatra Island, Indonesia, in November and December of 2015. As a part of the campaign, we performed 3-hourly radiosonde observation and continuous weather radar observation at the research vessel (R/V) Mirai deployed about 50 km off the coast. Before convective envelope of the Madden-Julian Oscillation (MJO) arrived at the study area in middle December, typical diurnal cycle was observed. Analyses of the observations reveal that the lower free troposphere starts cooling and moistening in late afternoon, a couple of hours earlier than the boundary layer does. This cooling and moistening seem to contribute to the offshore precipitation via destabilization of the lower atmosphere. We argue that these results support the idea that gravity waves excited by evaporative cooling associated with convection over land play a role in the offshore migration. Furthermore, we conducted another field campaign in November 2017–January 2018 period, named YMC-Sumatra2017, with similar configuration to Pre-YMC. We also observed the offshore migration, although its speed was much lower than that in Pre-YMC. This difference may be related to that in large-scale wind field and MJO phase.

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