Global non-hydrostatic simulation of the Pre-YMC field campaign in 2015

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In order to deepen our understanding of multi-scale multi-process interactions over the Maritime Continent, a field campaign Pre-YMC was conducted during November-December 2015 in the southwest Sumatra by JAMSTEC. Near real-time forecasts using a global non-hydrostatic model (Nonhydrostatic Icosahedral Atmospheric Model, NICAM) had been operated throughout the observation period at cloud-system-resolving resolutions. This approach is useful for investigating relationship between mesoscale convective systems and large-scale disturbances, such as the Madden-Julian Oscillation (MJO), equatorial waves, and monsoon activities. The forecasts were initialized at 0000 UTC each day using NCEP Final analysis, and integrated for 7 (30) days using the 7 (14) km mesh sizes. Two member ensemble was made by different setups of sea surface temperature. We will discuss the model performance in simulating the observed large-scale variabilities and the processes in them.During the first half of the observation period, lower tropospheric westerlies and convective center persisted over the central Indian Ocean. Over the Maritime Continent, diurnal variation of precipitation was pronounced, with passages of westward propagating synoptic-scale vorticity disturbances at 4-5 periodicity. After 12 December 2015, the peak of equatorial westerlies rapidly moved eastward, with southward shift of westerly axis over the broad warm pool domain. These correspond to intensification of MJO amplitude and eastward propagation. The 30-day forecasts generally capture these large scale variations at the lead time of approximately two weeks. The abrupt change in the low-level winds were accompanied with marked variation in convective organization. The 7-km mesh simulations show that the westerly intensification started on 10-11 December as a part of a vorticity disturbance around the northwest Sumatra, followed by further acceleration within eastward propagating Kelvin-wave like convective disturbances. In the latter phase, convective activity was significantly enhanced, which masked diurnal variation in precipitation. These results suggest that mesoscale convective organization was not totally passive to the dynamical modulations, but drove the large-scale change in some ways. Possible scenarios are being searched.

Keywords: Global high-resolution model, Maritime Continent, Madden-Julian Oscillation, equatorial waves, diurnal cycle

