

Observed Synoptic-Mesoscale Variability and Dry Air Intrusion in DYNAMO MJO2

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The second MJO event in DYNAMO (MJO2) started in the Indian Ocean between 20-24 Nov. 2011 and moved into the Maritime Continent in early December. This event is currently the most intensely observed MJO over the Indian Ocean. The goal of this study is to document the internal day-to-day variability within the MJO convective envelope in order to understand its possible implications for MJO prediction and downstream weather. The NOAA P3 conducted 12 missions from the pre-MJO transition, through the MJO active phase, continuing to the post-MJO suppressed phase. In addition, this study makes use of TRMM-derived rainfall, 3-hourly radiosonde data from the DYNAMO array, and ECMWF analysis.

The initiation of MJO2 occurred when a Southern Hemisphere dry air surge penetrated to within 5 deg. of the Equator. The leading edge of the surge was characterized by a sharp moisture gradient. When the drier air reached the latitudes of the southern ITCZ, convection was suppressed at the off-Equator ITCZ latitudes and re-developed along the Equator. This marked the initial time when eastward propagation of the convection could be seen, in effect, the onset of MJO2.

Embedded within MJO2 were synoptic systems similar to Kelvin waves and Rossby gyres as well as associated mesoscale convective systems. Different from previously observed MJO events in the Indian Ocean and west Pacific, the Rossby gyres form very near the Equator and move off the Equator into alternating Hemispheres. The Kelvin-like wave at the leading edge lead to a primary intense rainfall maximum co-located with the shift from Equatorial easterlies to westerlies. A second rain maximum occurred associated with the Rossby gyres. The peak westerlies were dry.

The Rossby gyres in the Indian Ocean drew drier into the equatorial region, which led to a break in the rainfall within the MJO2 envelope. The drier air was drawn in across the east-west moisture gradient in the western Indian Ocean as well as from higher subtropical latitudes. This is referred to as dry air intrusion.

The distinct asymmetric structure of MJO2 with the convection alternating between the Hemispheres differs from MJO cases sampled in previous field campaigns. In particular, MJO2 did not resemble the "Kelvin-Rossby wave" seen in TOGA-COARE. The next question to be explored is whether this internal variability is important for MJO dynamics and/or prediction.