Diagnostic of Boundary Layer Moistening Process for the Three MJO events during DYNAMO IOP

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We use ECMWF Interim and TRMM (2A23, 3B42) data to diagnose the process of boundary layer moistening and shallow convection in order to compare with DYNAMO field observations to be released soon. This study examines the dynamics of low level moistening of the sounding array through scale-separation and moisture budget in Indian Ocean. All variables are separated into four different time scales which are over 60 days (low frequency), 20 to 60 days(MJO scale) , below 20 days (synoptic scales) and the unresolved scale (convective eddies). The result reveals a dominant budget balance between synoptic-scale and unresolved-scale processes. During suppressed phase of MJO in Indian Ocean (Phase 5-8 defined by RMM indices), eddy activities contribute to moistening but synoptic-scale subsidence causes drying in the boundary layer. This is different from Hsu et al (2012) who showed that mean state moisture and wave activity contribute dominantly to boundary layer moisture convergence. From TRMM 2A23, low- and mid-level cloud increases during the suppressed phase, suggesting that developing shallow convection plays an important role in the low-level moistening prior to the deep convective phase of MJO. This is consistent with previous findings over western Pacific that cloud top height increases from suppressed phase (phase3 and 4) to convective phase (phase 5) in Lau et al (2010). Overall, our result suggests the importance of convection coupled wave in MJO development. This is line with a recent study based on cloud system resolving model with prescribed large-scale wave activity that successfully simulated the interaction between cumulus and gravity wave (Kuang 2008).