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MMM SEMINAR with EOL and CGD

A Dynamic Mechanism for Initial MJO Convective Onset

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Observations, reanalysis, and regional modeling simulations support a dynamic mechanism that explains onset of convectively active periods of the Madden-Julian Oscillation (MJO) over the Indian Ocean. Observations made during DYNAMO confirm that clouds moisten the middle troposphere prior to MJO onset over the Indian Ocean. Regional modeling (WRF) runs show that the moistening is caused directly by upward advection of moisture within cloud updrafts and divergence of the moisture away from cloud updrafts into the environment.

TRMM and SPOL observations during DYNAMO show that, in terms of depth, two modes of precipitating convection over the Indian Ocean exist. One is a congestus-like mode that exists mainly below 500 hPa and increases in areal coverage during a 3–7 day long transition period prior to MJO onset. The other is a deep mode of convection, whose widespread existence is dependent upon the moistening caused by the congestus mode. The question of what permits widespread deep convective events then boils down to why congestus-like convection becomes more likely to develop.

Upper-tropospheric velocity potential anomalies (anomalies of large-scale (LS) divergence) have long been linked to MJO convective activity. Using ERA-Interim reanalysis, the low zonal wavenumber (1–1.5), eastward-propagating structures of vertical and zonal motion associated with the divergence signal are shown. As LS positive anomalies of divergence in the upper-troposphere approach the Indian Ocean, LS subsidence throughout the troposphere, and thus adiabatic warming, decreases. Peak reduction in LS subsidence occurs near 500 hPa, acting to destabilize the lower half of the troposphere.

WRF successfully reproduces three convective regimes prior to October and November convective events: suppressed, transition, and active periods, during which, respectively, shallow and non-precipitating, congestus, and deep convection are common. More congestus mode convection develops when the mean 900–700 hPa buoyancy within cloud updrafts becomes less negative, which occurs because the mean environmental (updraft) temperature in that layer decreases (increases) by 0.05–0.2K over a week prior to MJO onset. The updraft and environmental temperatures appear sensitive to sea surface temperature and the magnitude of LS environmental subsidence, suggesting that elements of both the “discharge-recharge” and circumnavigating wave hypotheses for MJO onset were active during DYNAMO.

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http://www.fin.ucar.edu/it/mms/fl-live.htm

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Thursday, 22 October 2015, 3:30 PM
Refreshments 3:15 PM
NCAR-Foothills Laboratory
3450 Mitchell Lane
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