The Generation of Ertel's Potential Vorticity by Convectively Coupled Atmospheric Kelvin Waves that Propagate through the Convective Region of the MJO

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Northeast Tropical Conference 2011

This study investigates the potential vorticity (PV) generated by convectively coupled atmospheric Kelvin waves that propagate through the local active convective phase of the Madden-Julian Oscillation (MJO), and begins to assess, through analysis of observations and reanalysis datasets, the potential relevance of this PV generation to the MJO.

Lag composites are created to illustrate PV generation. The MJO is tracked using modified real time multivariate MJO (RMM) indices that use outgoing longwave radiation (OLR) and zonal winds that have been filtered for the zonal wave number frequency band of the MJO. This filtering reduces the contributions of other signals that project onto the standard RMM indices. Kelvin waves are tracked using Kelvin filtered OLR averaged from 3°N-6°N. These data are used to find the dates on which Kelvin wave events crossed selected longitudes in the vicinity of active convection associated with a selected phase of the MJO. Lag composites are generated by averaging fields of data over these dates and time lags from these dates. Ertel's PV on the 315K isentropic surface from the ECMWF interim reanalysis is used to analyze PV generation.

The results show that low-level PV increases dramatically with Kelvin wave passage within the active convective phase of the MJO. This suggests that convection associated with Kelvin waves is the principal source of low level PV in the MJO and might be critical to the overall structure of the MJO.