Selected Results

A. Convective mechanisms

Prior to maximum rainfall associated with an MJO event (lag days -10 to -5), positive covariances (below, a) between the apparent convective heat source Q_c and temperature T suggest the generation of eddy available potential energy, a fuel source of tropical waves (see "1" and aqua circles below). Similarly, subgrid-scale convective processes also work to increase specific humidity q variance during lag days -15 to -10 (see "2" and dark blue circles below).

Selected Results (cont.)

C. Wave instability theories and the composite MJO

Four proposed wave instability theories are examined in the context of our composite MJO results. Although shallow cumuli preceding deep convection may partake in a CISK-like process in which shallow heating generates weak low-level moisture convergence, a pure application of wave-CISK does not match observations. Weak surface evaporative fluxes prior to intense rain suggest that the WISHE mechanism is not critical to the events making up our composite MJO. Although several key features of stratiform instability theory are not seen in our results, it is possible that this mechanism prolongs convection and possibly the MJO wet phase itself by reducing CIN and regenerating or maintaining residual convection.

Summary

1. The birth of the MJO involves low-level heating and moistening by shallow cumuli, increased instability, and an erosion of the mid-tropospheric dry layer.
2. There is a transition from convective to stratiform rain during the MJO wet phase.
3. The death of the MJO is first associated with horizontal advective drying followed by delayed but stronger subsidence drying.
4. Our observations lend support to the discharge-recharge theory of wave instability.

List of Acronyms

- TRMM: Tropical Rainfall Measuring Mission
- ERA40: European Centre for Medium-range Weather Forecasts 40-yr Reanalysis Dataset
- MERRA: Modern-Era Retrospective Analysis for Research and Applications
- wave-CISK: Conditional Instability of the Second Kind (associated with tropical waves)
- WISHE: Wind Induced Surface Heat Exchange
- CIN: Convective Inhibition