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The Optimal Initial Condition of MJO Development

Chun-Hao Chang[1] and Kai-Chih Tseng[2]
[1]Atmospheric Sciences, National Taiwan University, Taipei City, Taiwan (chriscattycat@gmail.com)
[2]Atmospheric Sciences, National Taiwan University, Taipei City, Taiwan (kaichiht@ntu.edu.tw)

Madden-Julian Oscillation (MJO), an intraseasonal oscillation over the equatorial Indian ocean and Pacific, has profound impacts around the globe. Its extended-range life cycle (20-90 days) makes it the most important predictability source on subseasonal-to-seasonal timescales. While the mechanisms responsible for MJO's life cycle have been well explored through the frameworks of moisture modes, and tropical wave dynamics, the mechanisms of initiation remain unsolved. By using linear inverse modeling (LIM) and incorporating different frameworks, this study investigates the processes resulting in MJO convection initiation. It is suggested that multi-scale interactions play a vital role in intraseasonal convection initiation over the Indian ocean. On intraseasonal timescales, the remnant of former MJO can create an environment favoring the convection development for the next event through modulating the prevailing circulations and moisture state (e.g., moisture advection). On shorter timescales (< 20 days), the optimal initial condition arises from the synoptic convergence/divergence of moisture flux, and the upper troposphere instability.