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The Energy Cycle of the Tropical Madden-Julian Oscillations seen through Wavelets

Jun-Ichi Yano

LMD, UPMC, Paris, France

The Madden–Julian Oscillations (MJO) are probably the most notable planetary-scale convective equatorial waves in the tropical atmosphere, which propagates around the globe eastwards with 30–60 day period. The MJO constitute a good example among the complex phenomena associated with geophysical flows. Their understanding and simulations remain a challenging fluid mechanics problem with complex interactions between planetary–scale flows and small-scale moist deep convection. Even their basic mechanism is hard to identify by conventional Fourier–based analyses due to strong nonlinearities in cloud physics associated with moist deep convection. Here, the wavelet is proposed as a general methodology for analyzing complex geophysical flows, and this method is used in order to identify the maintenance mechanism of MJO under an energy cycle. The analyses of the simulation results from global models show that this system is not necessarily maintained by moist deep convection in a simple manner as expected from the current dominant view.

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