

# **Tropical Atmospheric Madden-Julian Oscillation: Strongly-Nonlinear Free Solitary Rossby Wave?**

Jun-Ichi Yano, CNRM, Météo France, Toulouse

## *Abstract:*

The Madden-Julian oscillation (MJO), a planetary-scale eastward propagating coherent structure with periods of 30-60 days, is a prominent manifestation of intraseasonal variability in the tropical atmosphere. It is widely presumed that small-scale moist cumulus convection is a critical part of its dynamics. However, the recent results from high-resolution modeling as well as data analysis suggest that the MJO may be understood by dry dynamics to a leading-order approximation. Simple, further theoretical considerations presented herein suggest that if it is to be understood by dry dynamics, the MJO is most likely a strongly nonlinear solitary Rossby wave. Under a global quasi-geostrophic equivalent-barotropic formulation, modon theory provides such analytic solutions. Stability and the longevity of the modon solutions are investigated with a global shallow water model. The preferred modon solutions with the greatest longevities compare overall well with the observed MJO in scale and phase velocity within the factors.