



Ocean-atmosphere interaction: a key element of the Madden-Julian Oscillation

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The Madden-Julian Oscillation dominates intra-seasonal climate variability in the Tropics, plays an important role in the El Niño Southern Oscillation, and influences weather around the world. Despite its importance, uncertainties exist in the mechanism for the MJO and it is poorly simulated and predicted by models. Although ocean-atmosphere interaction is believed important to the MJO, no consensus exists.

Here we show through analysis of observations and coupled atmosphere-ocean model experiments that coherent sea surface warming before MJO events drives low-level moisture convergence, preconditioning deep atmospheric convection and eastward propagation. Thus, ocean-atmosphere interaction is central to MJO dynamics, and plays an important role in determining its strength, frequency, zonal wave number and eastward propagation speed. Comparison among observations and models with different degrees of ocean-atmosphere interaction indicate that resolving temperature variations of only the upper few meters of the ocean is essential to accurately simulate the eastward movement of the MJO over Indo-Pacific warm pool. A number of other sensitivity experiments confirm the importance of ocean-atmosphere interaction over the Indo-Pacific Warm Pool.