

Models for the Skeleton and Muscle of the MJO

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Abstract

Two simplified models are presented for the "skeleton" and the "muscle" of the MJO. First, by the MJO's "skeleton," we mean its fundamental features on intraseasonal/planetary scales: (i) the peculiar dispersion relation with near-zero group velocity, (ii) the slow phase speed of roughly 5 m/s, and (iii) the horizontal quadrupole vortex structure. A minimal dynamical model is presented that recovers all of these features. The key physical process in the model is interaction between low-level moisture anomalies and the growth of smaller-scale convective activity (such as convectively coupled waves and mesoscale convective systems). Second, by the MJO's "muscle," we mean tilts, vertical structure, westerly wind bursts, and other asymmetries to the MJO's skeleton. A simple model is presented to show how a westerly wind burst structure can be created through dynamical interactions of vertical wind shear and convectively coupled waves.