

**What causes the eastward propagation of Madden-Julian Oscillation?**

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The moisture dynamics associated with the eastward-propagating Madden-Julian Oscillation (MJO) is examined through a moisture budget diagnosis using 1979-2001 ERA-40 reanalysis data. A significant zonal asymmetry of MJO moisture occurs at the planetary boundary layer (PBL), pre-conditioning convective instability to the east of MJO convection. The leading of the PBL moisture is primarily attributed to effect of the moisture convergence, while the moisture advection also plays a role. A further diagnosis indicates that the perturbation convergence of the mean moisture is a dominant term. Why does the boundary layer convergence lead the MJO convection? A diagnosis of a PBL momentum budget indicates that the leading of the convergence is caused by both a Kelvin wave induced low pressure in the lower troposphere and a SST warming to the east of the MJO convection. While the free-atmospheric wave dynamics accounts for about 70-85% of the PBL convergence, the SST anomaly induced by a decreased latent heat flux contributes about 15-30% of the PBL convergence. The leading process in the moisture advection is the advection of the MJO flow across the mean moisture horizontal gradient. The synoptic eddy contribution to the MJO moisture advection is observed only in the Maritime Continent region. It shows a negative effect on the MJO advection over the Indian Ocean and western Pacific regions.