

The inhibiting role of the congestus after the MJO passage over the Indian Ocean and the Maritime Continent

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The passage of the Madden-Julian Oscillation (MJO) over the Indian Ocean and the Maritime Continent is investigated during two episodes: April 6-14, 2009 and November 23-30, 2011. For each episode, two Méso-NH simulations are examined, one convection-permitting (horizontal grid spacing of 4 km) and the other with parameterized convection (horizontal grid spacing of 32 km). They are assessed against the TRMM 3B42 rain product and the wind fields from the ECMWF operational analyses. The simulations with parameterized convection fail to propagate the convective activity and the zonal wind change across the Indian Ocean and the Maritime Continent. The convection-permitting simulations reproduce the MJO signal correctly as shown by the eastward propagation of the main rain activity and the wind anomalies. The atmospheric overturning is further investigated over the Indian Ocean. The isentropic analysis is adopted to separate the ascending air with high equivalent potential temperature from the subsiding air with low equivalent potential temperature. Three key circulations are found. The two first circulations are a troposphere deep circulation spanning from the surface to 15-km altitude and an overshoot one within the tropical tropopause layer. As expected for circulations associated with deep convection, their intensity increases during the active phase of the MJO. The unexpected third circulation is characterized by the rising of low equivalent potential temperature in the low free troposphere. Its intensity also varies with the MJO activity as well as does its depth. During the active phase, this circulation points out a weak drying of the low troposphere associated with shallow convection. During the suppressed phase, it shows a strong drying of the low to middle troposphere associated with congestus convection.