

Simulation of winter Madden-Julian Oscillation cases

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A case sweep simulation of winter MJOs through 1990 - 2012, including the two MJO cases observed in CINDY/DYNAMO, is conducted using a global non-hydrostatic model NICAM, powered by the new peta-flops computer "K" (RIKEN AICS, Kobe, Japan). A total of 37 winter (October – March) MJO cases are selected based on results of a space-time spectral analysis of observed OLR by NOAA satellite data. The simulations are initialized at dates on which the active convection of the MJO resides in the western Indian Ocean. The average skill limit of the MJO reproduction was measured by a method based on Real-time Multivariate MJO index 1 (RMM1, Wheeler and Hendon 2004) and RMM2 bivariate correlations. The duration of reproduction skill (the duration that the bivariate correlation between observation/reanalysis and NICAM stays above 0.6) was as long as 27 days. Figure 1a,b shows OLR Hovmoller diagrams of an MJO case observed intensively in CINDY/DYNAMO. The simulation by NICAM is successful in reproducing the eastward migration of the highly convective envelope throughout the 40 day integration. On the other hand, there were also cases in which NICAM produced relatively poor or no eastward propagation of the MJO. The MJO ensemble dataset allows our studies to proceed beyond case studies and distinguish the essence of the MJO from case-to-case varieties.

The occurrence of cirrus clouds associated to the $n = 0$ eastward inertial gravity waves and equatorial Kelvin waves over the tropical Indian Ocean in November 2011 during the CINDY2011/DYNAMO campaign