

A Momentum Budget Analysis of Westerly Wind Events Associated with the Madden–Julian Oscillation during DYNAMO

Ji-Hyun Oh (1), Xianan Jiang (2,3), Duane Waliser (2,3), Mitchell Moncrieff (4), Richard Johnson (5), and Paul Ciesielski (5)

(1) APEC Climate Center, Busan, Korea, Republic Of (jihyunoh@apcc21.org), (2) Joint Institute for Regional Earth System Science and Engineering, University of California, Los Angeles, Los Angeles, CA, USA, (3) Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA, (4) National Center for Atmospheric Research, Boulder, CO, USA, (5) Colorado State University, Fort Collins, CO, USA

Three Madden-Julian Oscillation events during Dynamics of the Madden–Julian Oscillation (DYNAMO) field campaign were investigated to understand the contributions of the dynamical processes involved in the wind evolution associated with the MJO over the Indian Ocean (IO). The DYNAMO field campaign was conducted from October 2011 to February 2012 over the IO to shed light on the initiation of the MJO. Based on European Centre for Medium-Range Weather Forecasts analysis, a momentum budget analysis of three MJOs that occurred in late October, late November, and late December shows that westerly acceleration at lower levels associated with the MJO active phase generally appears to be maintained by the pressure gradient force (PGF), which could be partly canceled by meridional advection of the zonal wind. Westerly acceleration in the midtroposphere tends to be mostly attributable to vertical advection.

In particular, the dynamical contribution of synoptic-scale equatorial waves to the WWEs is illuminated by diagnosing the MJO in November (MJO_2), accompanied by two WWEs (WWE1 and WWE2) spaced a few days apart. Unlike other WWEs during DYNAMO, horizontal advection is more responsible for the westerly acceleration in the lower troposphere for WWE2 than the PGF. Different interactions between the MJO_2 envelope and convectively coupled waves (CCWs) can be responsible for different developing processes among WWEs.