M.S. Defense Announcement
Joseph Messina
Monday, August 19 at 2:00pm

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August 19, 2019
2:00pm

Defense
ATS Large Classroom (101 ATS)

Post Defense Meeting
Riehl Conference Room (211 ACRC)

Committee:
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CHARACTERISTICS OF LINEAR MESOSCALE CONVECTIVE SYSTEMS DURING DYNAMO

Mesoscale convective systems (MCSs) have long been known to play a large part in the vertical transport of horizontal momentum. They also contribute to the vertical redistribution of heat and radiative forcing. The Madden Julian Oscillation (MJO) is a tropical disturbance that propagates across the central Indian Ocean and western Pacific Ocean with an intraseasonal cycle of 30-60 days. Many studies have explored the kinematic characteristics and organization of MCSs in the tropics, while others investigated the characteristics of convective systems within the MJO. However, there remains a gap in current literature on the connection between MJO phase and kinematics of precipitating tropical convection. Those studies that did examine MCSs in the tropical environment did so with limited observations.

This study used radar, sounding, and meteorological data from the Dynamics of the Madden Julian Oscillation (DYNAMO) field campaign in the central Indian Ocean to examine the influence of vertical shear on the orientation of linear MCSs, effects of cold pools on propagation of linear systems, and the mesoscale flow features of the MCSs over the phases of the MJO. DYNAMO took place from October-December 2011 and produced a vast dataset for the analysis of tropical convection during multiple MJO events. Our results show that convection during DYNAMO was consistent with studies from previous tropical field campaigns. That is, convective lines are frequently oriented perpendicular to strong low-level shear. In the absence of strong low-level shear, they are oriented parallel to strong mid-level shear. Linear systems were more prevalent during active MJO phases. Cold pools did not play a substantial role in tropical squall line propagation. Kinematic features are also consistent with previous works. The presence of a jump updraft and descending rear inflow were ubiquitous in our samples. The absence of a downdraft outflow was common. This result shows that the MCSs studied were transporting front to rear horizontal momentum from low- to mid-levels and rear to front horizontal momentum from low- to mid-levels.