EGU24-2215, updated on 20 May 2024
https://doi.org/10.5194/egusphere-egu24-2215
EGU General Assembly 2024

Modulations of local rainfall in Northeast Australia associated with the Madden Julian Oscillation

Thi Lan Dao[1], Claire L. Vincent[1], Yi Huang[1], Joshua S. Soderholm[2], and Dale S. Roberts[1]
[1]School of Geography, Earth and Atmospheric Sciences and ARC Centre of Excellence for Climate Extremes, The University of Melbourne, Melbourne, Victoria, Australia
[2]Science and Innovation Group, The Bureau of Meteorology, Melbourne, Victoria, Australia

This study investigates the interaction of the Madden Julian Oscillation (MJO) with local scale forcings in regulating precipitation and its diurnal variation over coastal areas in Northeast (NE) Australia. Radar results show that the variation of rainfall with MJO phases exhibits both large-scale and local-scale influences. During the enhanced convection phases of the MJO, widespread increased rainfall signals are generated by large-scale forcings associated with the MJO convection, but the environmental factors controlling the type and amount of precipitation during each phase is different. By contrast, the locally enhanced rainfall probability during suppressed convection phases of the MJO possibly results from mesoscale convective systems such as sea breezes and the interaction of easterly trade-winds and topography. The amplitude of the rainfall diurnal cycle in suppressed convection phases is generally larger than in enhanced convection phases of the MJO. However, the impact of the MJO on diurnal rainfall characteristics (e.g., diurnal timing and amplitude) varies from phase to phase suggesting that each MJO phase needs to be considered separately. Simulations from the UK Met-Office Unified Model with grid-spacing of 2.2 km have been used to understand the processes driving this observed interaction of large-scale and mesoscale variability. The simulations show that coastal rainfall during suppressed convection phases of the MJO is sensitive to the trade-wind inversion height as well as moisture distribution. The findings are important for assessing numerical model skills at small scales and highlight the importance of process-based understanding at these scales.