

Modulation of cold season U.S. daily precipitation by the Madden-Julian Oscillation

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This study examines the characteristics of cold season (November - March) daily precipitation over the contiguous United States during active periods of the Madden-Julian Oscillation (MJO). A large response in the precipitation rate anomaly is found over the eastern U.S. when MJO-related enhanced tropical convection is moving through the far western to central Pacific (conventionally known as Phases 5, 6, and 7 of the MJO). Positive anomalies occur in the region of the eastern Mississippi River basin, and negative anomalies in the Southeast. The relative stability of this pattern throughout the three phases suggests that they can be considered together. During Phases 5 - 7, the central U.S. has a daily precipitation rate between 110% and 150% of normal, while the precipitation rate over much of Florida is less than 70% of normal. Much of the lower Mississippi River basin region receives somewhat more frequent daily precipitation during MJO Phases 5 - 7, but a greater increase is found in the daily precipitation intensity, suggesting more intense storms. On the other hand, Florida has substantially fewer daily precipitation events, with a smaller decrease in the intensity. In order to understand the atmospheric mechanisms related to the above shifts in daily precipitation, elements of the atmospheric circulation were examined. Positive moisture flux convergence anomalies, which have been linked to increased precipitation rate and intensity, are found in the region of increased precipitation rate during MJO Phases 5 - 7. During those phases, the North American jet stream is shifted northward, likely leading to a higher incidence of storms over the lower Mississippi River basin and fewer storms over Florida. This is supported by the fact that the storm track also shows increased activity over the central U.S. during MJO Phases 5 - 7.