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The Role of Extratropical Controls in Northward Moisture Surges of the North American Monsoon

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Advanced understanding of the dynamics of the North American monsoon (NAM) is critical to the moisture-sensitive desert southwest region of the United States where upwards of 50% of the annual rainfall is contributed by the monsoon season of June through September. A key determinant in interannual summer precipitation variability across the central and southern interior western United States are the northward surges of subtropical moisture that penetrate into the midlatitudes. Prior research into initiation mechanisms for these NAM-associated moisture surges has been limited to dynamical mechanisms inherent to tropical and sub-tropical latitudes, such as easterly waves. A novel approach is considered in this study by examining the role of extratropical features in both initiating and enabling NAM surge events. Observational evidence indicates that surge events can be triggered through an extratropical-tropical feedback process initiated by Rossby wave breaking east of the upper-tropospheric monsoonal ridge. In the wake of wave breaking, a positive vorticity eddy, or tropical upper tropospheric trough (TUTT), is injected into the subtropical latitudes, thereby invoking a mechanism for the return flow of moisture into midlatitudes across the south and central interior western United States. Results also suggest that the northward surge of subtropical moisture associated with the proposed Rossby wave breaking-TUTT triggering mechanism is further sensitive to the midlatitude background flow, providing additional evidence that the extratropics play a decidedly vital function in the NAM system.