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Spatiotemporal Patterns and Synoptics of Extreme Wet-Bulb Temperature in the Contiguous United States

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Extremes of wet-bulb temperature (WBT)—jointly reflecting temperature and specific humidity —have seen relatively little study in terms of climatology, despite their demonstrated relevance for health and economic impacts. In this study, we uncover and characterize distinct spatiotemporal patterns of WBT extremes in the contiguous United States for the 1981–2015 period, focusing on identifying and making a first pass at understanding regional differences. We find that anomalies of specific humidity are of greater importance than those of temperature in controlling extreme WBT in most of the contiguous U.S., particularly for southern and arid regions. Composites of extreme-WBT days for each region reveal coherent sea-surface temperature anomalies and midlevel and upper-level geopotential-height anomalies that differ considerably between regions, particularly in terms of the resulting low-level temperature and moisture fields. These findings suggest that the primary factors controlling the timing and intensity of WBT extremes, while ultimately forced by synoptic-scale weather patterns, vary spatially according to both local geography and baseline climate. We demonstrate this conclusion by showing how regional features such as late-summer WBT extremes in the Southwest and southern Great Plains derive primarily from spatial and temporal variations in moist low-level flows.