A North Pacific Jet Phase Diagram Perspective on Extreme Weather Events during 2016–2017: Illustrative Examples

by

Lance F. Bosart, Andrew C. Winters, and Daniel Keyser

Department of Atmospheric and Environmental Sciences
University at Albany, State University of New York
Albany, NY 12222

A previous presentation by Keyser et al. (2017) suggested that extreme weather events (EWEs) during a single season contribute disproportionately to temperature and precipitation anomaly statistics for that particular season. This disproportionate contribution of EWEs to seasonal anomalies motivated a need to consider EWEs in understanding the dynamical and thermodynamic processes that operate at the weather–climate intersection. Keyser et al. (2017) also suggest that correct forecasts of EWE occurrences were necessary to produce successful operational probabilistic medium-range (8–10-day) temperature and precipitation forecasts. Considerable variability characterizes the antecedent environments over the North Pacific prior to the development of EWEs over the CONUS. This variability motivated the development of the North Pacific Jet (NPJ) phase diagram described in the preceding presentation to provide an objective tool to characterize the NPJ regime and the evolution of the upper-tropospheric flow pattern over the North Pacific prior to the development of EWEs.

We will illustrate the ability of the NPJ phase diagram to provide forecasters a “first alert” of the potential for EWE development from a sample of illustrative recent high-impact weather events. Illustrative examples will be drawn from a subset of high-impact EWEs that impacted the CONUS between autumn 2016 and summer 2017 such as: (1) heavy rains in South Carolina in early October 2016, (2) exceptionally heavy rains in California in early January 2017, (3) severe winter weather in Oregon and Washington in January 2017, (4) a severe winter storm in the Northeast on 8–9 February 2017, (5) additional heavy rains in California in late January and mid-February 2017, (6) strong upper-level ridging and an associated “heat wave” across the central and eastern CONUS in mid-February 2017, (7) unexpectedly heavy rains in the San Diego, California, area on 27–28 February 2017, and (8) the northeastern CONUS “Slushmageddon” aka “Pi” day storm of 13–14 March 2017. These illustrative EWEs occurred on a variety of temporal and spatial scales and featured a variety of relatively short predictability horizons. Application of the NPJ phase diagram methodology to these EWEs will be used to illustrate the sensitivity of EWE predictability horizons to upstream disturbances and jet stream configurations.