

Thunderstorms and associated cloud-to-ground (CG) lightning are a major cause of wildfire ignition across the western United States (US). Motivated by a lack of a multidecadal climatology of lightning and associated weather patterns across the region, we utilize a 30-year dataset of National Lightning Detection Network daily lightning activity (1988-2017) to establish a climatology of CG lightning occurrence across the western US. We then characterize the atmospheric conditions, both dynamic and thermodynamic, associated with lightning activity above a chosen threshold across the region. The results of a comprehensive, location-relative analysis reveal a preferred synoptic meteorological setup across the region that features 1) positive 500-hPa geopotential height anomalies to the northeast of the location experiencing the outbreak, and 2) negative sea level pressure anomalies in the vicinity and to the northwest of the typical location. The western and northern periphery of the study domain, including the Pacific Northwest interior as well as the Sierra Nevada, show positive anomalies of greater magnitude across analyzed indices of moisture and instability on active lightning days compared with areas to the south and east, in addition to greater amplification of the synoptic circulation fields. This work provides an observation-based foundation for estimating future changes in CG lightning activity across the western US in climate model projections using driving meteorological patterns, helping to understand possible changes in wildfire ignitions and other related hazards across this region.