@article{Kalashnikov2025ef,
  abstract = {Cloud-to-ground (CG) lightning is a major source of summer wildfire ignition in the western United States (WUS). However, future projections of lightning are uncertain since lightning is not directly simulated by most global climate models. To address this issue, we use convolutional neural network (CNN)-based parameterizations of daily June-September CG lightning. CNN parameterizations of daily CG lightning occurrence at each grid cell use fields of three thermodynamic variables—ratio of surface Moist Static Energy (MSE) to 500 hPa saturation MSE, 700–500 hPa lapse rate, and 500 hPa relative humidity. Applying these parameterizations to the Community Earth System Model version 2 Large Ensemble, we find widespread increases in CG lightning days across much of the region by the mid-21st century (2031–2060) under a moderate warming scenario. Projected increases are pronounced in the northern WUS where many grid cells experience 4–12 additional CG lightning days compared to 1995–2022 and are driven by increases in all three thermodynamic variables. To assess the risk of lightning-ignited wildfire (LIW) ignition, we also quantify the concurrence of CG lightning with high Fire Weather Index (FWI) days. By 2031–2060, CG lightning will coincide more frequently with high FWI, but the magnitude of increases relative to CG lightning days varies across the region. Future projections of CG lightning and LIW risk can be useful for understanding the changing risks of associated hazards, and guide wildland fire management and suppression planning.},
  author = {Dmitri A. Kalashnikov and John T. Abatzoglou and Frances V. Davenport and Zachary M. Labe and Paul C. Loikith and Danielle Touma and Deepti Singh},
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