

Enhanced Pacific Northwest Heat Extremes and Wildfire Risks Induced by the Boreal Summer Intraseasonal Oscillation

Sandro W. Lubis^{a,*}, Ziming Chen^a, Jian Lu^a, Samson Hagos^a, Chuan-Chieh Chang^a, L. Ruby Leung^a

^aPacific Northwest National Laboratory, Richland, WA, USA

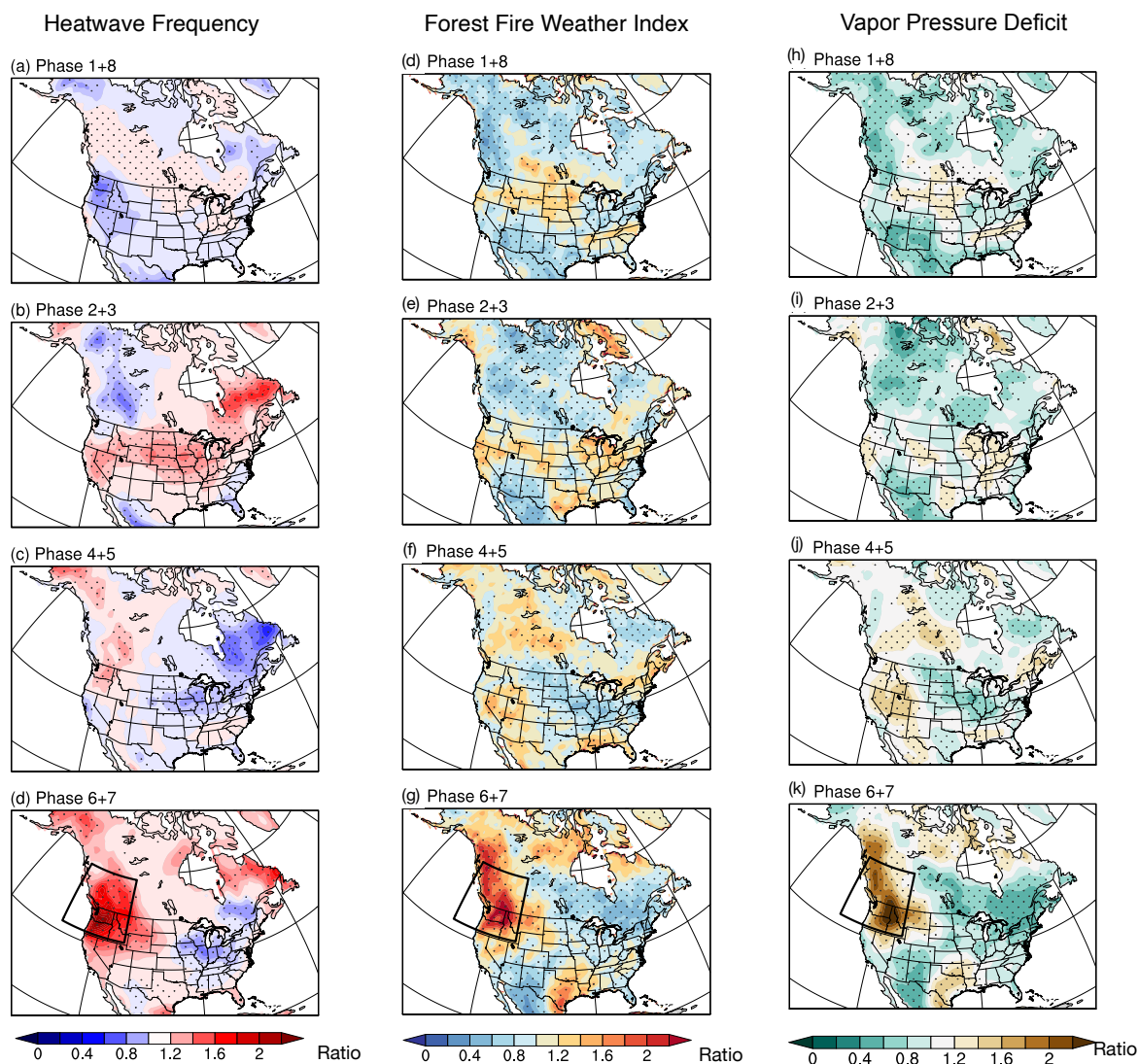


Fig S1 (a-d) Probability ratio of occurrence (frequency) of heatwave events during different BSISO pair phases relative to the climatological occurrence in JJA. Probability composites are calculated by counting the number of heatwave days within the first two pentads (0-9 days) following each BSISO phase. Stippling denotes values that are statistically significant at the 95% confidence level, based on a bootstrap test. (d-g) Similar to (a-d), but for the daily FWI. (h-k) Similar to (a-d), but for the daily VPD.

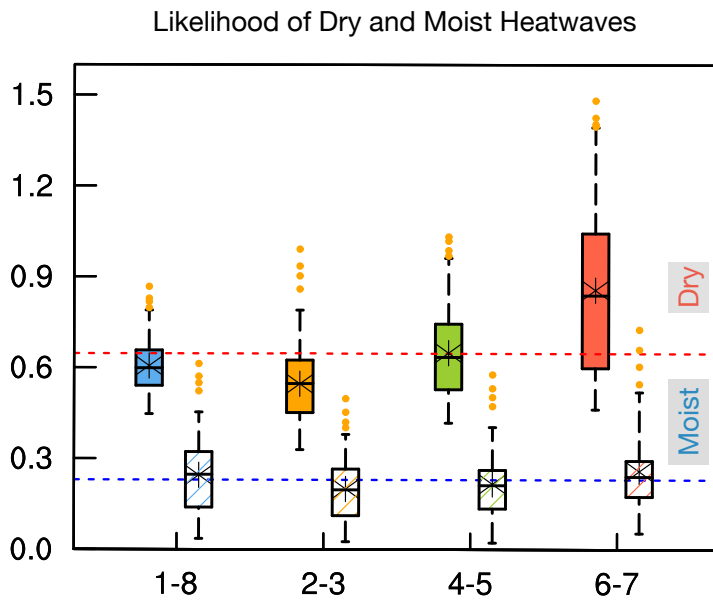


Fig S2 Probability ratio of dry heatwave frequency (color-filled bar) and moist heatwave frequency (raster-filled bar) averaged over the PNW (42-57°N, 112-130°W) in the 0-9-day period following the various BSISO phases. The horizontal dashed line represents the mean averaged across all phases.

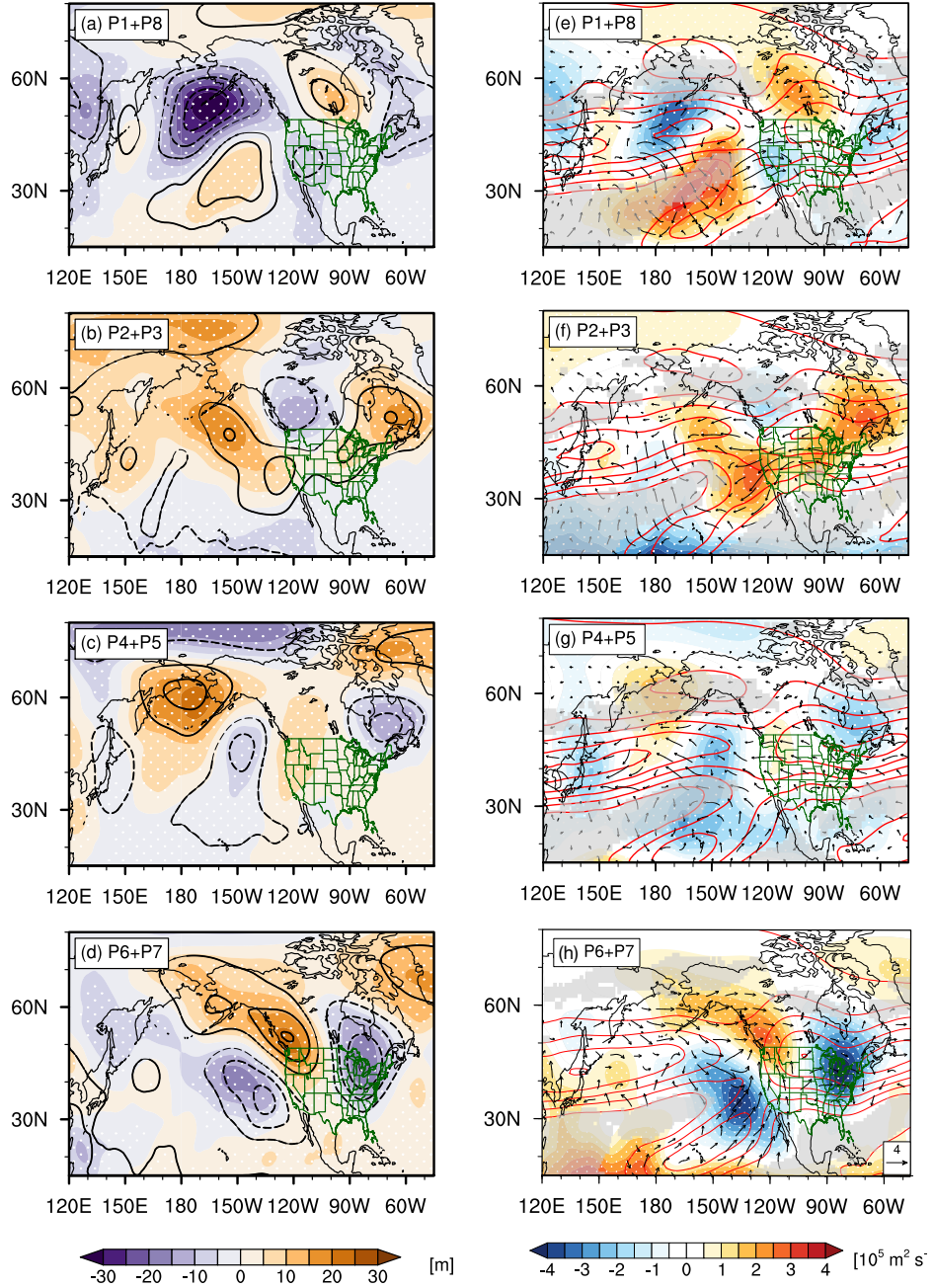


Fig S3 (a-b) Composite of GPH500 (color shading) and GPH200 (black contour line) anomalies averaged over the 0-9-day period following different BSISO phases: (a) phases 8-1 and (b) phases 2-3, (c) phases 4-5 and (d) phases 6-7. Stippling and bold contour lines indicate values that are statistically significant at the 95% level. (e-h) Same as (a-d) except for the composite of stream function (SF, color shading) and wave activity flux (WAF, vectors) anomalies at 200 hPa. The red contour line indicates the composite of daily zonal wind at 200 hPa. Gray shading indicates wave evanescence regions ($Ks \leq 0$).

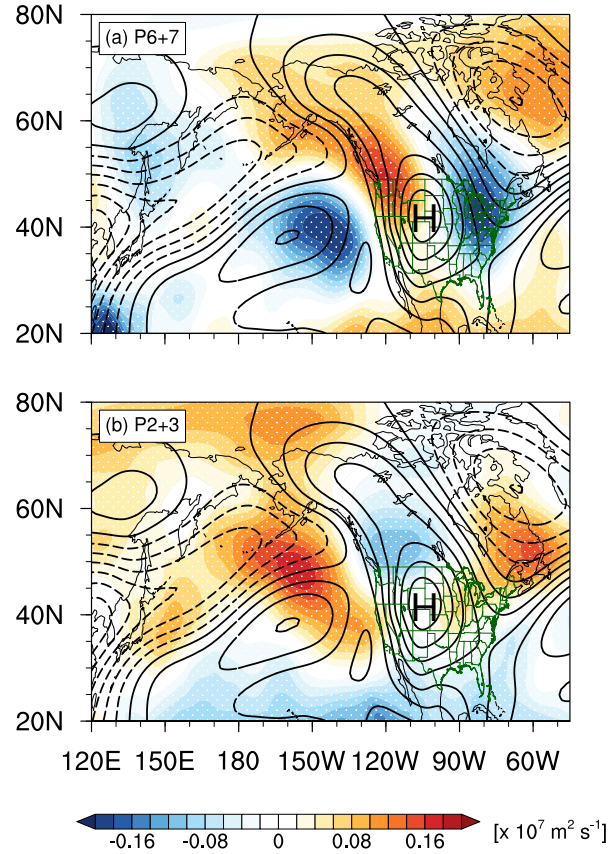


Fig S4 Composite of quasi-stationary eddy streamfunction anomalies (color shading) calculated following Takaya and Nakamura (2001) during BSISO phases (a) 6-7 and (b) 2-3 at 500 hPa, averaged over the 0-9-day period following each phase. Contour lines represent boreal summer (JJA) stationary wave streamfunction, calculated following Wills et al. (2019) based on the seasonal mean of u and v (with the eddy component defined as the deviation from the zonal mean). It is clear that quasi-migratory wave trains induced by BSISO phases 6-7 (2-3) strengthen (weaken) the summer background ridge over the PNW.

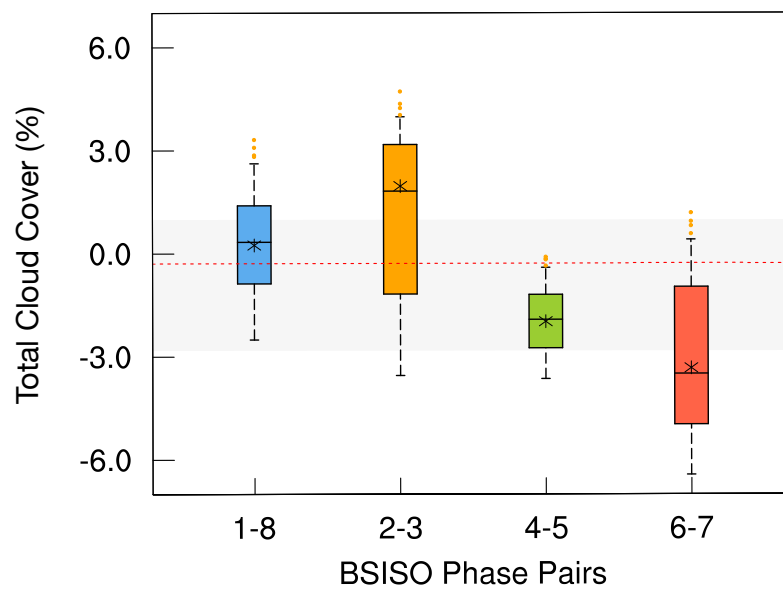


Fig S5 The daily total cloud cover (TCC) anomaly averaged over the PNW (42-57°N, 112-130°W) for the 0-9-day period following different BSISO phases. The gray shading illustrates the region within one standard deviation.

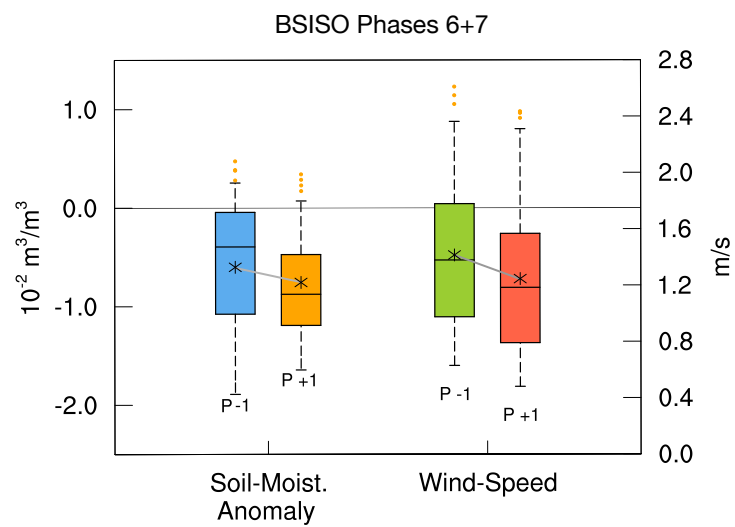


Fig S6 Anomalies of the soil moisture and wind speed averaged over the PNW (42-57°N, 112-130°W) for pentads -1 and +1 during BSISO phases 6-7.

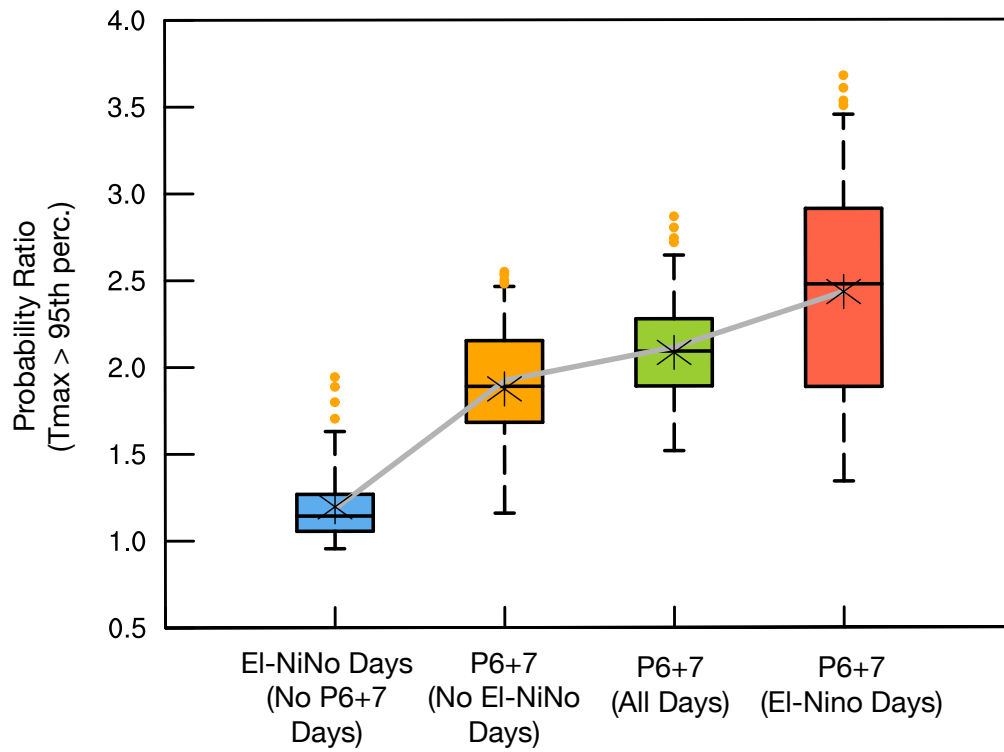


Fig S7 Composite of the GPH500 anomalies averaged over the PNW (42-57°N, 112-130°W) during BSISO phases 6-7, with and without El Niño days. ENSO years are selected when the average of Southern Oscillation Index (SOI) exceeds a threshold of 4 (one standard deviation). The SOI is a standardized index based on the observed sea level pressure differences between Tahiti and Darwin, Australia.