Supplement of Biogeosciences, 22, 7591–7610, 2025
https://doi.org/10.5194/bg-22-7591-2025-supplement

Biogeosciences Open Access EGU

Supplement of

Global wildfire patterns and drivers under climate change

Hemraj Bhattarai et al.

Correspondence to: Maria Val Martin (m.valmartin@sheffield.ac.uk) and Amos P. K. Tai (amostai@cuhk.edu.hk)

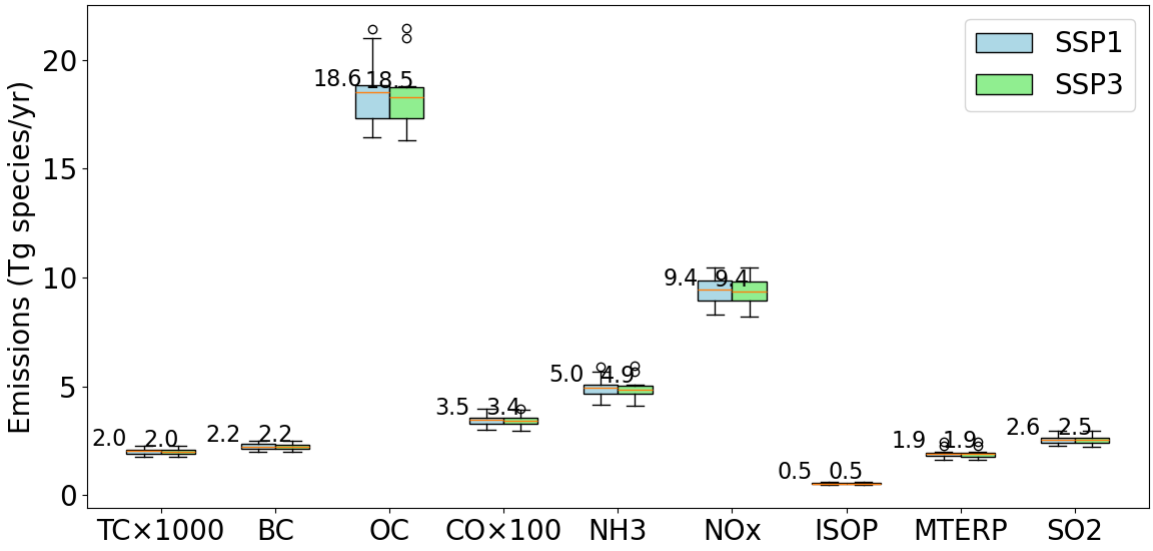

Figure S1. Comparison of global annual emissions of main fire emitted species including total carbon (TC), black carbon (BC), organic carbon (OC), carbon monoxide (CO), ammonia (NH_3), nitrogen oxide (NO_x), isoprene (ISOP), monoterpene (MTERP), and sulfur dioxide (SO_2) under two Shared Socioeconomic Pathways: SSP1 and SSP3 during 2015–2024.

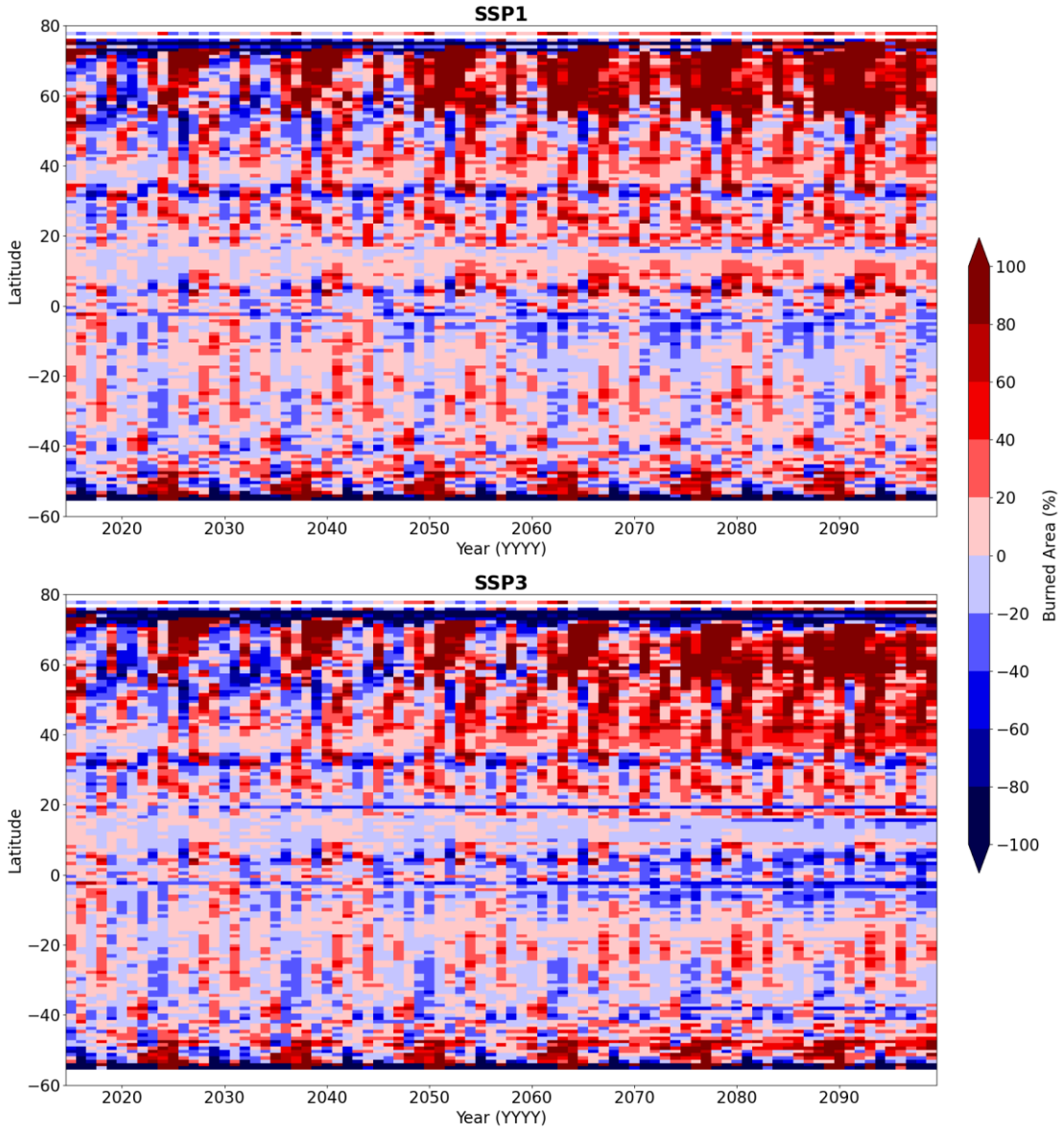

Figure S2. Yearly differences in burned area from 2015 to 2099 under SSP1 and SSP3 scenarios. BA average of 2015 to 2024 (10 years) is used to find the difference, which is also treated as a "Baseline" year in this study.

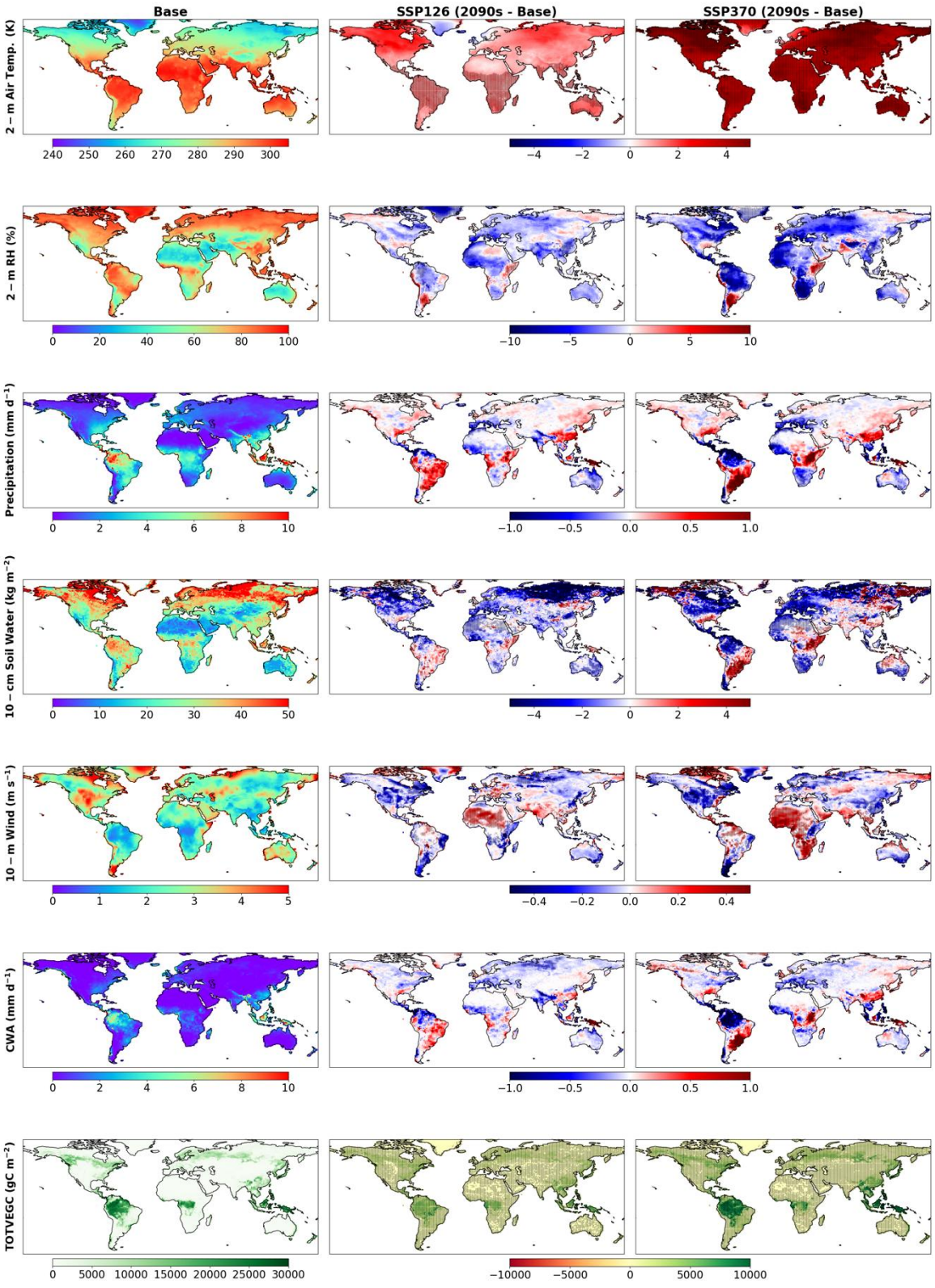

Figure S3. Spatial variation of 2-m air temperature, 2-m RH, precipitation, 10-cm soil water, 10-m wind, climate water availability (CWA), and total vegetation carbon (TOTVEGC) at present day and their future differences in SSP1 and SSP3. Dots indicate areas with a 95% significance level.

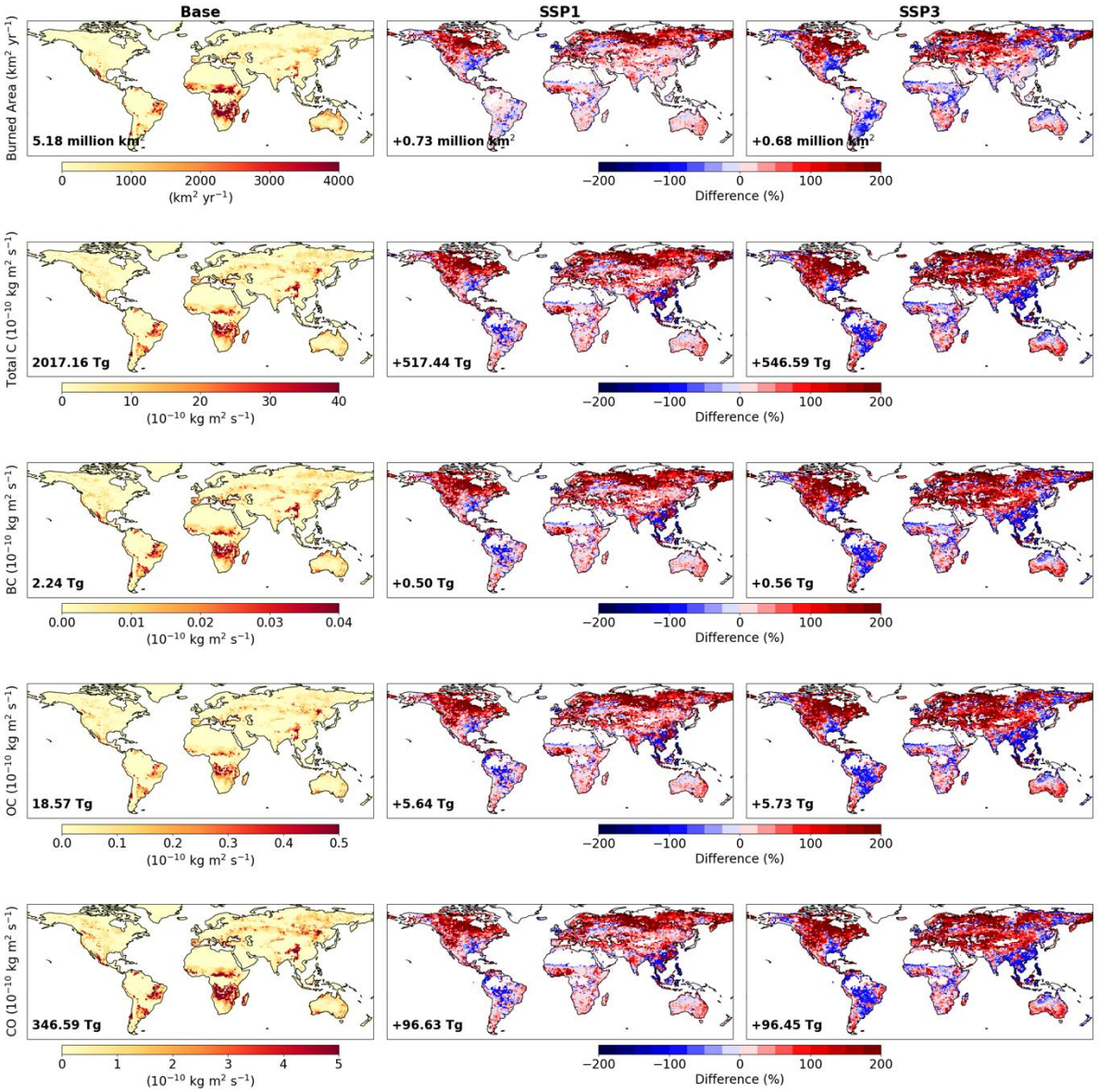

Figure S4. Base year level for burned area (BA) and carbon emissions and their percentage difference in SSP1 and SSP3. Percentage difference in BA and carbon emissions [future (2090 to 2099) – baseline (2015 to 2024)] under SSP1 and SSP3 scenarios are estimated from their respective baseline.

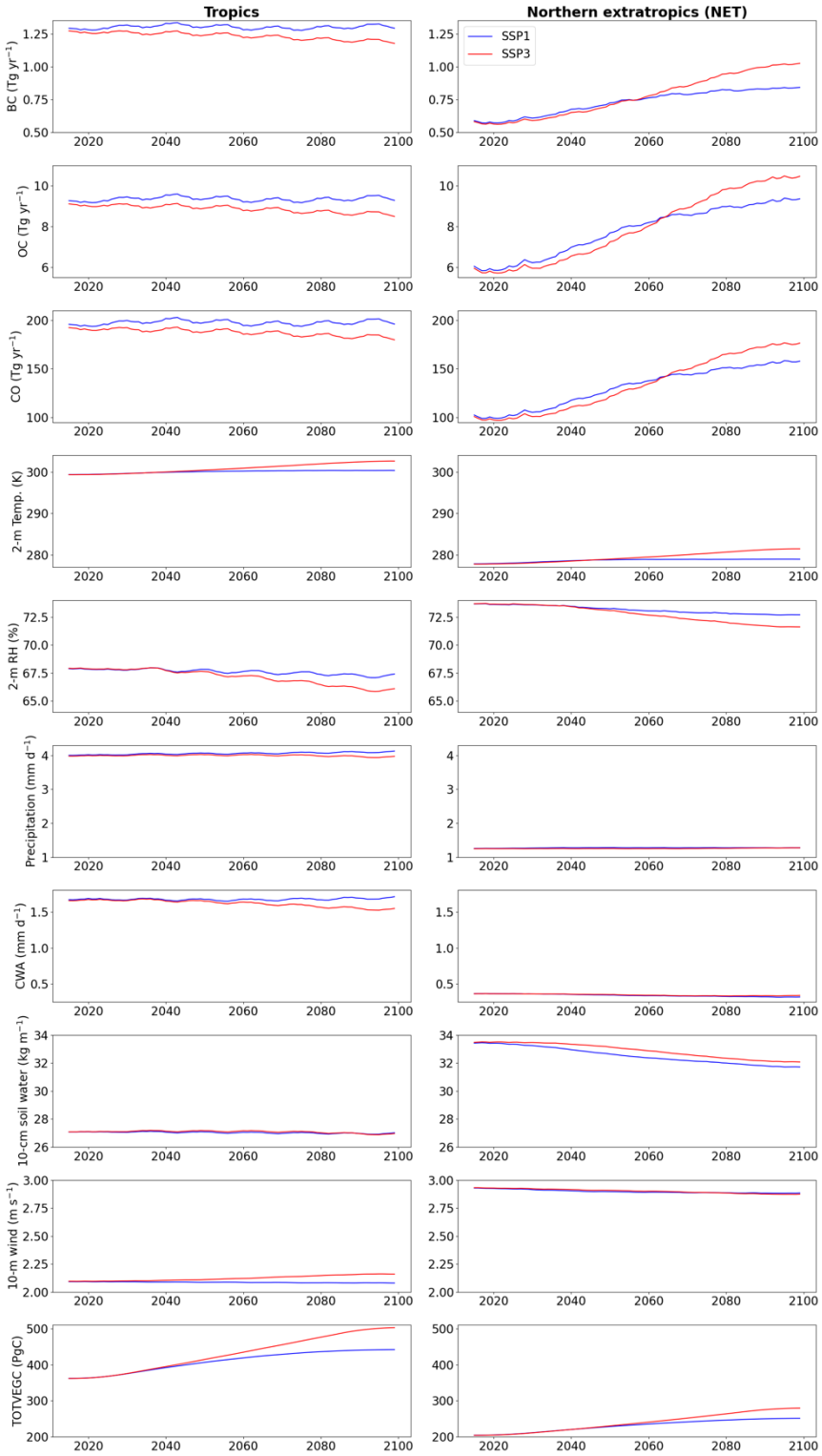

Figure S5. Trend analysis of carbonaceous species emissions (black carbon (BC), organic carbon (OC), carbon monoxide (CO)), meteorology (2-m air temperature, 2-m relative humidity (RH), precipitation, climate water availability (CWA = precipitation – evapotranspiration), 10-cm soil water, and 10-m wind speed), and total vegetation carbon (TOTVEGC) from 2015 to 2099 averaged over tropics (20°S–20°N) and boreal (30°N–70°N) region under SSP1 and SSP3 future scenarios. The time series is shown at a 30-year centered moving average.

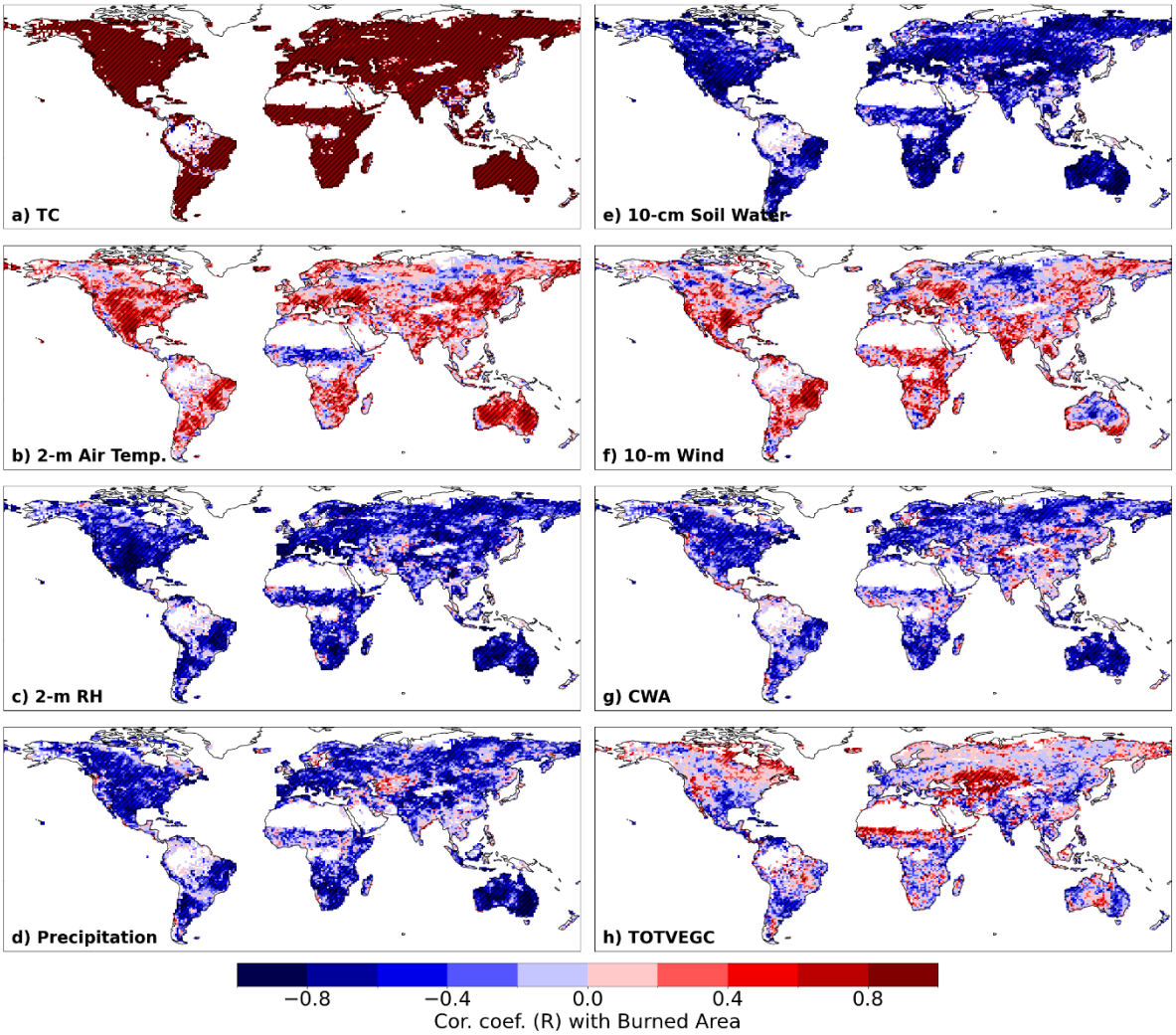

Figure S6. Pearson correlation (R) on annual mean time series data (2015 to 2100) between detrended burned area (BA) and (a) total carbon (TC), (b-g) meteorological variables (2-m surface temperature, 2-m relative humidity (RH), precipitation, 10-cm soil water, 10-m wild velocity, and climate water availability (CWA)), and (h) total vegetation carbon (TOTVEGC) under SSP3 scenario. Hatch lines are shown over regions with a 95% significant level.

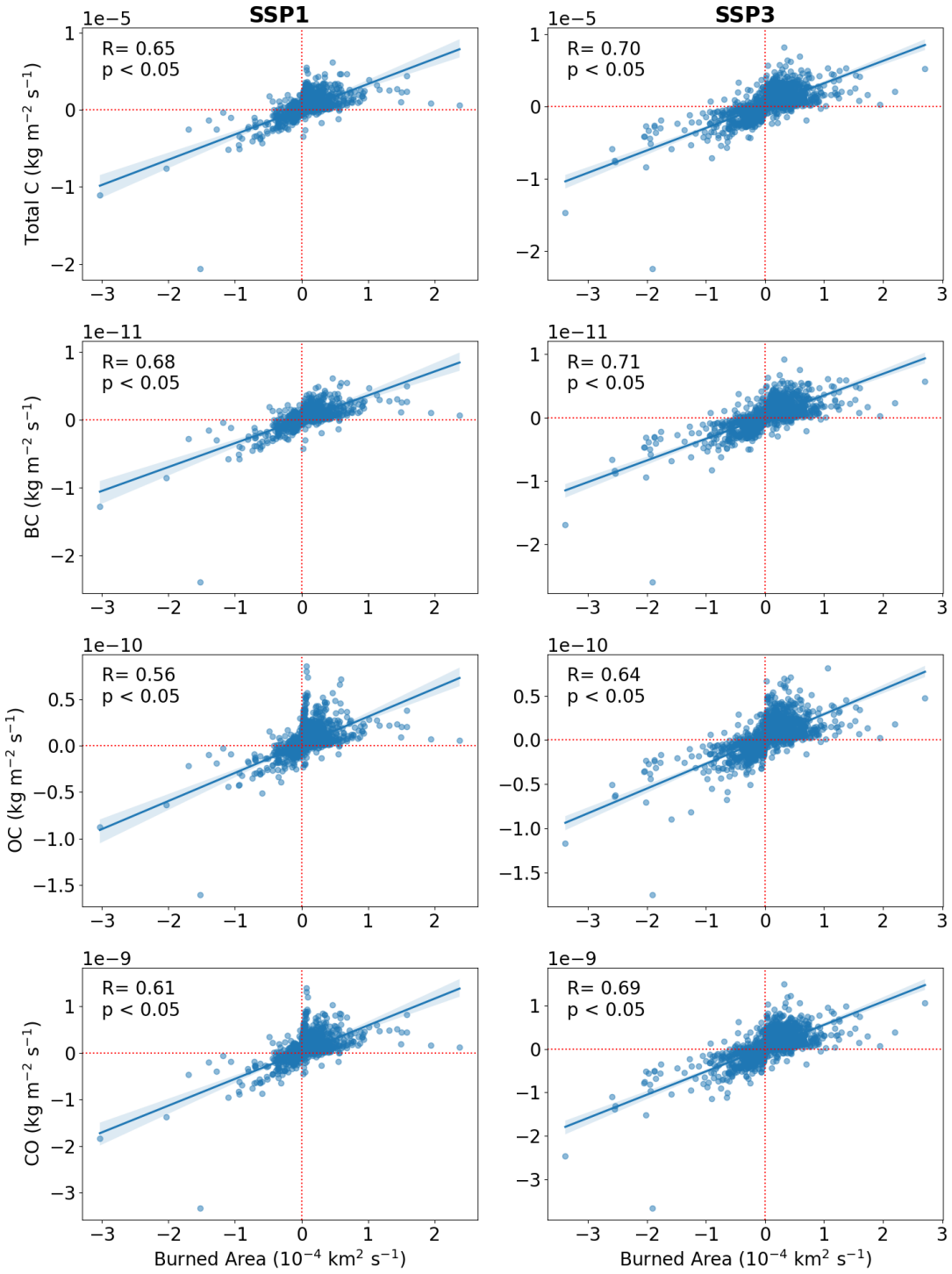

Figure S7. Pearson correlation coefficient of burned area with carbonaceous species (BC, OC, and CO). The difference (2090s – Base) values are taken to plot the scatter plot with regression line. The shaded area along the regression line represents the 95% confidence interval. The dotted red line shows the scatter points above and below zero coordinates, indicating the increase or decrease of respective variables as compared to the baseline.

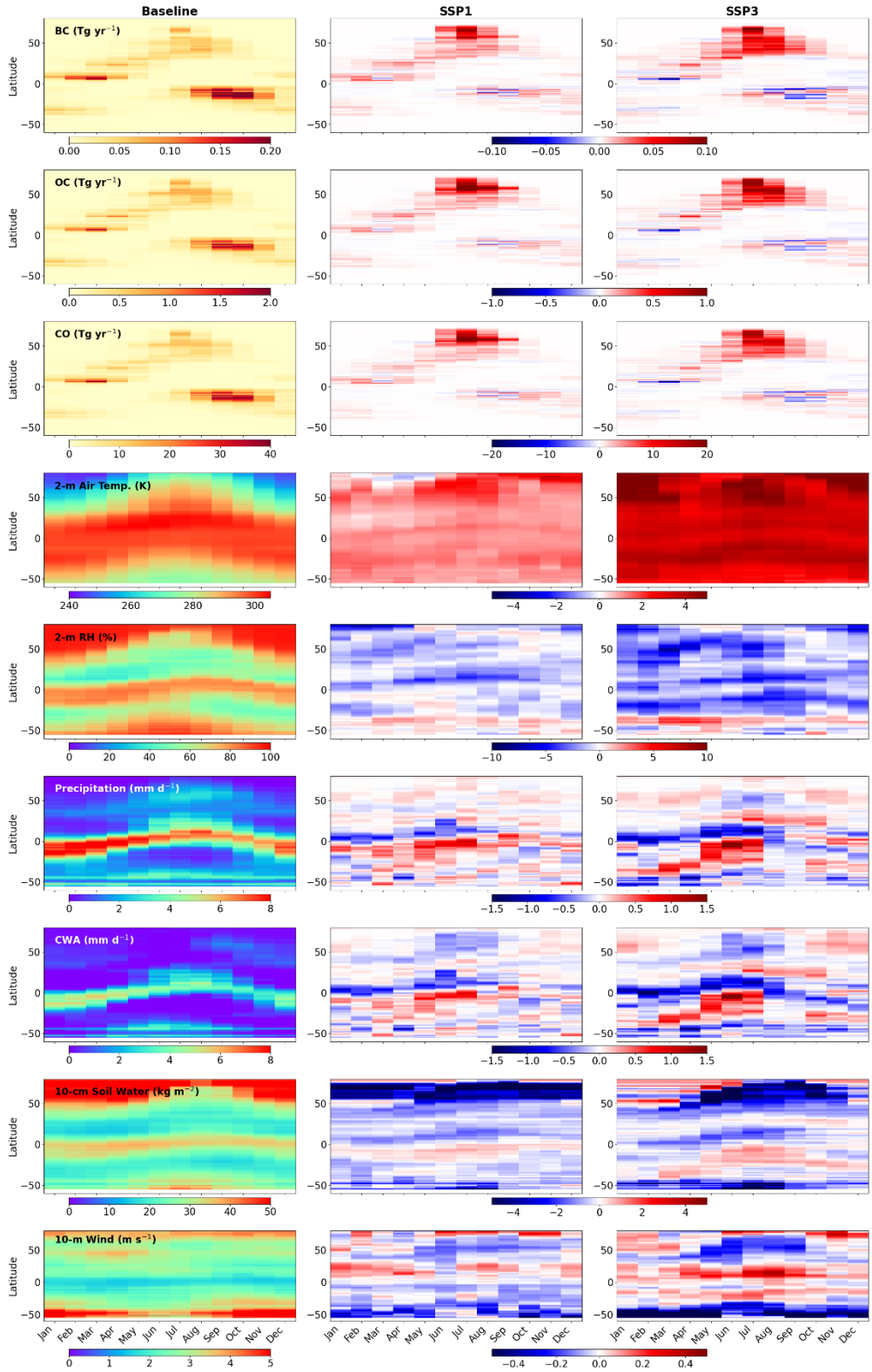

Figure S8. Latitudinal monthly variations in emissions of carbonaceous species (black carbon (BC), organic carbon (OC), carbon monoxide (CO)), and meteorological variables (2-m air temperature, 2-m RH, precipitation, climate water availability (CWA), 10-cm soil water, and 10-m wind) at baseline (2015-2024 average) and their future (2090-2099 average) differences in SSP1 and SSP3.

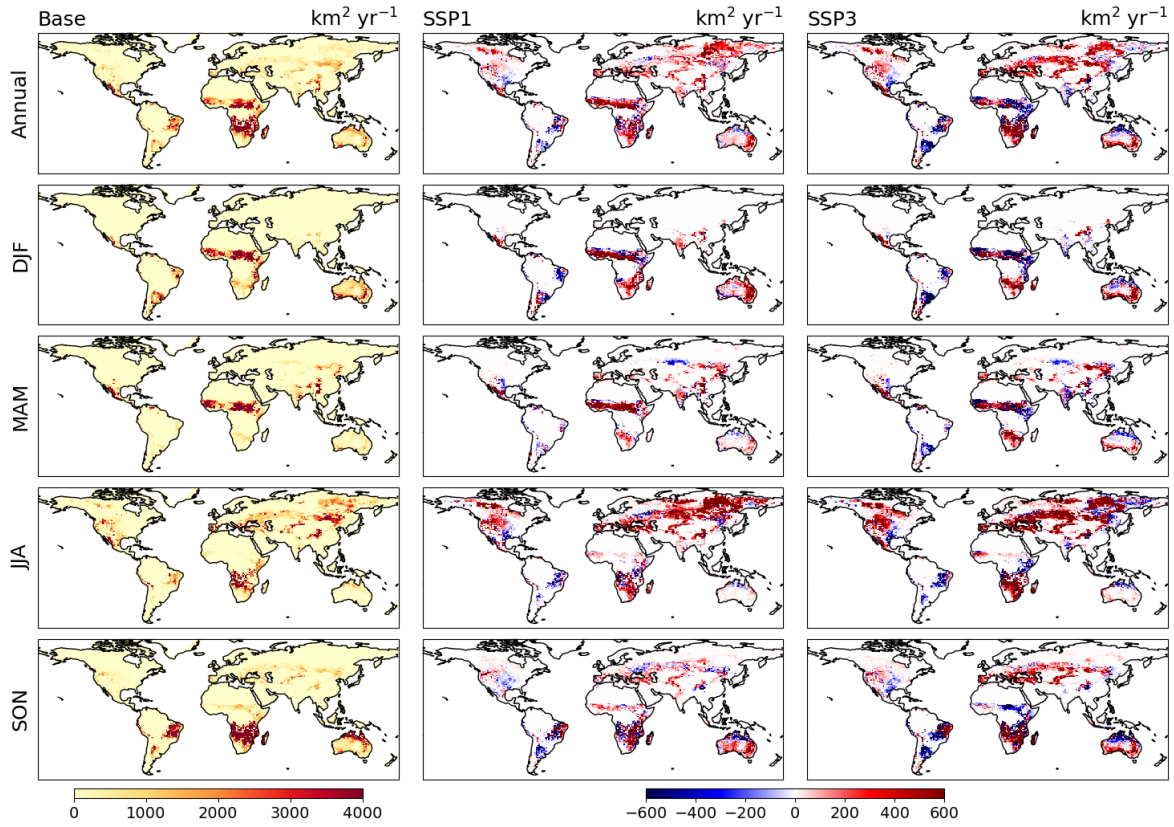

Figure S9. Annual and seasonal variation of burned area for the baseline and its future differences in SSP1 and SSP3.

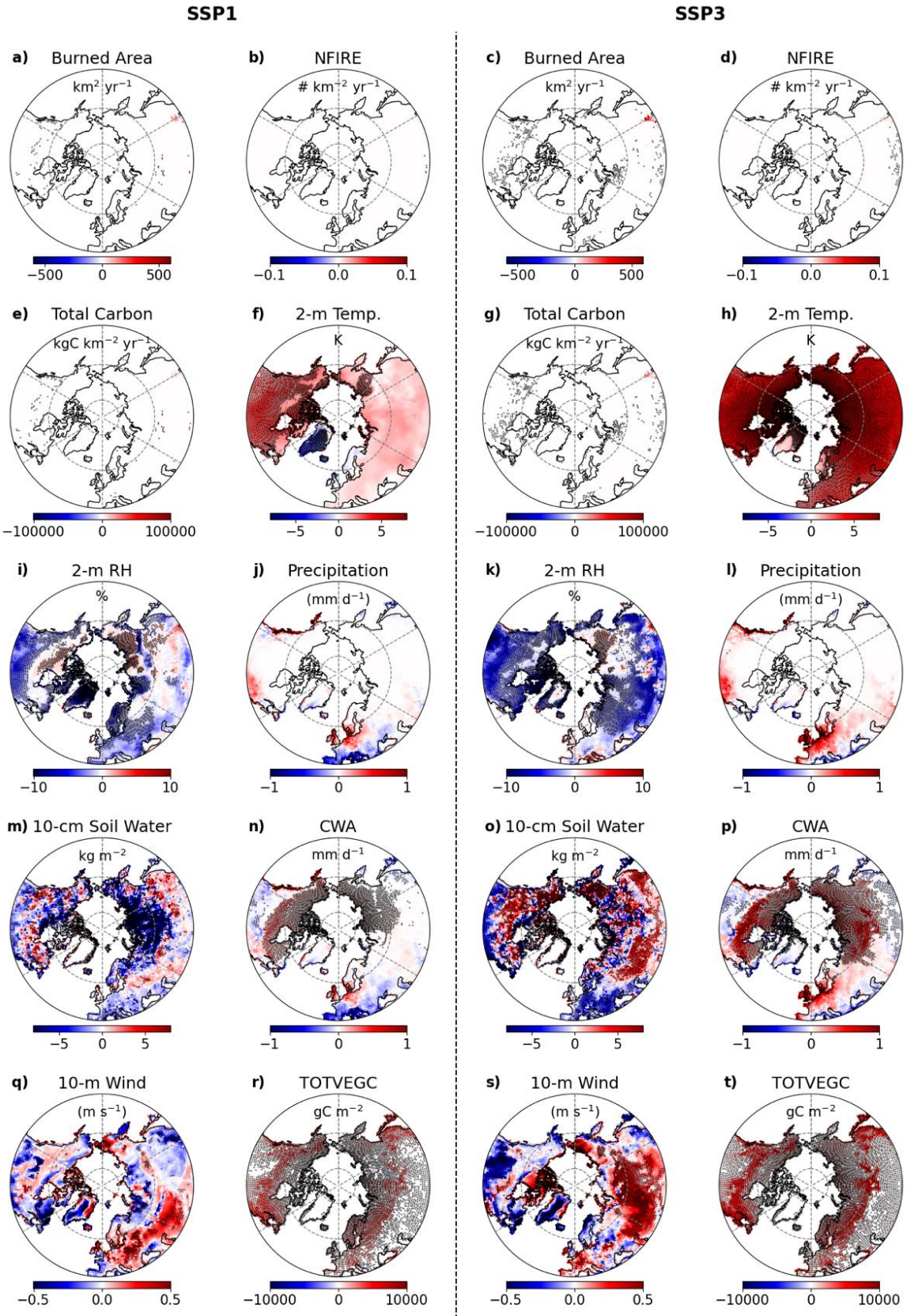

Figure S10. The 2090s winter (DJF) anomaly (relative to the present day) for modeled burned area, number of fires (NFIRE), carbon emissions, and meteorology in the boreal region (>40°N) for SSP1 and SSP3. Dots indicate areas with a 95% significance level.

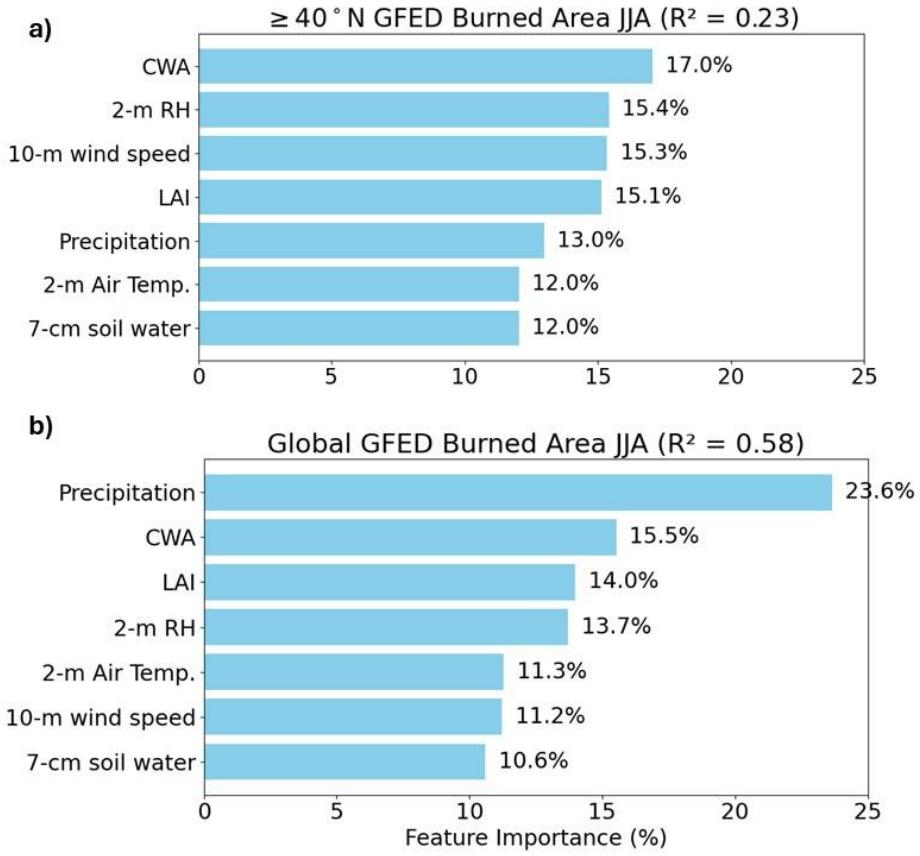

Figure S11. Feature importance of environmental drivers of GFED5 wildfire activity during 2007 to 2020 boreal summer (JJA) over (a) northern latitude (≥40°N) and (b) global using XGBoost machine learning model. The predictors (precipitation, climate water availability [CWA = precipitation - evapotranspiration], leaf area index (LAI), RH, temperature, wind speed and soil water) are based on ERA5 land.