Figure S1. Wilting point parameter $[m^3/m^3]$ from Chen and Dudhia (2001) gridded over the Med-CORDEX domain with the USGS soil types.

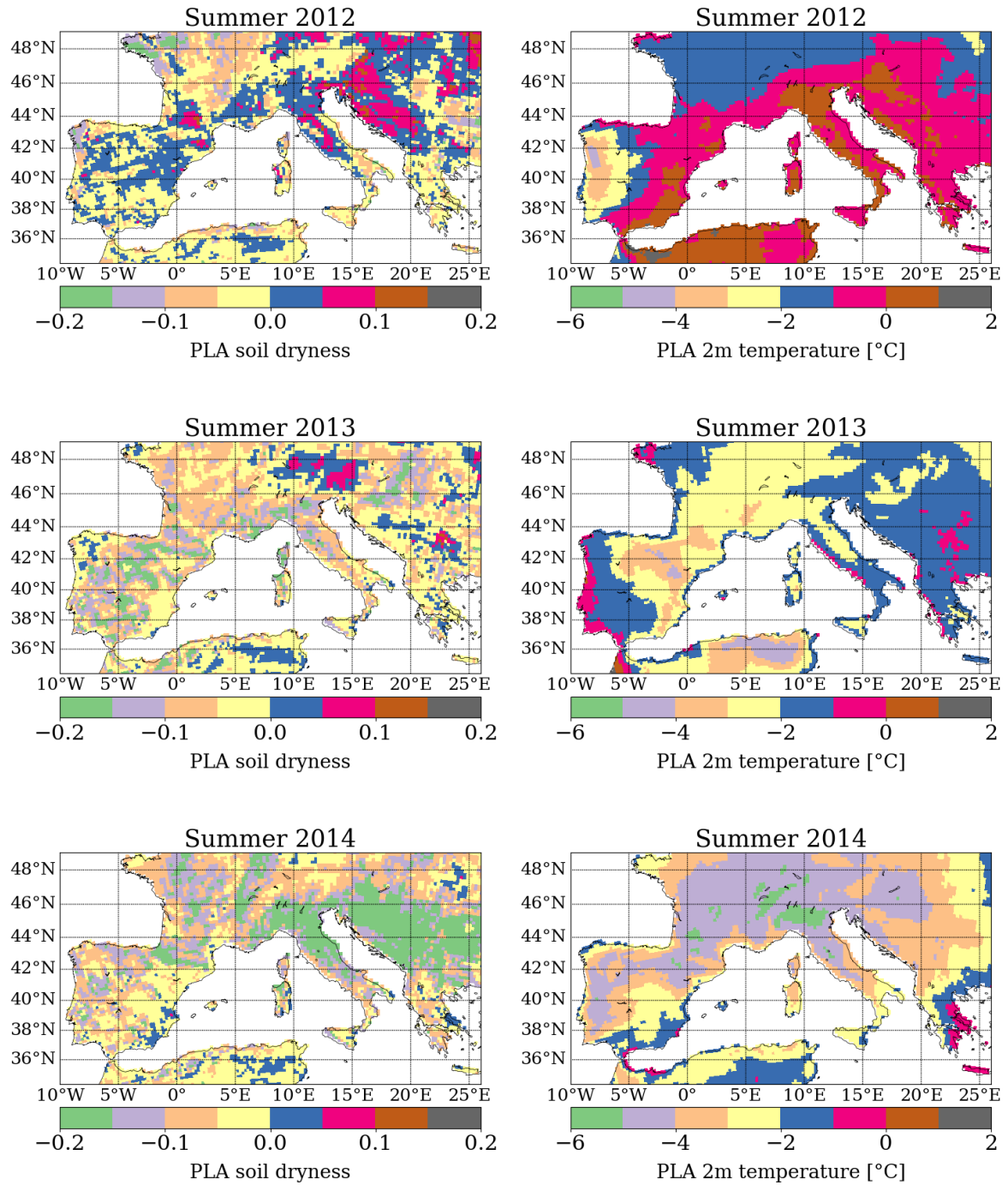**Appendix: Supplementary Information**

Figure S2. Summer mean (JJA) drought (PLA_{SD}) and heatwave indicators (PLA_{T2m}) for 2012, 2013 and 2014.
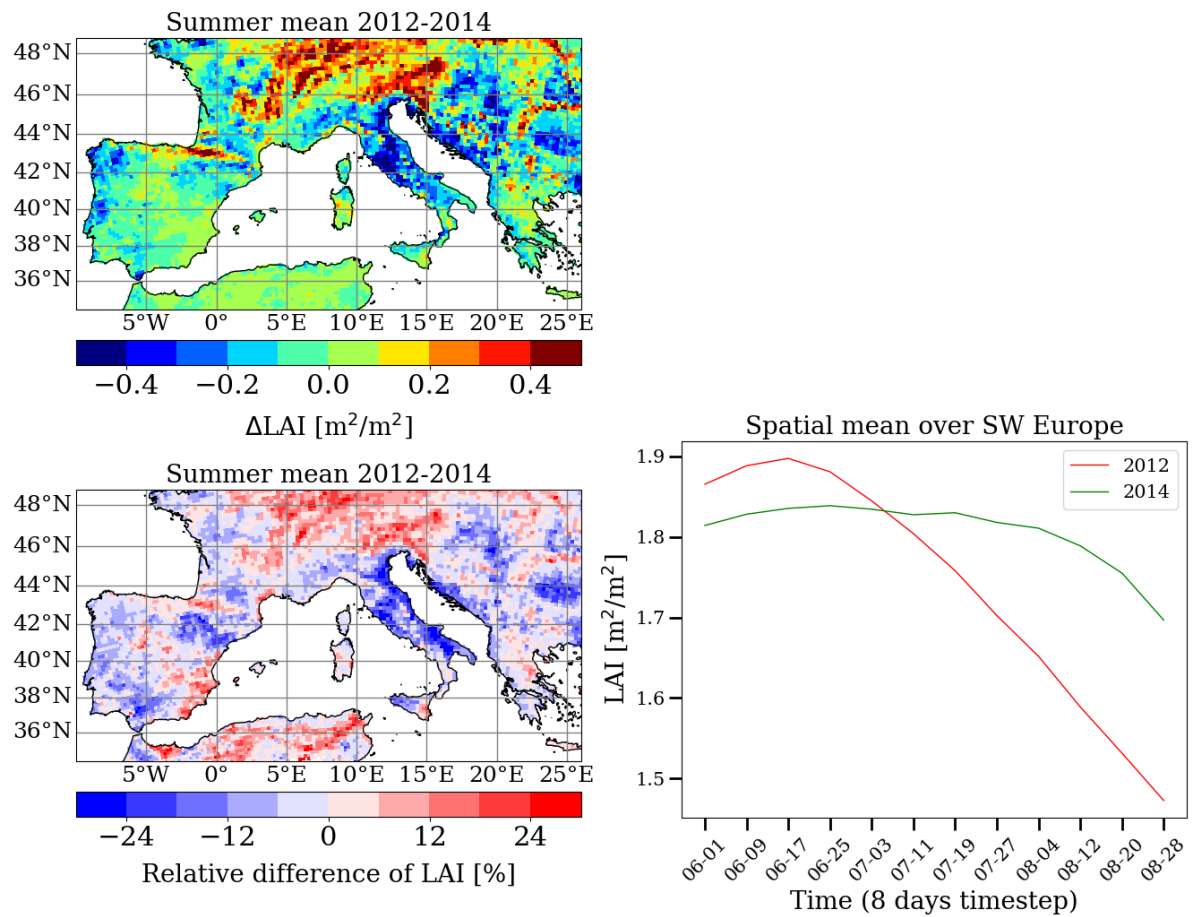
Figure S3. Mean ΔLAI $[m^2/m^2]$ between summer (JJA) 2012 and 2014 (upper left), relative difference of LAI (lower left) and time series of LAI spatially averaged over the Southwestern Europe (lower right).
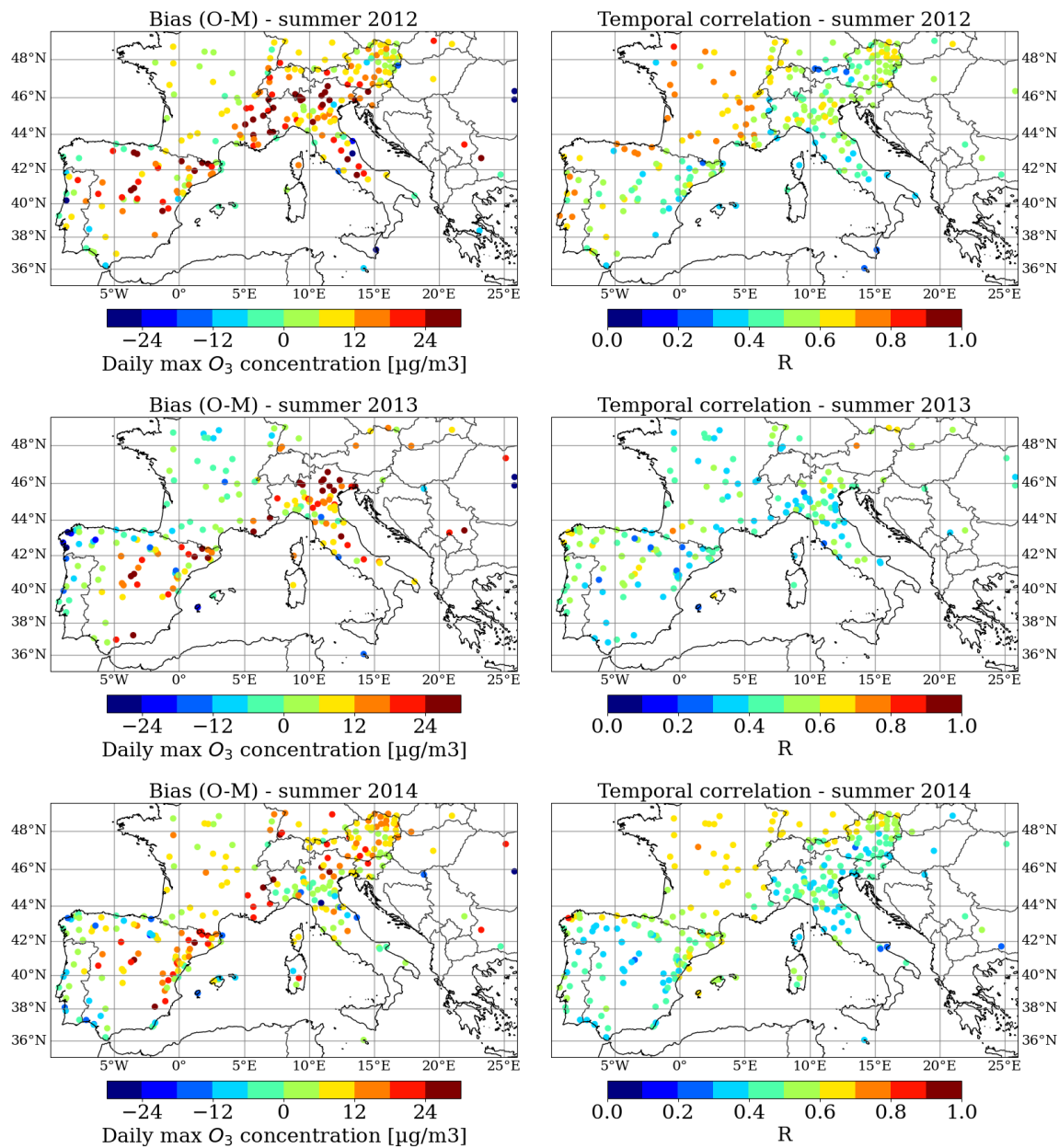
Figure S4. Validation scores of the daily maximum surface O_3 $[\mu g/m^3]$ for summer (JJA) 2012, 2013 and 2014 ("Reference" simulations), with the European surface network observations AQ e-Reporting. Left column: mean bias. Right column: temporal correlation (R pearson).
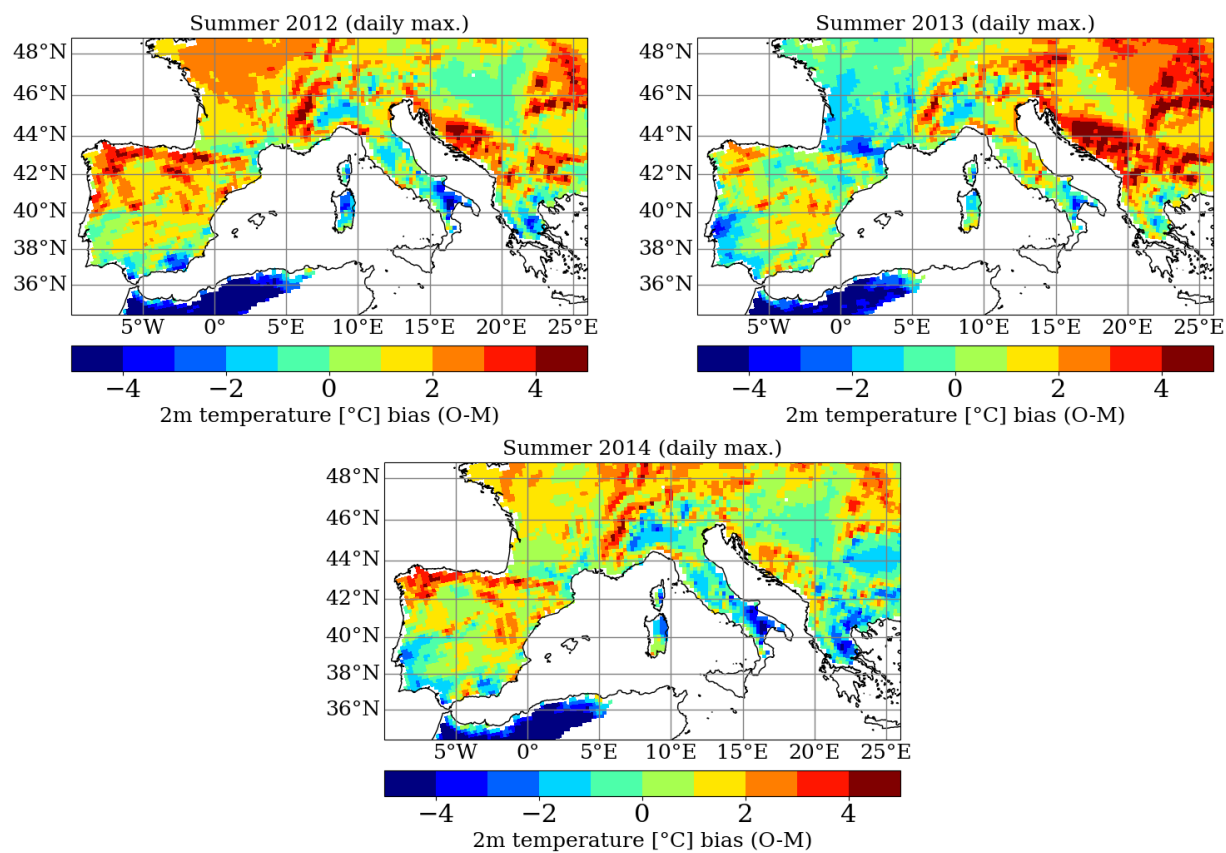
Figure S5. Summer mean bias (JJA) of the daily maximum 2m temperature between observations (E-OBS) and simulations (CHIMERE) for 2012, 2013 and 2014.
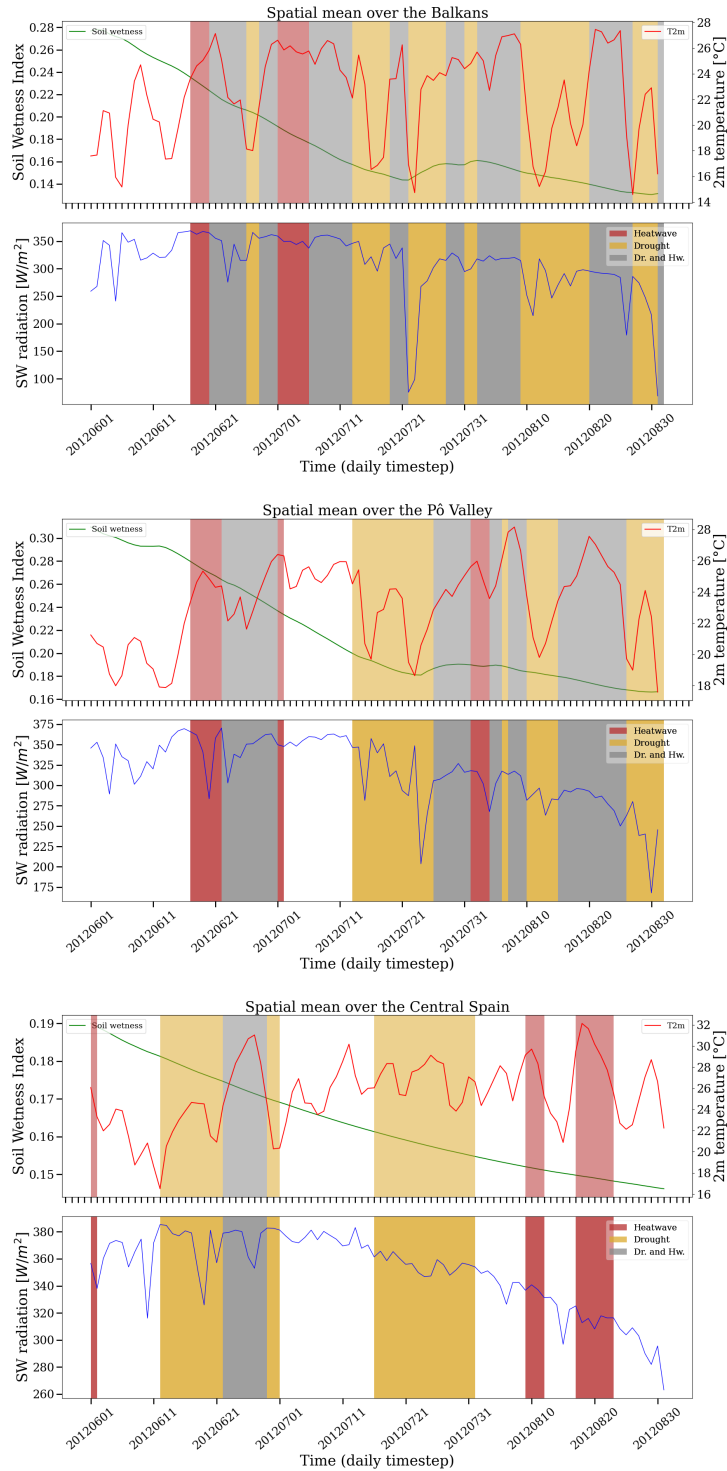
Figure S6. Daily mean 2m temperature, shortwave radiation and soil wetness simulated by the WRF model during summer 2012 over the Balkans (upper panel), Pô Valley (middle) and Central Spain (lower).
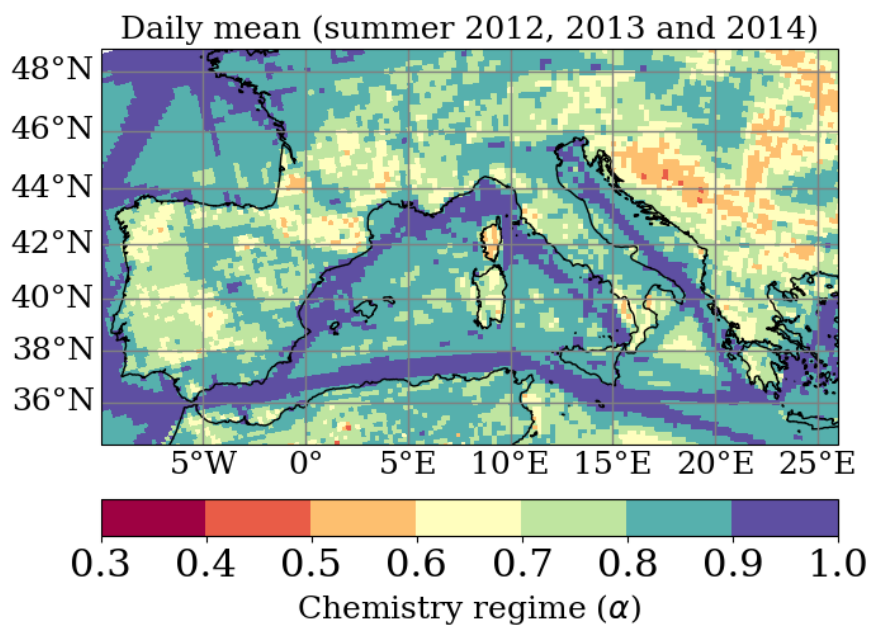
Figure S7. Daily mean chemistry regime parameter [α] averaged over the summer 2012, 2013 and 2014 ("Reference" simulations). α indicates the areas of low-NO_x regime (low α) and high-NO_x regime (high α). More information about the calculation method is provided on the online documentation (https://www.lmd.polytechnique.fr/chimere/).
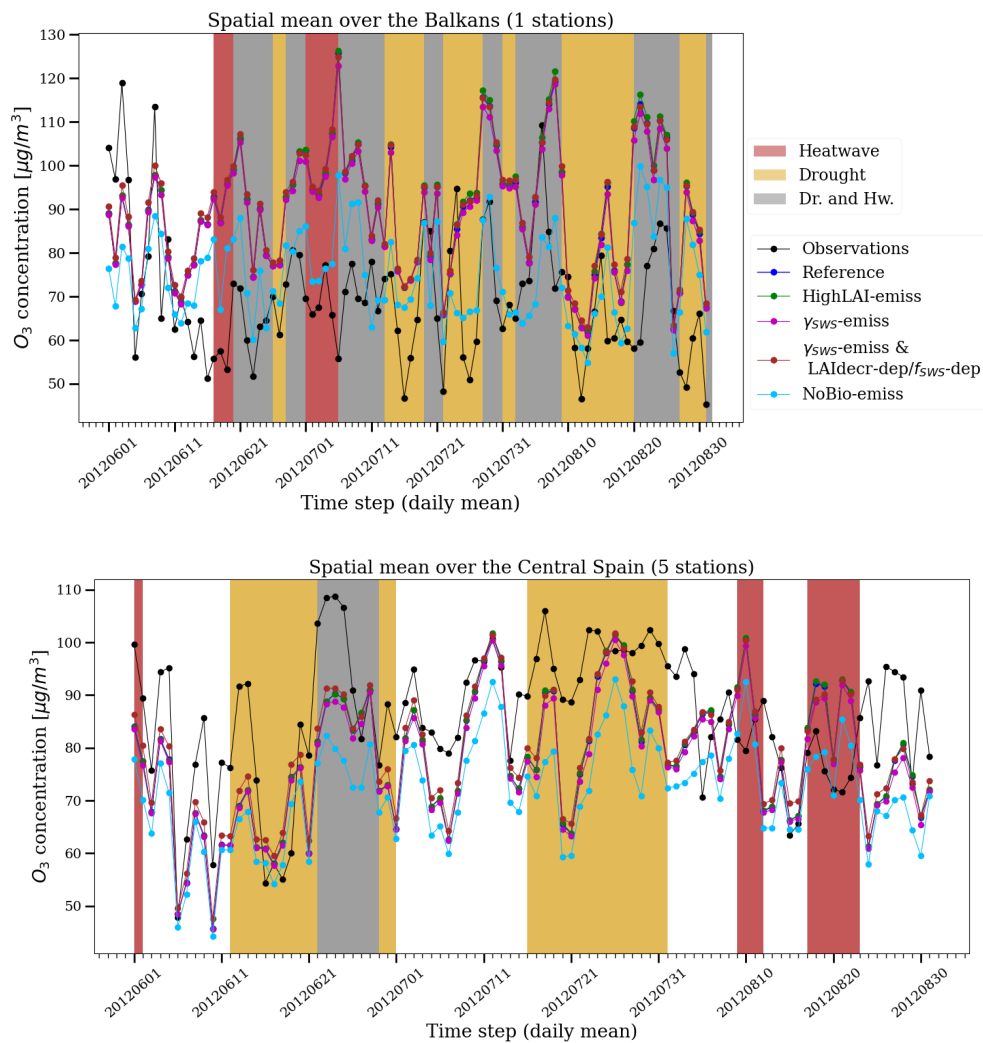
Figure S8. Daily mean O_3 surface concentration [$\mu g/m^3$] during summer 2012, spatially averaged over the Balkans (upper panel) and Central Spain (lower panel) from the EEA observations and the different CHIMERE experiments.
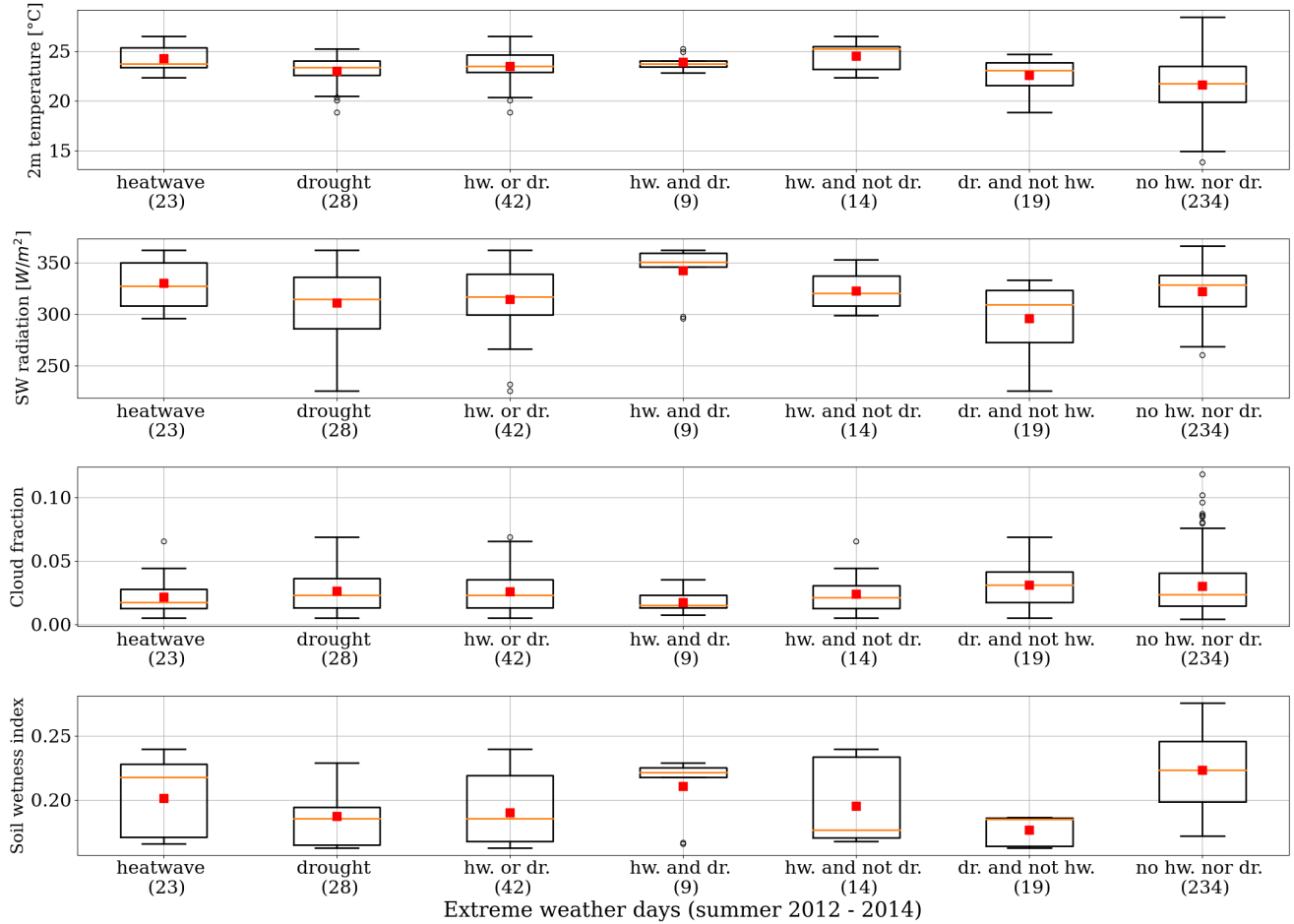
Figure S9. Simulated weather conditions (2m temperature, shortwave radiation, cloud fraction and soil wetness) by the WRF model over the Southwestern Europe, clustered by identified extreme weather events (from the RegIPSL model). The number of days is in parentheses. The analyzed period is summer 2012, 2013 and 2014, covering a total number of 276 days.
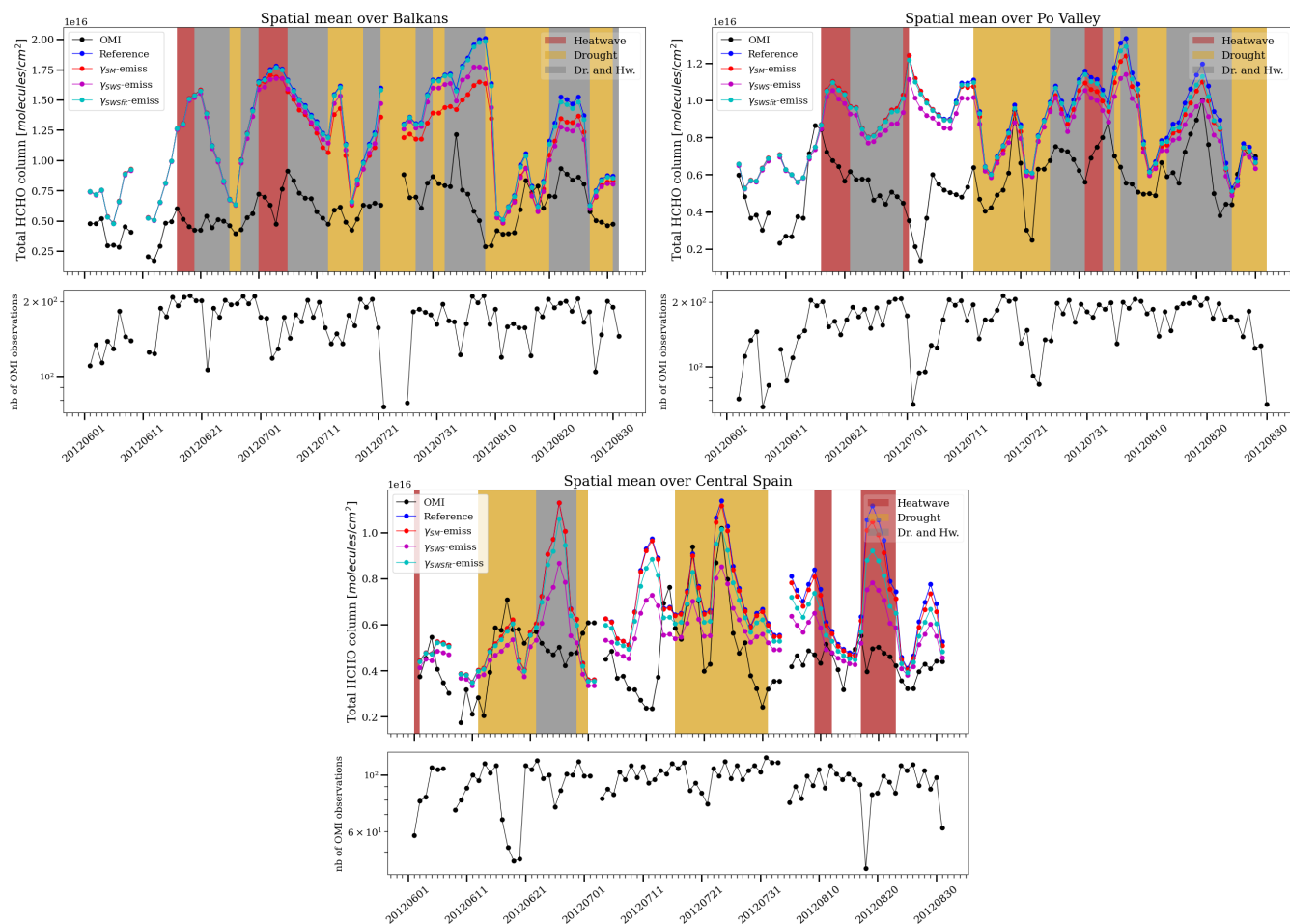
Figure S10. Daily HCHO total column [$molecules/cm^2$] during summer 2012 observed by OMI and simulated by CHIMERE, averaged over the Balkans (upper left panel), Pô Valley (upper right panel) and Central Spain (lower panel). A moving average window of 3 days is applied on observations and only days with at least 30% of data over the spatial cover are kept. The number of observations (OMI pixels) is indicated below each panel.