# Exploring the interplay between observed warming, atmospheric circulation, and soil-atmosphere feedbacks on heatwaves in a temperate mountain region

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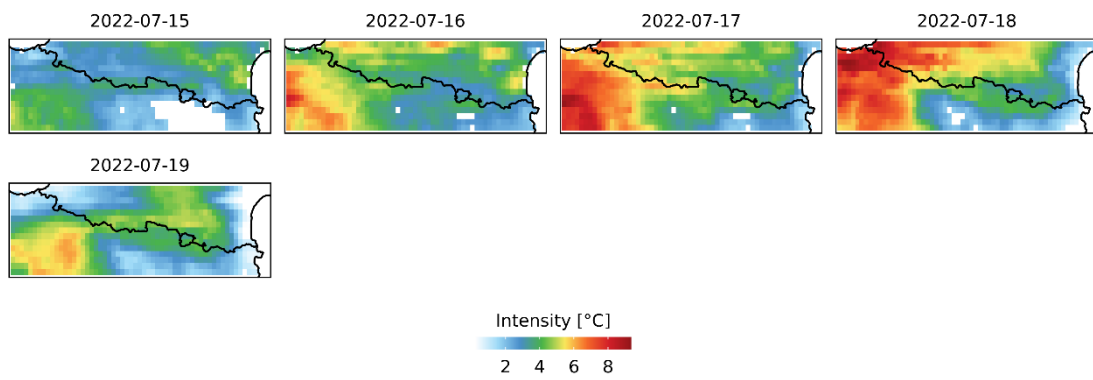*Correspondence to*: Marc Lemus-Canovas (marc.lemusicanovas@eurac.edu)

a)
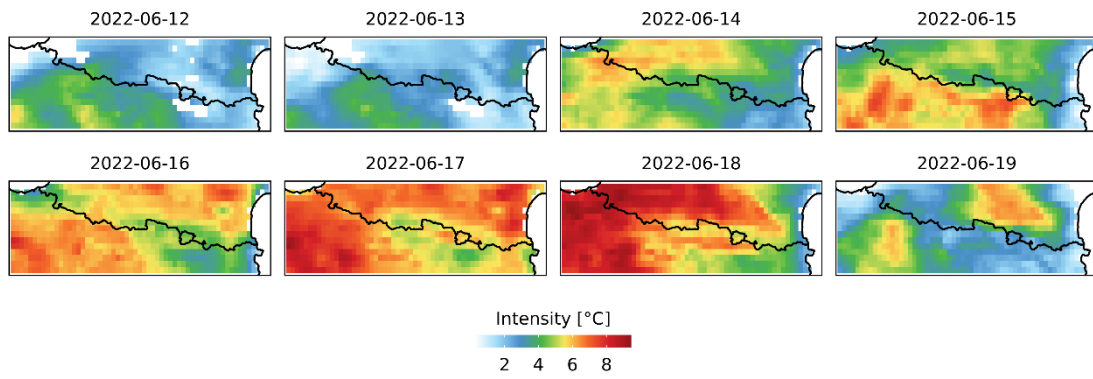
b)

Figure S1. Heatwaves intensity (in ºC) represented day by day for the a) June and b) July Heatwaves. At least the 80 % of the area for each day was affected by a heatwave.
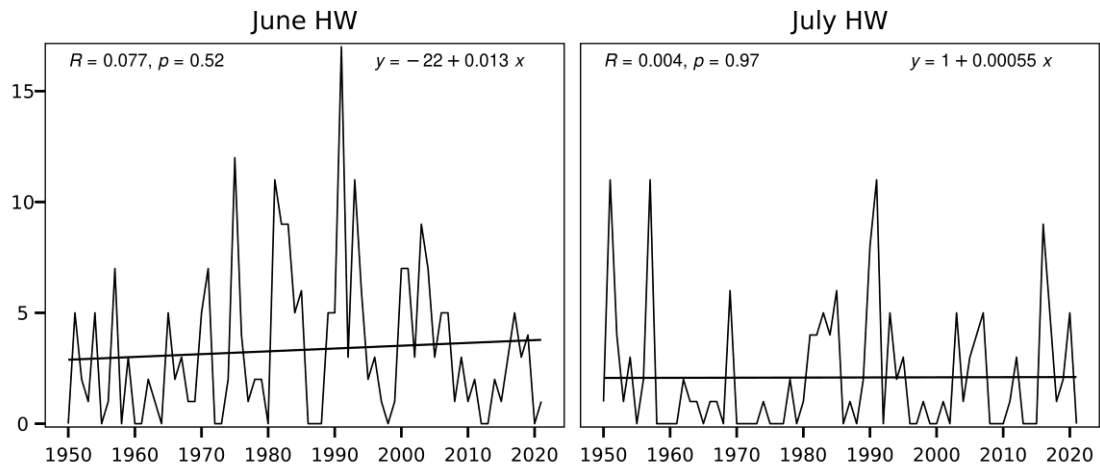
Figure S2. Frequency and trends in the number of annual analogues for each Heatwave. Non-statistically significant trends were observed for the period 1950 and 2021.
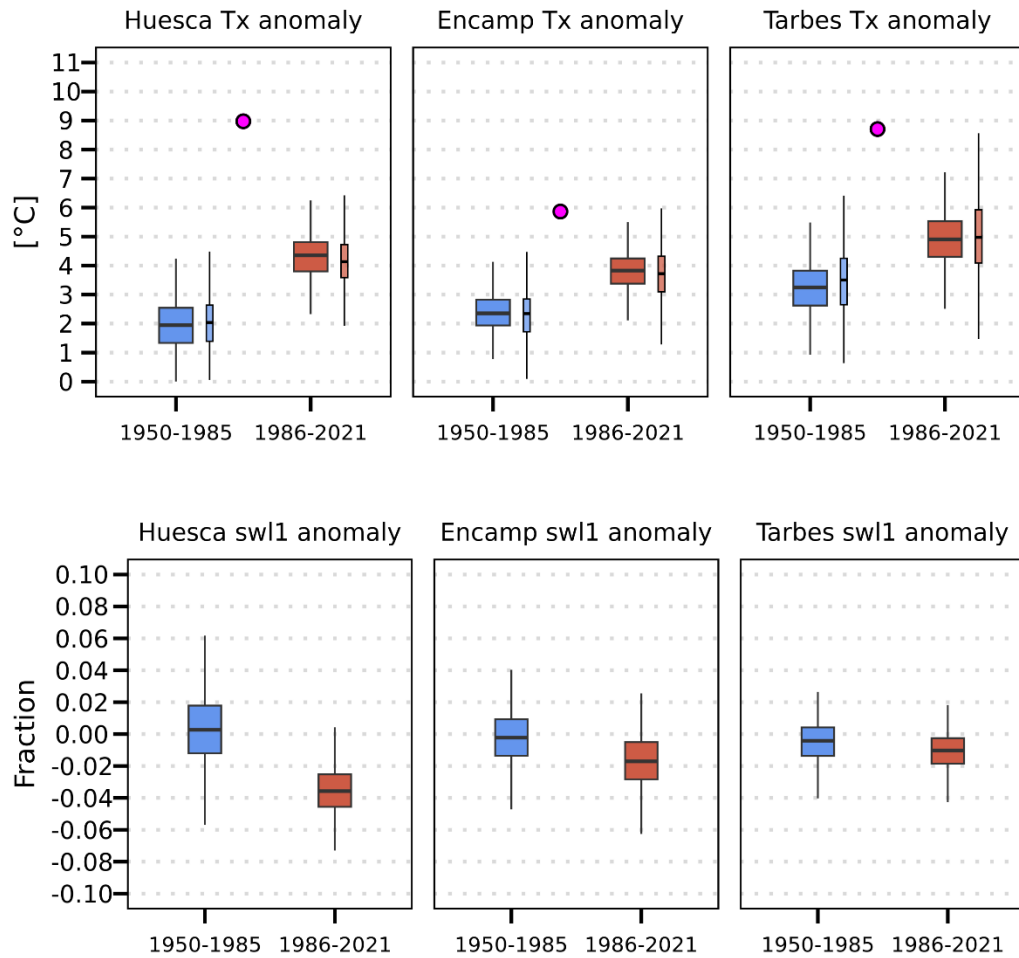
Figure S3. Flow-conditioned distributions of Tx and swl1 daily mean anomalies reconstruction for the June heatwave (HW) event in Huesca (Spain), Encamp (Andorra) and Tarbes (France).. First row shows the daily maximum temperature (Tx) anomalies distributions obtained from in-situ data (thinner boxplot) and for the closest ERA5-Land grid point to each location (wider boxplot). Magenta points in first row plots denote the mean value of observed HW Tx for each heatwave. The same is shown for the second-row plot but for soil water fraction anomaly in the first soil layer [0-7 cm], only provided for the closest ERA-5 Land cells to each observation. In all cases, boxes show the 25th–75th percentile ranges and whiskers span the 1st–99th percentiles. Blue and red boxes are representative of the past and most recent periods, respectively.
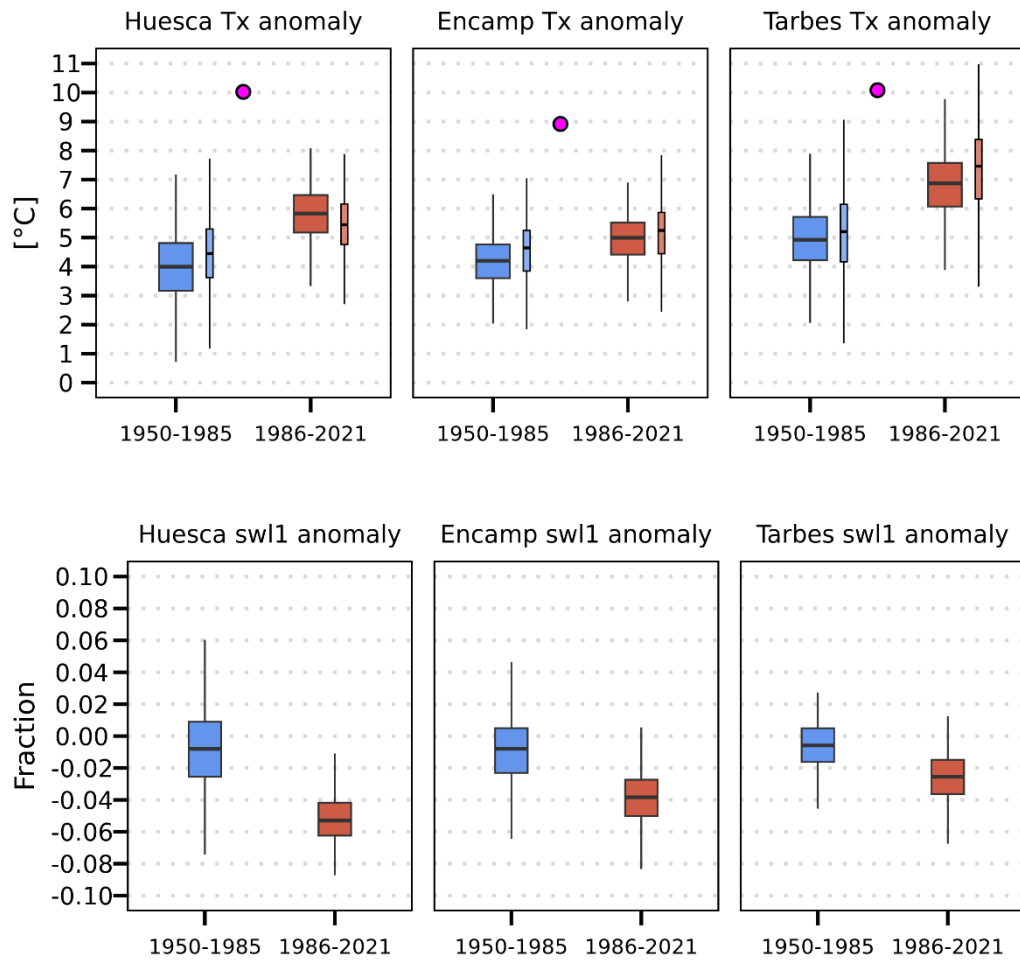
Figure S4. Flow-conditioned distributions of Tx and swl1 daily mean anomalies reconstruction for the July heatwave (HW) event in Huesca (Spain), Encamp (Andorra) and Tarbes (France). Idem as Figure S4 but for the July HW.
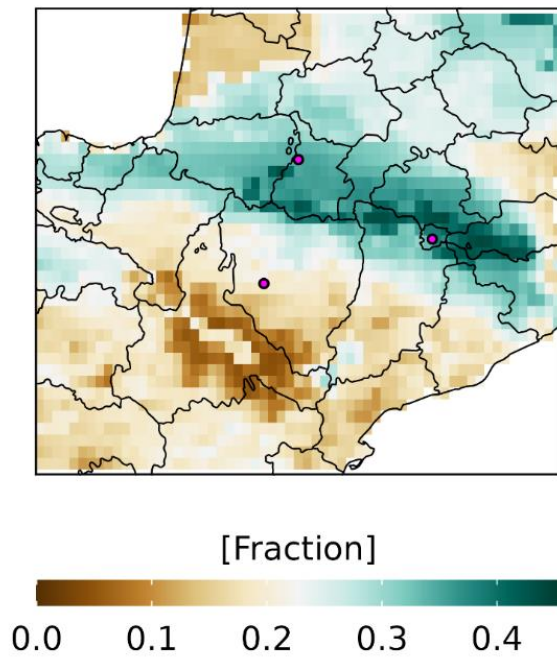
Figure S5. Long-term summer (JJA) mean soil moisture fraction at the first soil layer [0-7 cm]. Magenta points indicate the in-situ observations used in this study. From south to the north: Huesca, Encamp and Tarbes.
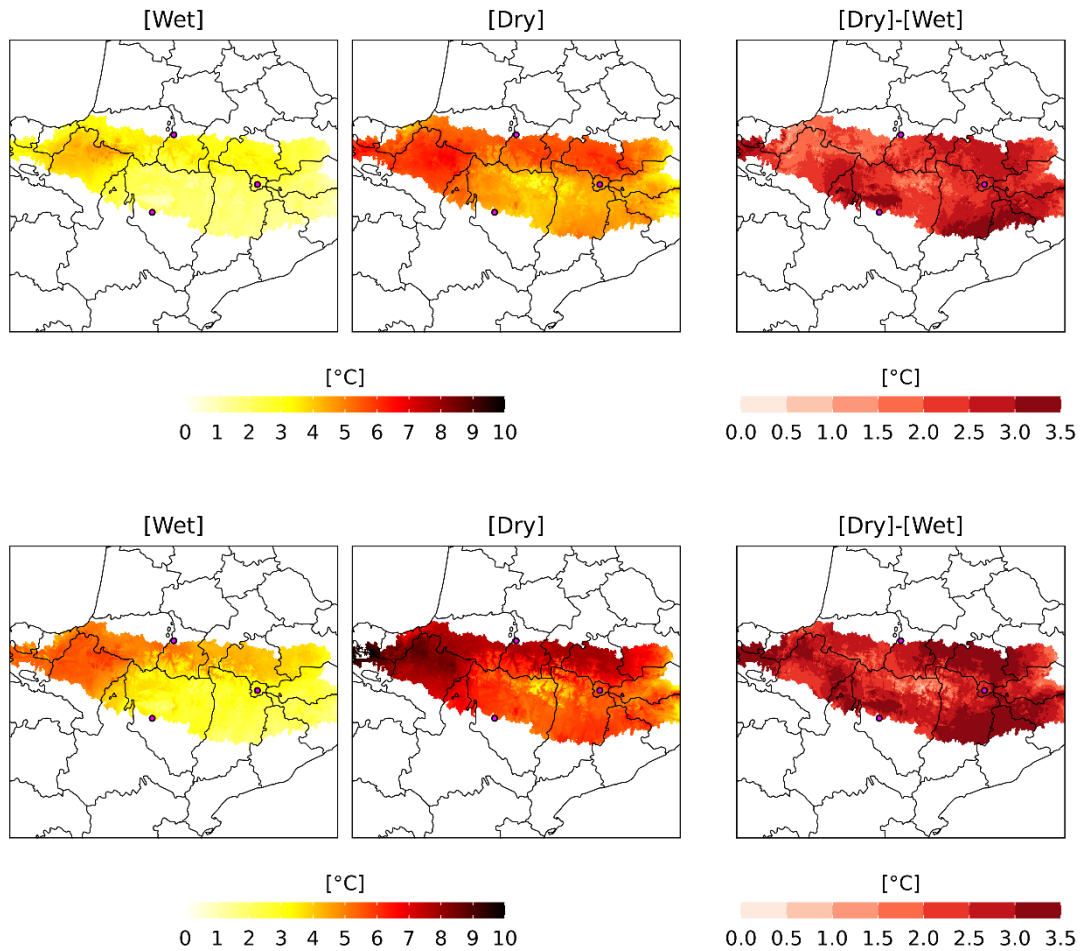
Figure S6. Dry wet precedent (1985-2015) Wet and dry circulation analogues of the June and July heatwaves using the Climpy gridded database. (a) TX anomalies (with respect to 1985–2015) reconstructed for June (a-d) and July (e-h) HW (12–19 June 2022 and 15-19 July 2022, respectively) from daily flow analogues of Z500 over SW Europe preceded by (a,d) wet (above 66th percentile) and (b,e) dry (below 33rd percentile) soil moisture conditions at 0–7 cm in the Pyrenees domain (blue rectangular box in Fig. 1 h-j) during the previous 15 days. c,f Difference between (b,e) and (a,d), respectively.