

**Annual Hottest Event minus Analogue
All Regions Pooled (2000-2024)**

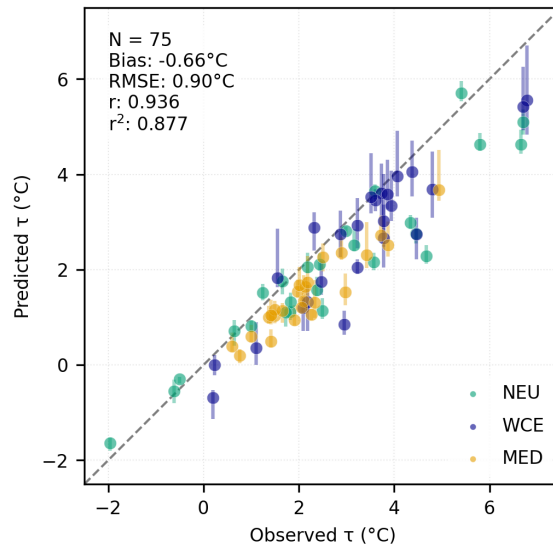


Figure ED1. Predicted and observed difference in temperature between the hottest events of the year in 2000-2024 and their respective analogues in 1979-1999. Colors show the values for the IPCC's NEU ("Northern"), WCE ("Central") and MED ("Southern") regions. Markers show the median prediction and whiskers show the 95% C.I.

Methodological Sensitivity: Annual Hottest Event minus Analogue (2000-2024)

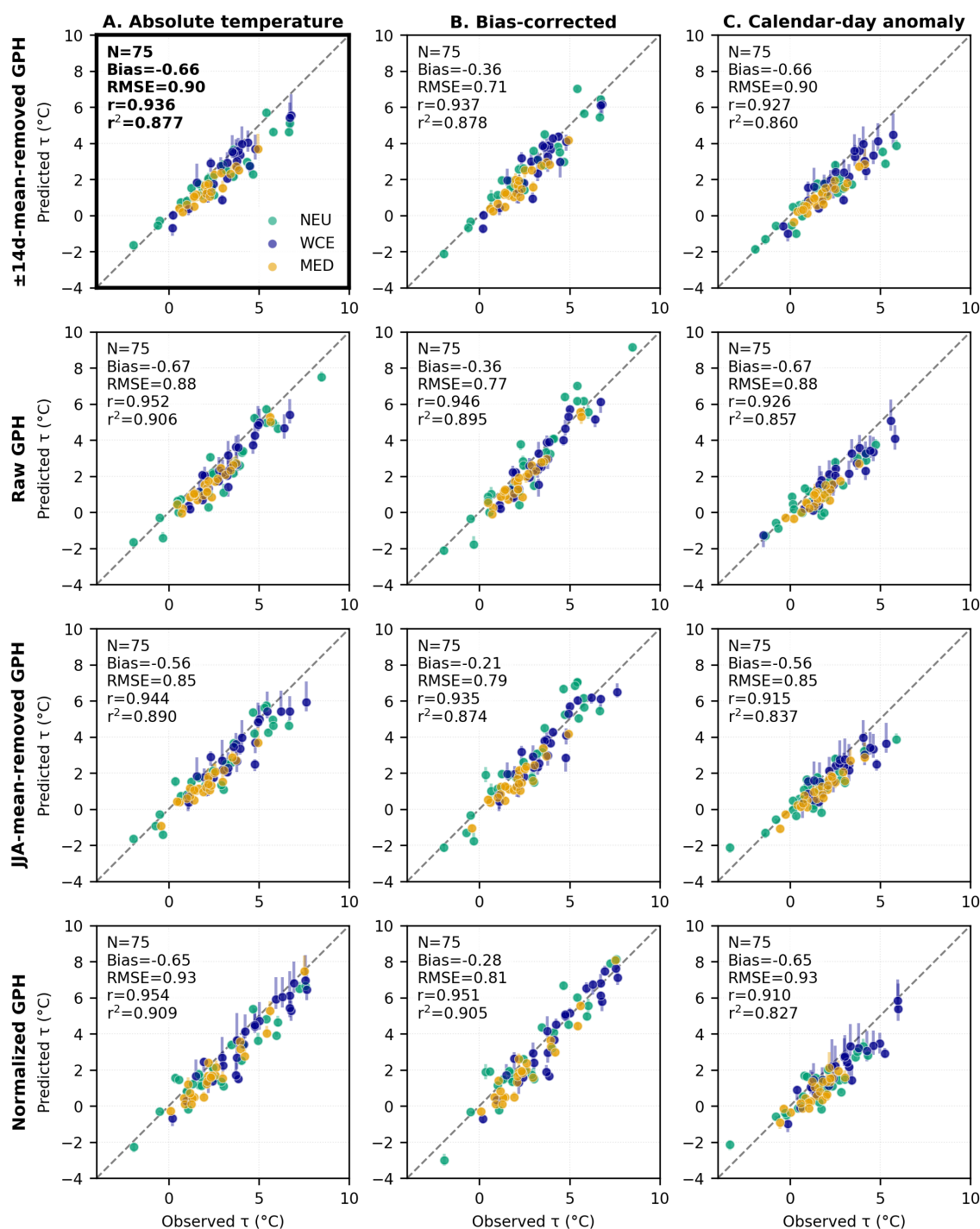


Figure ED2. Sensitivity to different treatments of temperature and geopotential height anomalies. As in Figure ED1, but for different geopotential height and temperature specifications (see Methods). (Panel A is identical to Fig. ED1.)

Northern: 500 hPa GPH Analogue Quality for Annual Hottest Events (2000-2024)

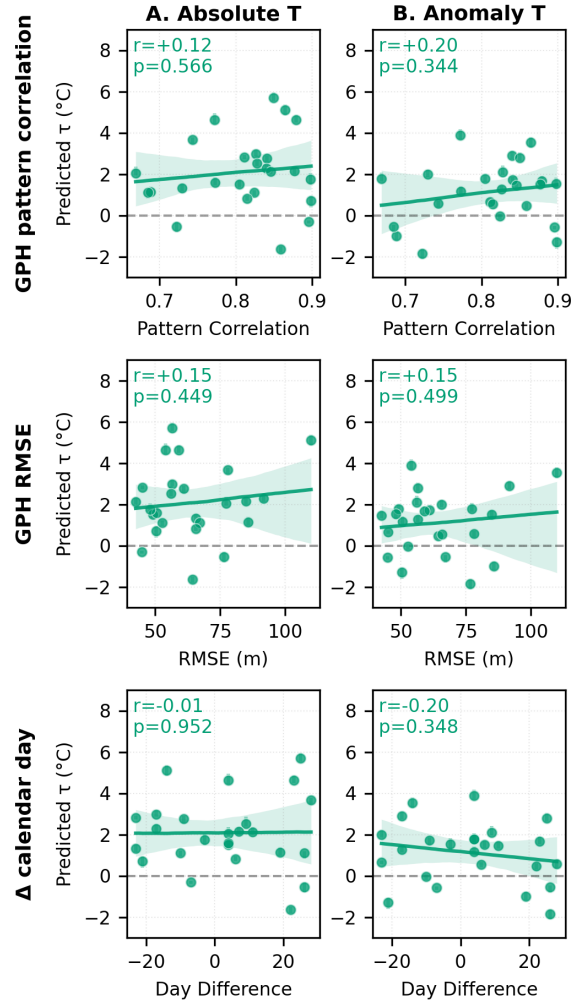


Figure ED3. Sensitivity of the predicted event-analogue temperature difference to event-analogue differences in circulation and seasonal timing for the IPCC’s “NEU” region. (Top row) The relationship between the event-analogue temperature difference and the event-analogue pattern correlation in 500 hPa geopotential height anomalies. (Middle row) The relationship between the event-analogue temperature difference and the event-analogue RMSE in 500 hPa geopotential height anomalies. (Bottom row) The relationship between the event-analogue temperature difference and the event-analogue calendar day difference. Comparisons are conducted for both the difference in absolute temperature (left column) and the difference in calendar-day anomalies (right column). In all panels, the confidence interval for the OLS regression is calculated for using 1000 block bootstraps with replacement, with the block size determined by the length of statistically significant autocorrelation.

Central: 500 hPa GPH Analogue Quality for Annual Hottest Events (2000-2024)

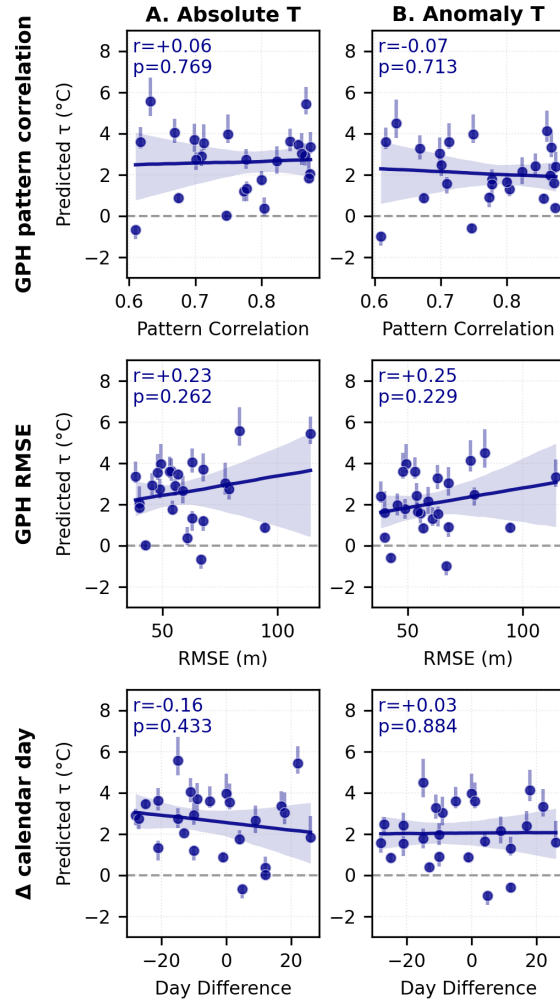


Figure ED4. Sensitivity of the predicted event-analogue temperature difference to event-analogue differences in circulation and seasonal timing for the IPCC’s “WCE” region. As in Figure ED3, but for the WCE region.

Southern: 500 hPa GPH Analogue Quality for Annual Hottest Events (2000-2024)

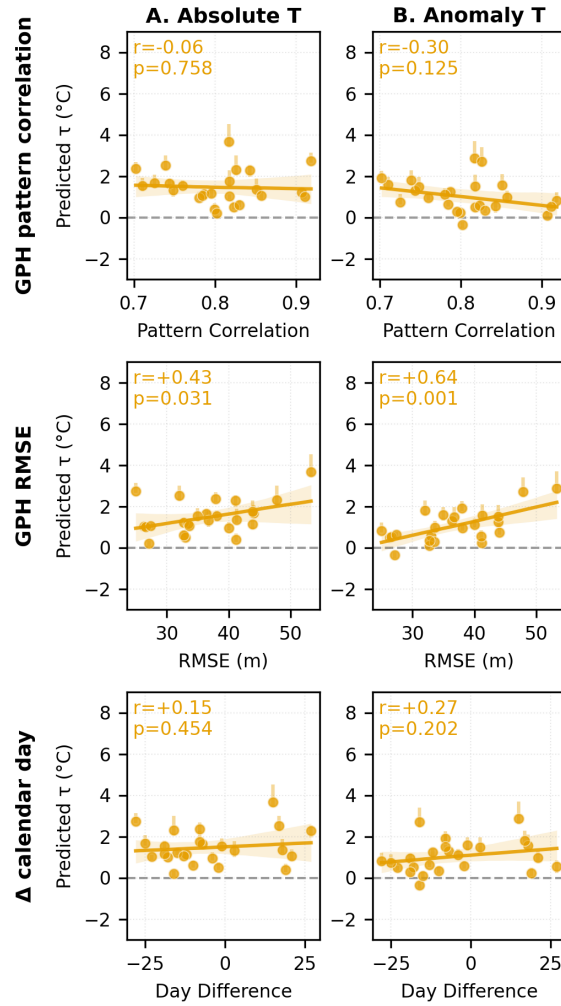


Figure ED5. Sensitivity of the predicted event-analogue temperature difference to event-analogue differences in circulation and seasonal timing for the IPCC’s “MED” region. As in Figure ED3, but for the MED region.

Isolating Impact of GMT on Event-Analogue Differences in Predicted Temperature

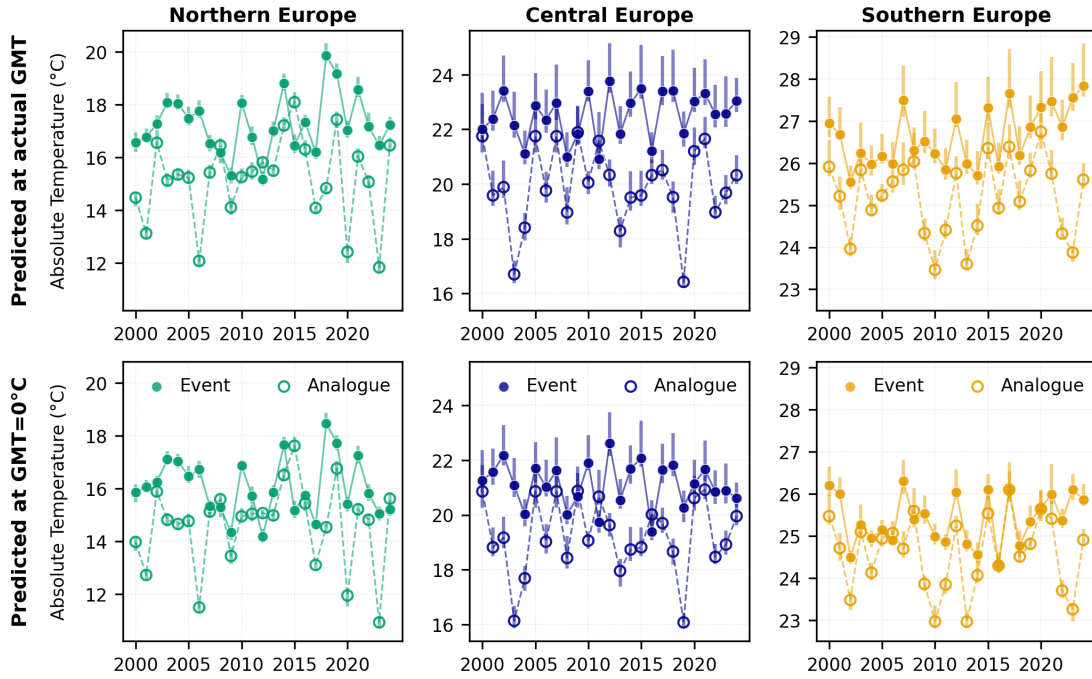


Figure ED6. Isolating the impact of global mean temperature on predicted event-analogue regional temperature differences. (Top row) The timeseries of annual hottest 3-day events in the machine learning-based predictions (solid markers), along with the respective 1979-1999 analogues (open markers); marker shows the median prediction and the whisker shows the 95% C.I. Predictions are made for the actual GMT averaged over the 12 months preceding the event. The middle panel of the top row is reproduced in Figure 1. (Bottom row) As in the top row, but for the counterfactual regional temperature prediction at GMT = 0°C for both the event and its analogue.

Relationship Between Event-Analogue Difference and Annual GMT Difference (2000-2024)

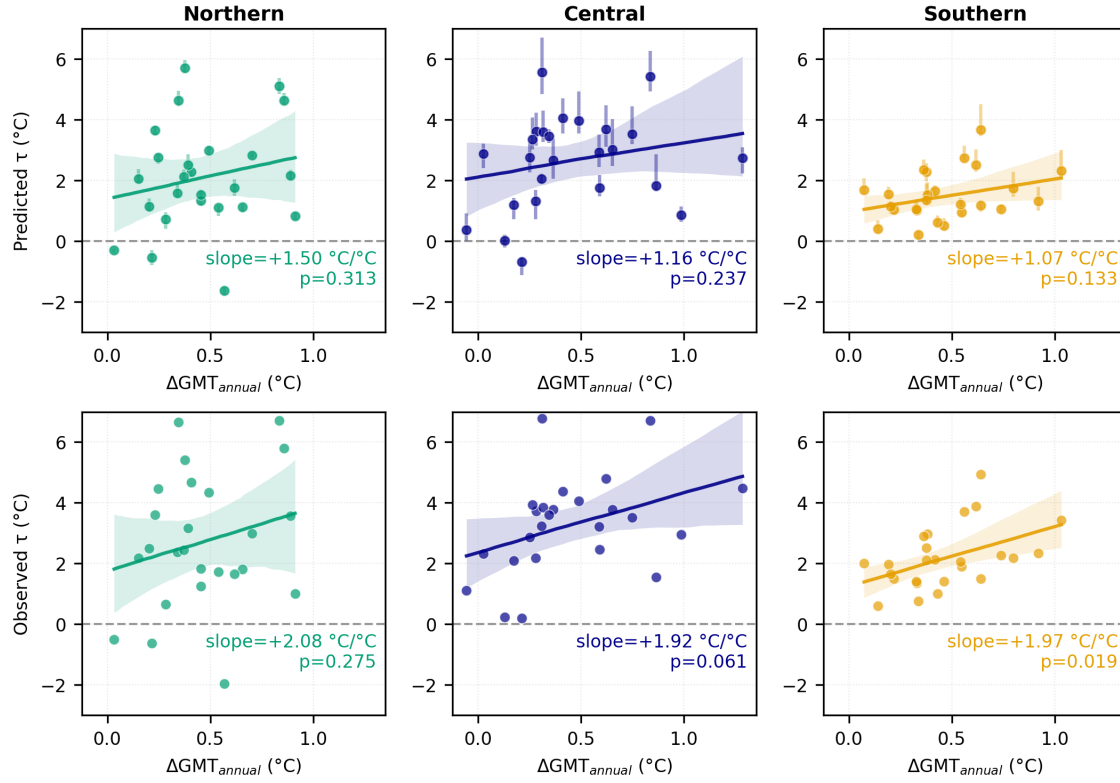


Figure ED7. Quantifying the relationship between event-analogue temperature difference and annual global mean temperature. (Top row) The relationship between predicted event-analogue regional temperature difference and the difference in annual global mean temperature when the event and analogue occurred. (Bottom row) As in the top row, but for the event-analogue regional temperature difference in the ERA5 reanalysis. In all panels, the confidence interval for the OLS regression is calculated for using 1000 block bootstraps with replacement, with the block size determined by the length of statistically significant autocorrelation.