Supplementary information for “Summer 2024 in northern Fennoscandia was very likely the warmest in 2,000 years”

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Supplementary Tables

Table S1. Annual probabilities (%), probability ratios (PRs), and changes in intensity (ΔIs) for Sodankylä mean temperature in 2024 using CMIP6 data for the three emission scenarios. The PR values compare the year 2024 with the year 1900.

Scenario	Probability in 1900	Probability in 2024	Probability in 2050	PR	ΔI
SSP1-2.6	0.07	6.58	18.38	94.2	2.1 °C
SSP2-4.5	0.07	6.27	26.62	96.3	2.1 °C
SSP5-8.5	0.06	6.54	41.20	108.0	2.1 °C

Table S2. Pearson correlation coefficients between the EOF components of mean sea level pressure and JJA mean temperature in Sodankylä Tähtelä. Statistically significant correlations (at 5 % level) are shown in bold.

EOF1	EOF2	EOF3	EOF4	EOF5	EOF6	EOF7	EOF8	EOF9	EOF10
0.10	-0.11	**0.54**	-0.04	**0.39**	0.06	-0.13	-0.15	-0.15	-0.06

Supplementary Figures

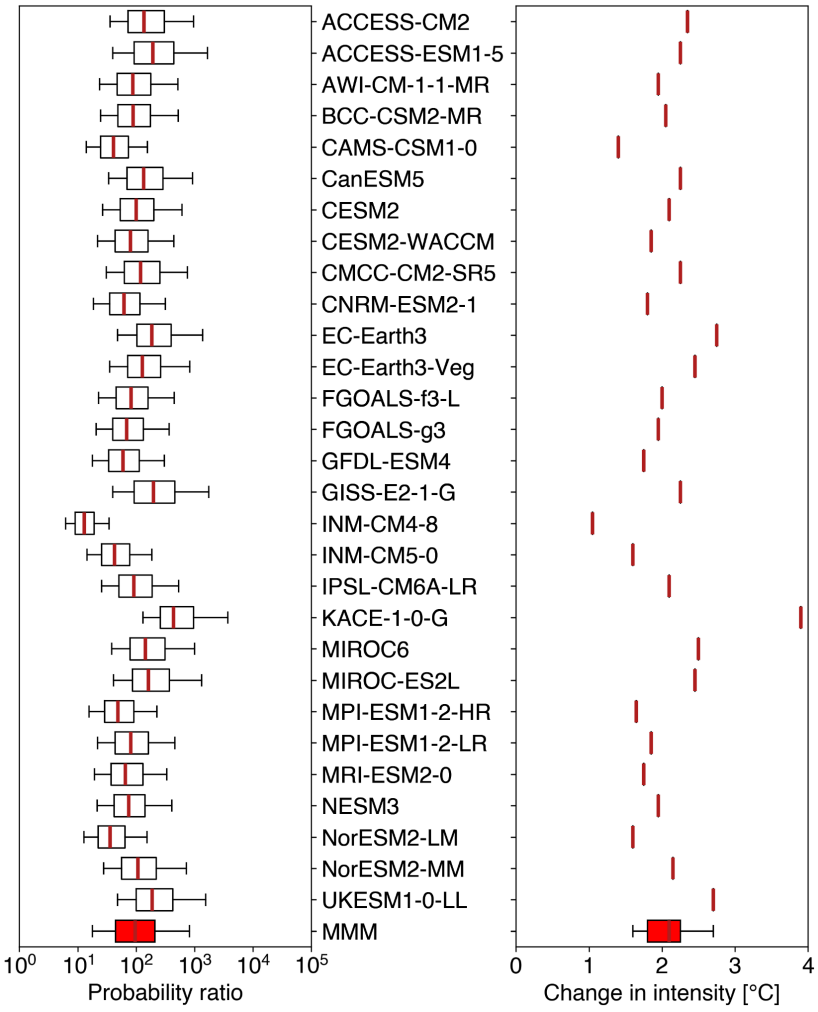

Figure S1. Model-simulated probability ratios (left) and changes in intensity (right) for JJA 2024 in Sodankylä Tähtelä. The boxes show the first and third quartiles of the 1000 bootstrap realisations for each model, and the whiskers cover their 5 % to 95 % range. MMM in the bottom row refers to the multi-model mean estimate. For ΔI, the box-whisker plot at the bottom row represents the variation between the 29 models.

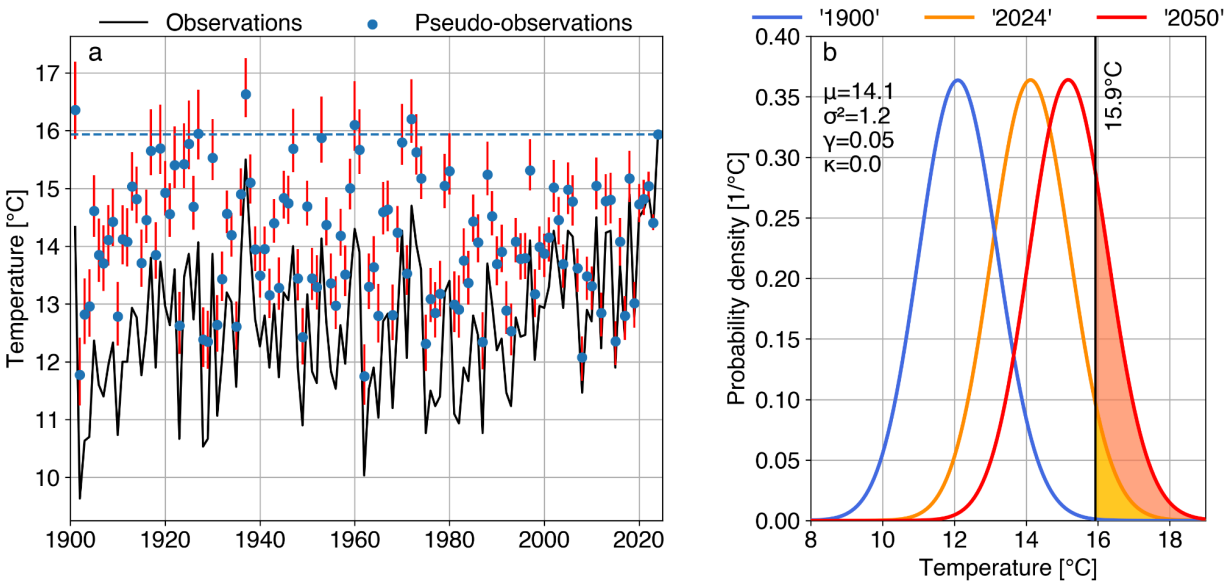

Figure S2. Same as Fig. 5 in the main text, but using the local Euro-Arctic JJA temperature as a covariate in the regression.

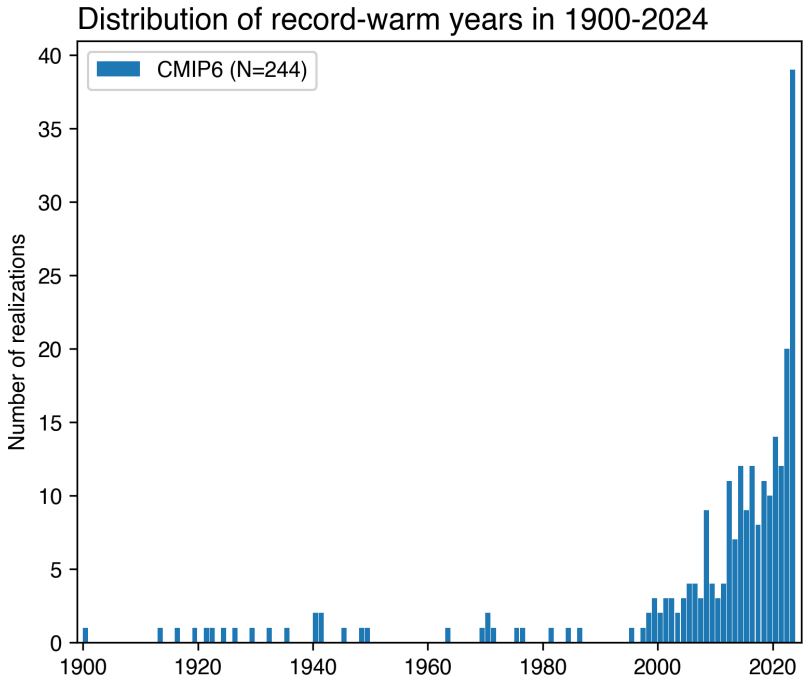

Figure S3. Distribution of record-warm summers in northern Fennoscandia (66°–70°N, 20°–30°E) in 244 CMIP6 simulations (42 models) for the period 1900–2024. The histogram shows the year in which the record-warm summer occurred in each simulation.

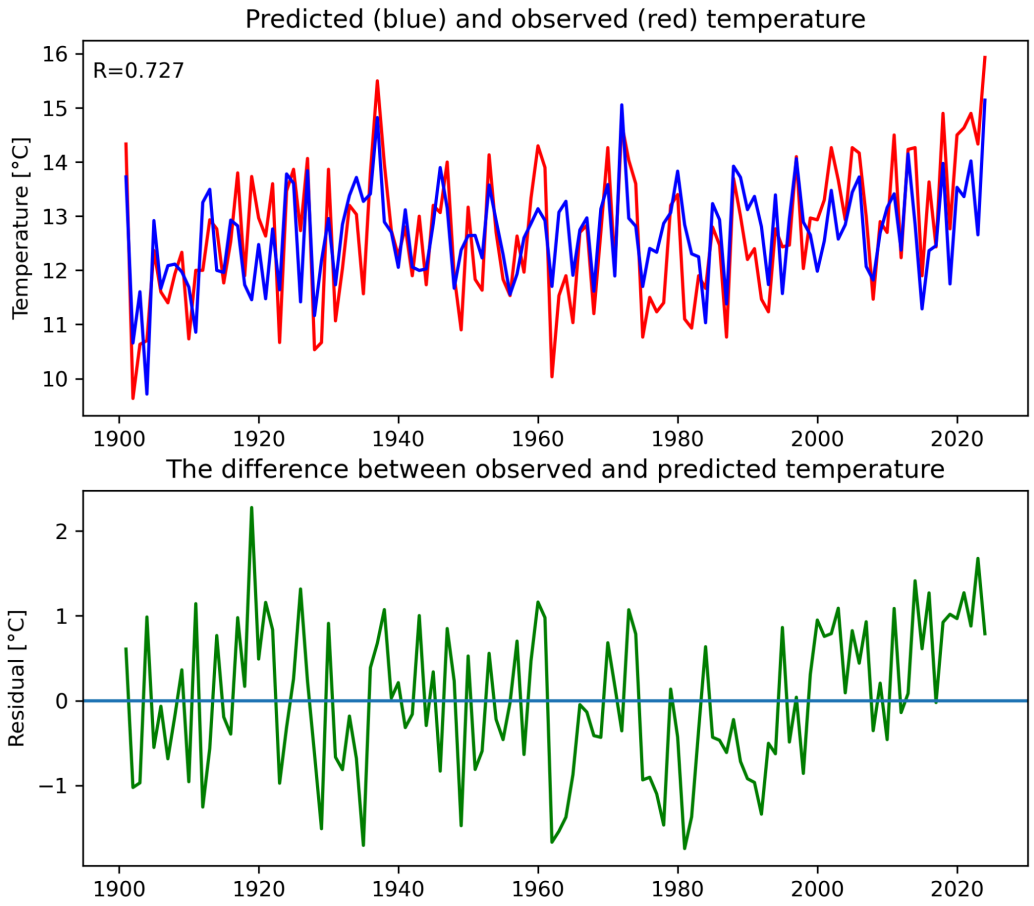

Figure S4. Top: predicted (blue) and observed (red) JJA mean temperature in Sodankylä Tähtelä. Bottom: the difference between observed and predicted JJA mean temperature.

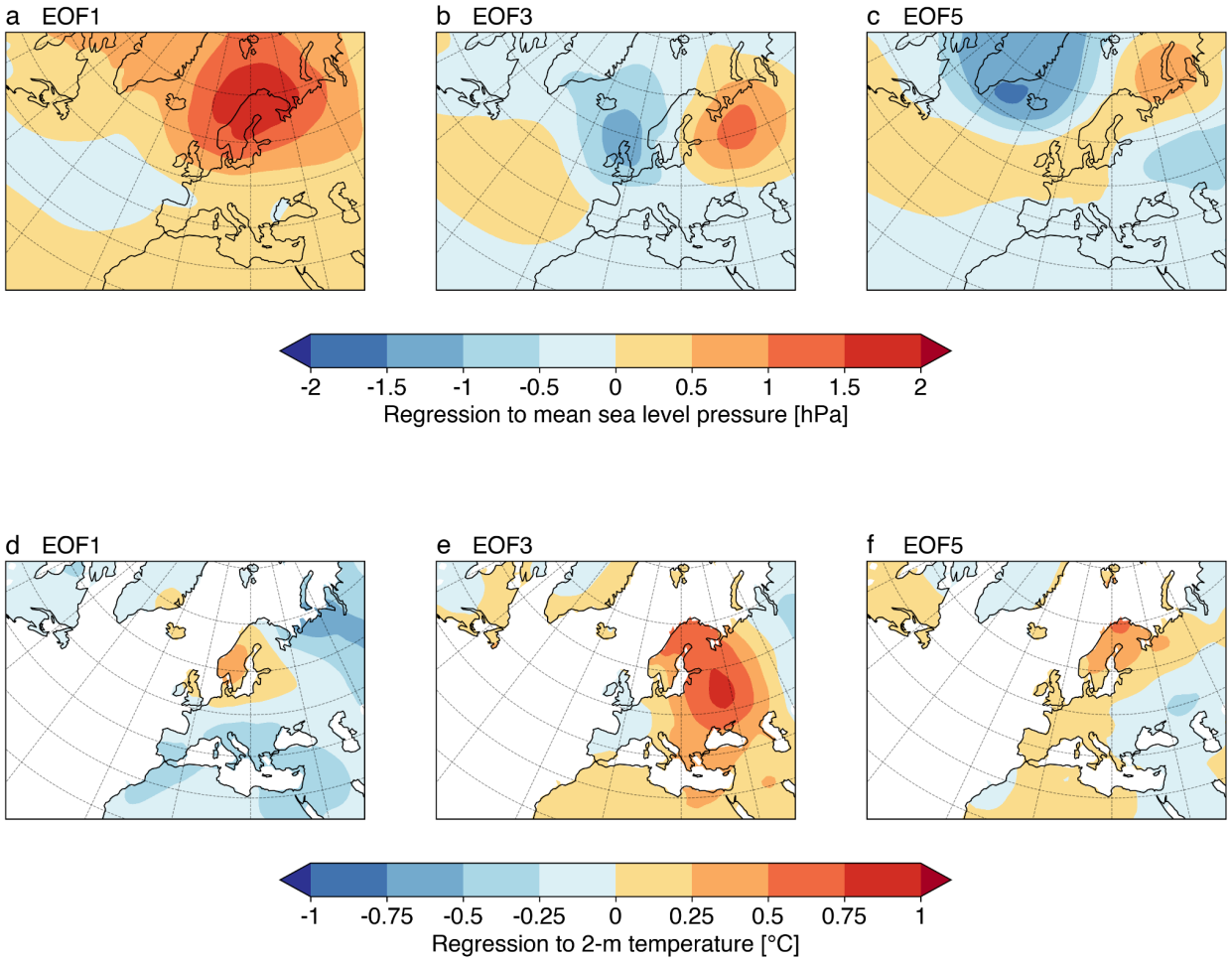

Figure S5. Regression of mean sea level pressure (MSLP, top row) and 2-m temperature (bottom row) onto EOF1, EOF3 and EOF5 indices. The MSLP data (a-c) is from the ERA20C reanalysis for 1901-2010 and from the ERA5 reanalysis for 2011-2024. The 2-m temperature data is from the Berkeley Earth dataset.

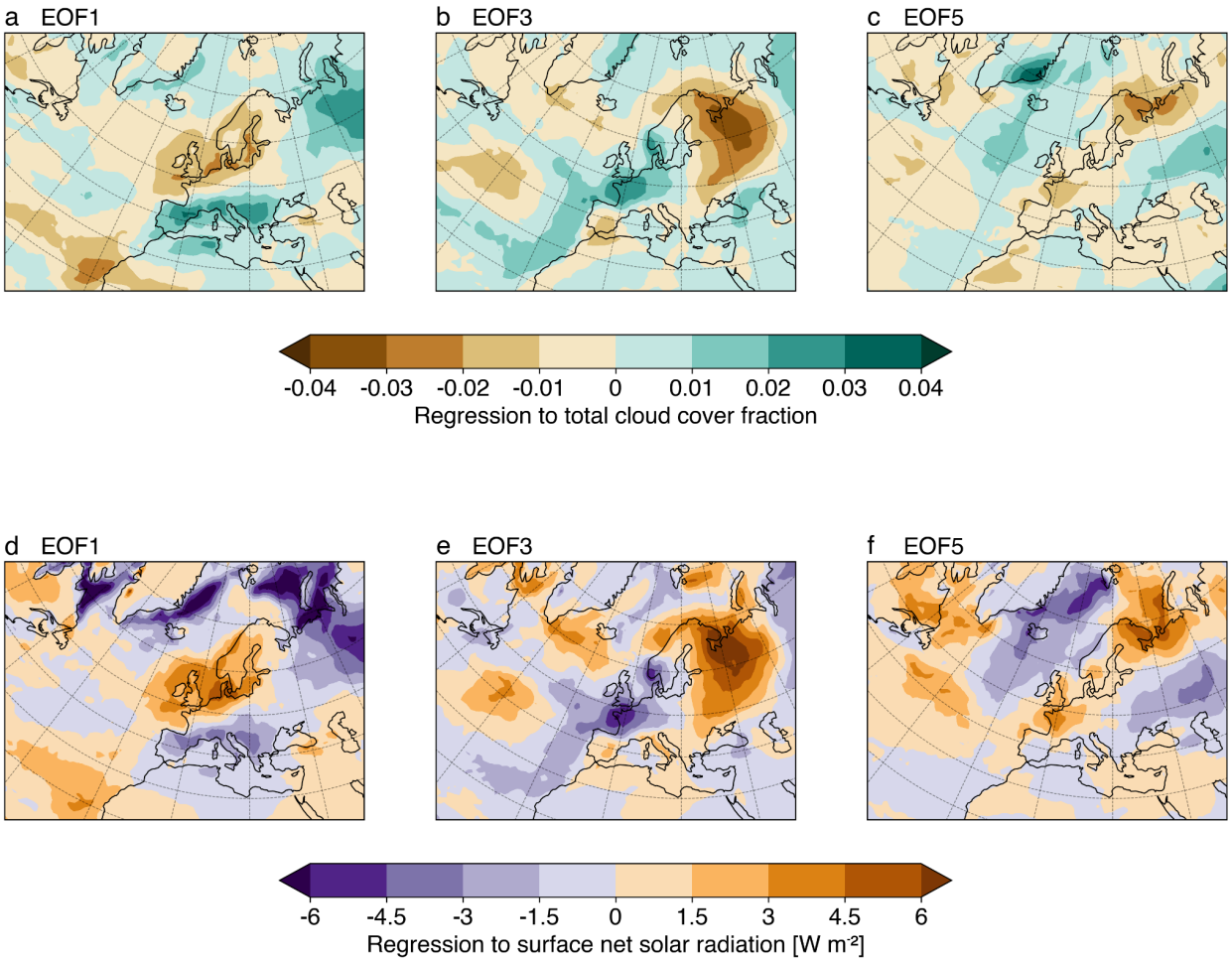

Figure S6. Same as Fig. S5, but for the total cloud cover fraction (top row) and the surface net solar radiation (bottom row). The 1901-2010 data are from the ERA20C reanalysis and the 2011-2024 data are from the ERA5 reanalysis. For homogeneity, the monthly mean differences between the two reanalyses for the years 2000-2010 were subtracted from the ERA5 fields for the years 2011-2024.