

# **Supplementary materials of “A Bayesian statistical method to estimate the climatology of extreme temperature under multiple scenarios: the ANKIALE package”**

Yoann Robin<sup>1</sup>, Mathieu Vrac<sup>1</sup>, Aurélien Ribes<sup>2</sup>, Occitane Barboux<sup>2,3</sup>, and Philippe Naveau<sup>1</sup>

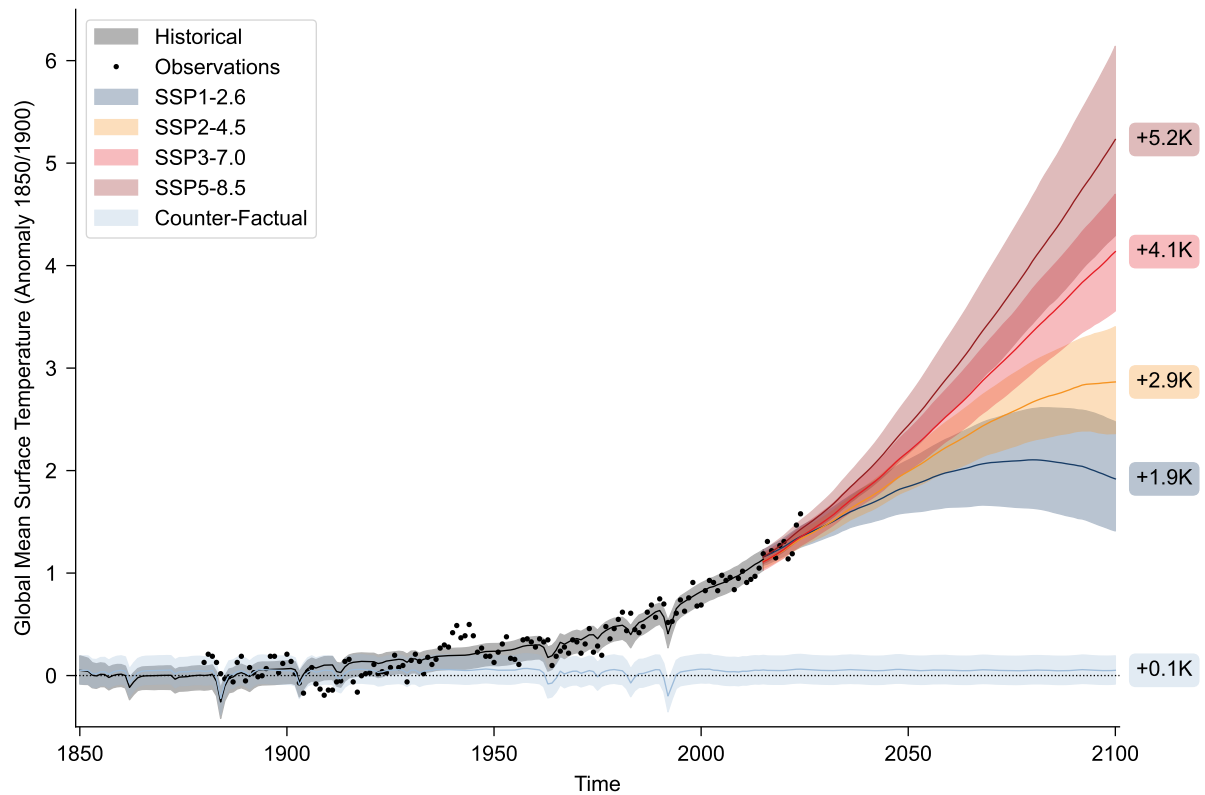
<sup>1</sup>Laboratoire des Sciences du Climat et de l’Environnement, UMR 8212 CEA-CNRS-UVSQ, Université Paris-Saclay / IPSL, Sorbonne Université, Gif-sur-Yvette, 91191, France

<sup>2</sup>CNRM, Université de Toulouse, Météo France, CNRS, Toulouse, France

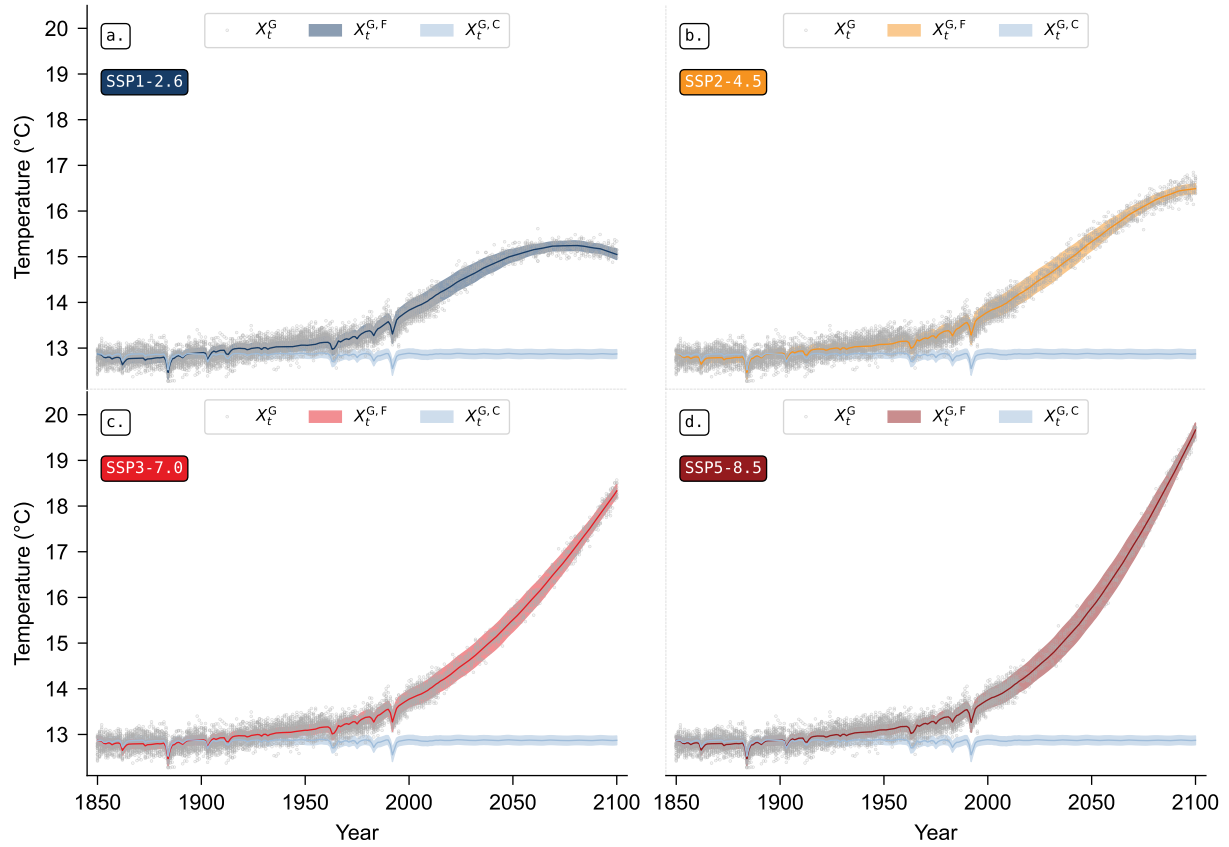
<sup>3</sup>Institut de Radioprotection et Sûreté Nucléaire (IRSN), PSE-ENV, SCAN, BERSIN, Fontenay-aux-Roses, France

**Correspondence:** Yoann Robin (yoann.robin@lsce.ipsl.fr)

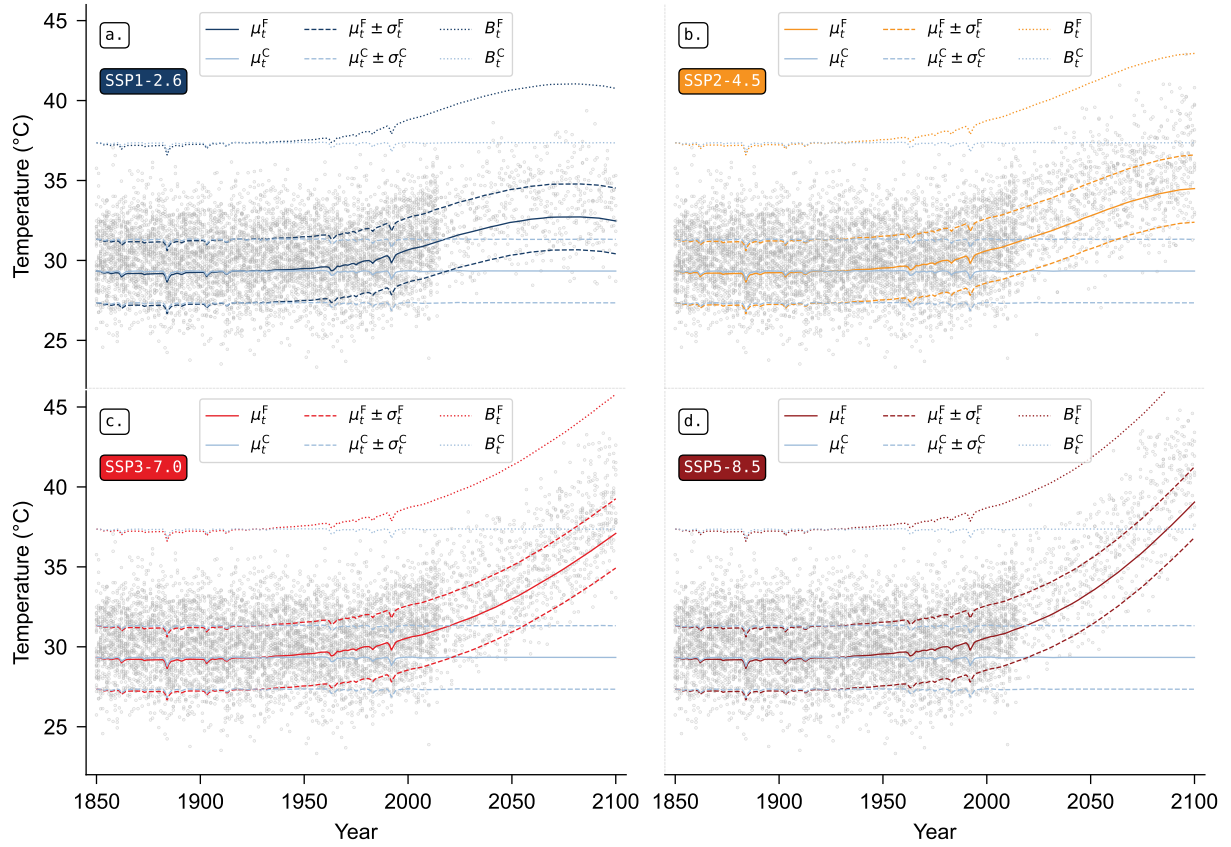
*Copyright statement.* TEXT



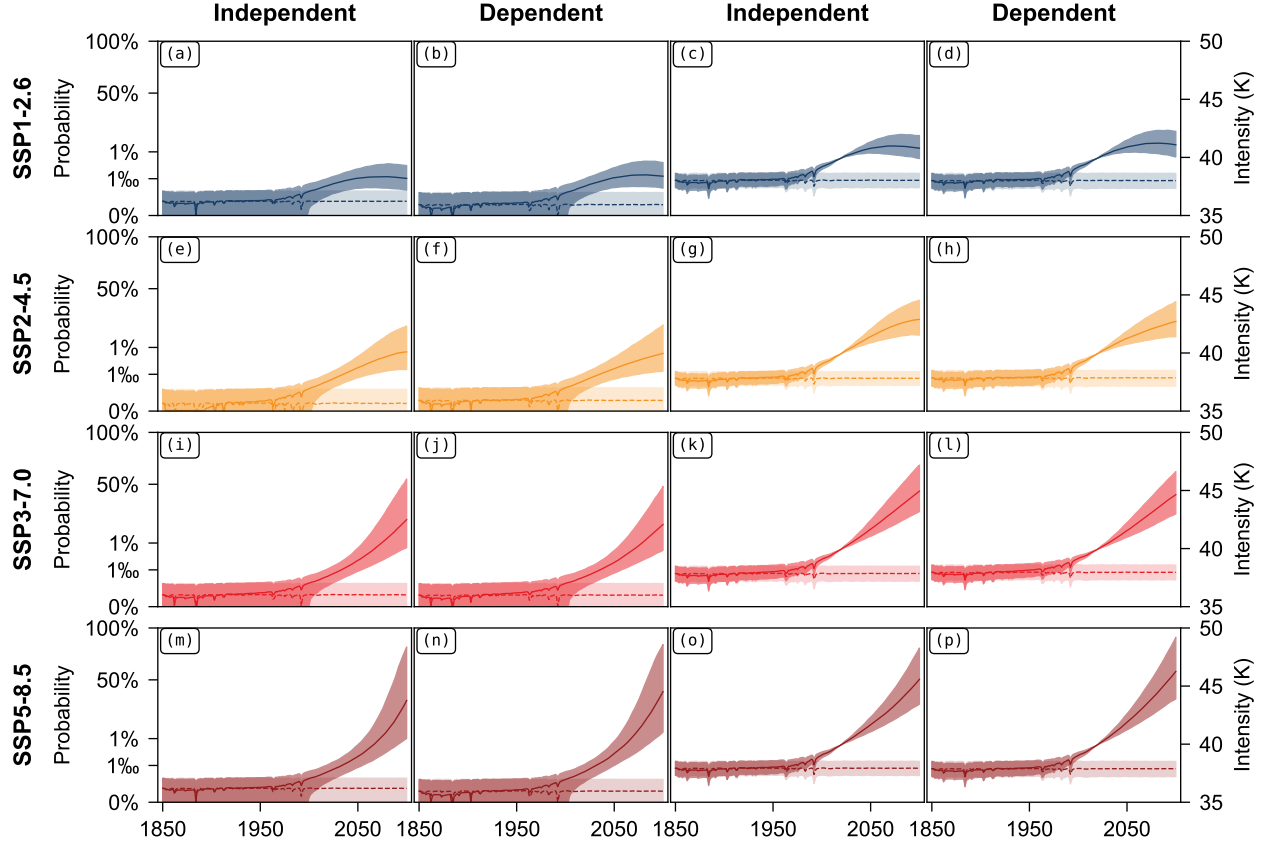
**Figure S1.** Global mean surface temperature estimated using a multi-model synthesis constrained by BEST observations (the black points), with the 95% confidence interval (the filled areas). The area in black corresponds to the historical period, followed by the four scenarios: SSP1-2.6, SSP2-4.5, SSP3-7.0 and SSP5-8.5. The counterfactual where external forcings due to human influence have been removed has been represented in light blue.



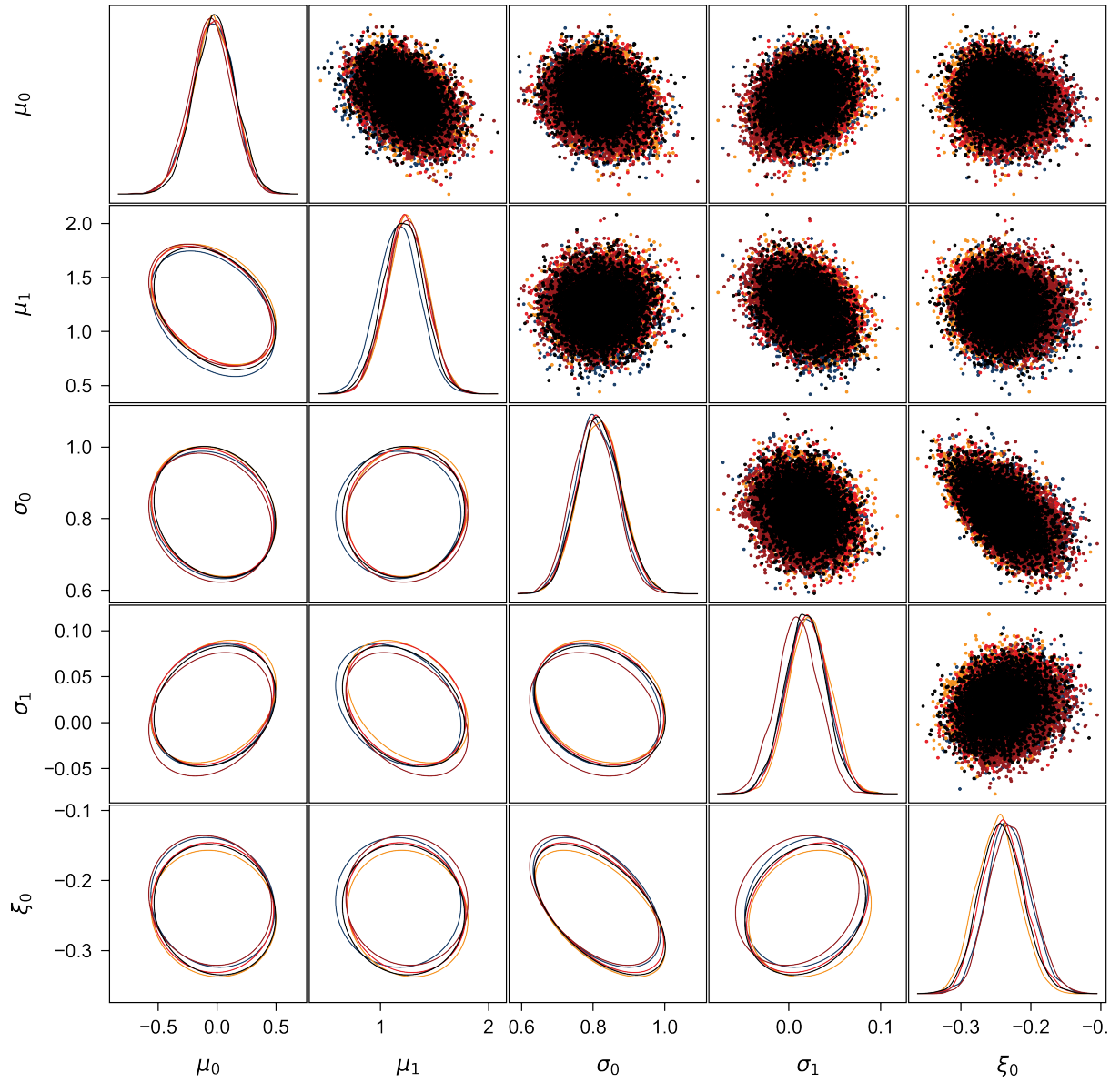
**Figure S2.** Decomposition into factual / counterfactual forcings of the IPSL model of the GMST with Eq. (3) for **a.** the SSP1-2.6 scenario, **b.** the SSP2-4.5 scenario, **c.** the SSP3-7.0 scenario, **d.** the SSP5-8.5 scenario.



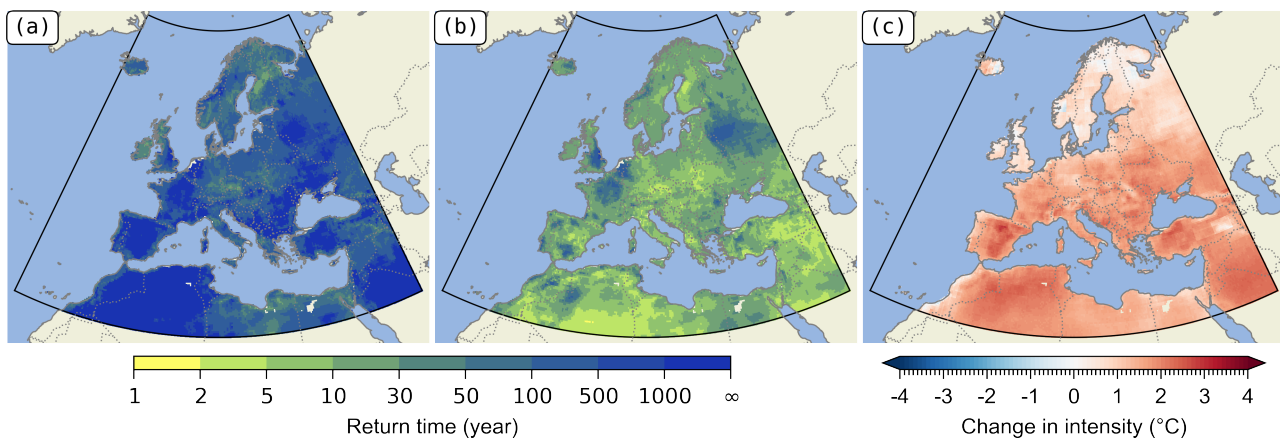
**Figure S3.** Non-stationary parameters  $\mu_t$  and  $\sigma_t$  in the factual and counter-factual world of the GEV distribution of the IPSL model for Paris. The upper bound of the GEV law (because  $\xi < 0$ ) has been added.



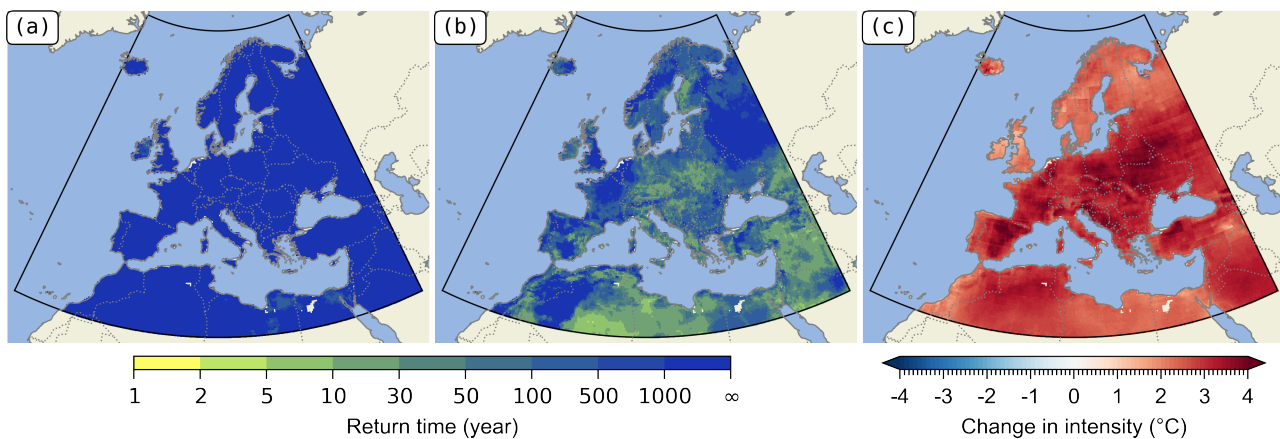
**Figure S4.** On the first two columns: probability in factual world ( $p_t^F$  solid color) and counter-factual ( $p_t^C$  light color). The first column is for the method where scenarios are estimated independently, the second when scenarios are estimated simultaneously. On the last two columns: intensity in factual world ( $I_t^F$  solid color) and counter-factual ( $I_t^C$  light color). The third column is for the method where the scenarios are estimated independently, the last when the scenarios are estimated simultaneously. The four lines are for the four scenarios analyzed.



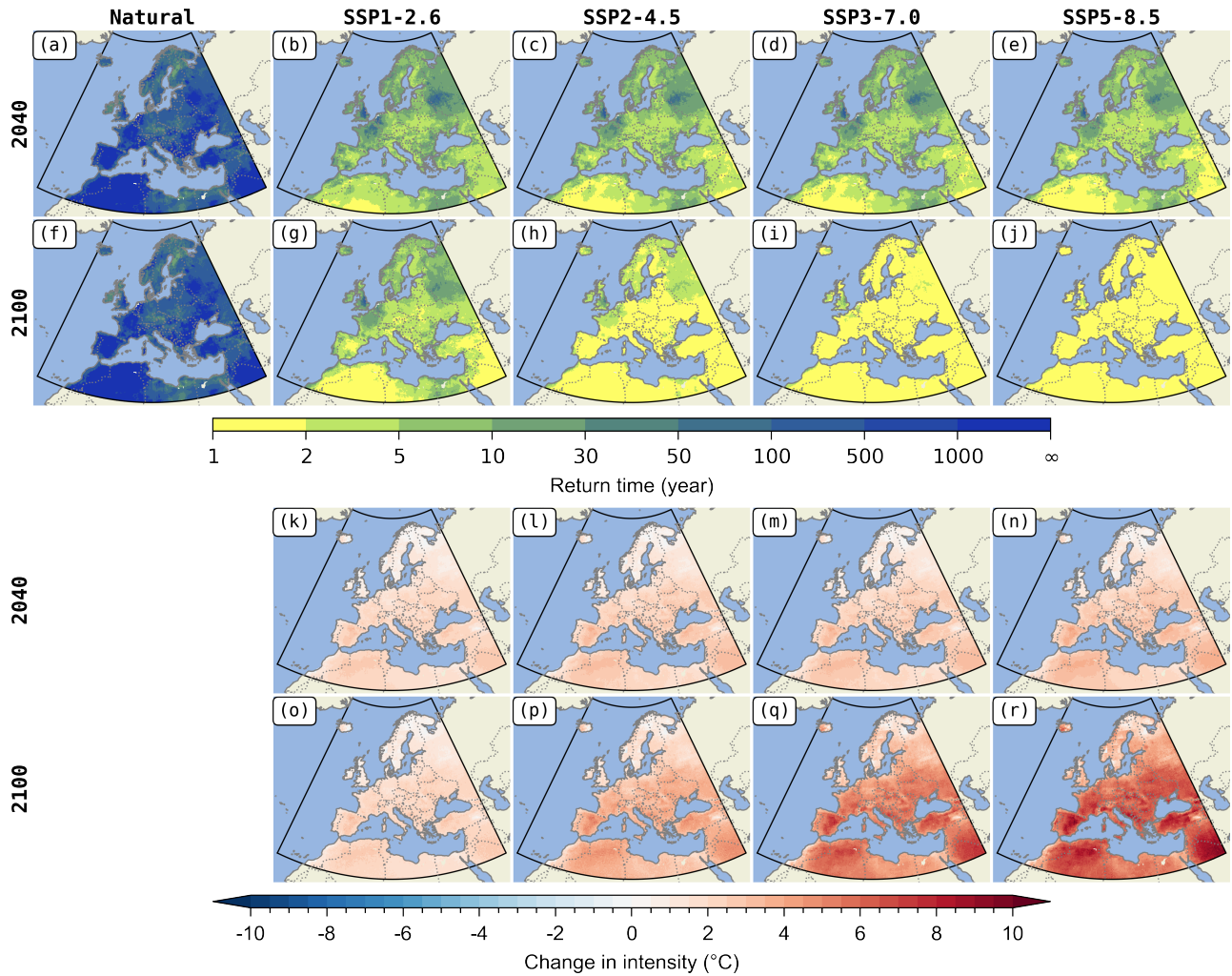
**Figure S5.** Bivariate dependency structure of GEV parameters  $\mu_0$ ,  $\mu_1$ ,  $\sigma_0$ ,  $\sigma_1$  and  $\xi_0$  for the case where scenarios were estimated independently (in color) or simultaneously (in black). The diagonal shows the distribution smoothed by a Gaussian kernel. The upper part of the panel matrix shows the points of the distribution, while the lower part shows the 95% confidence interval defined by the covariance matrix.



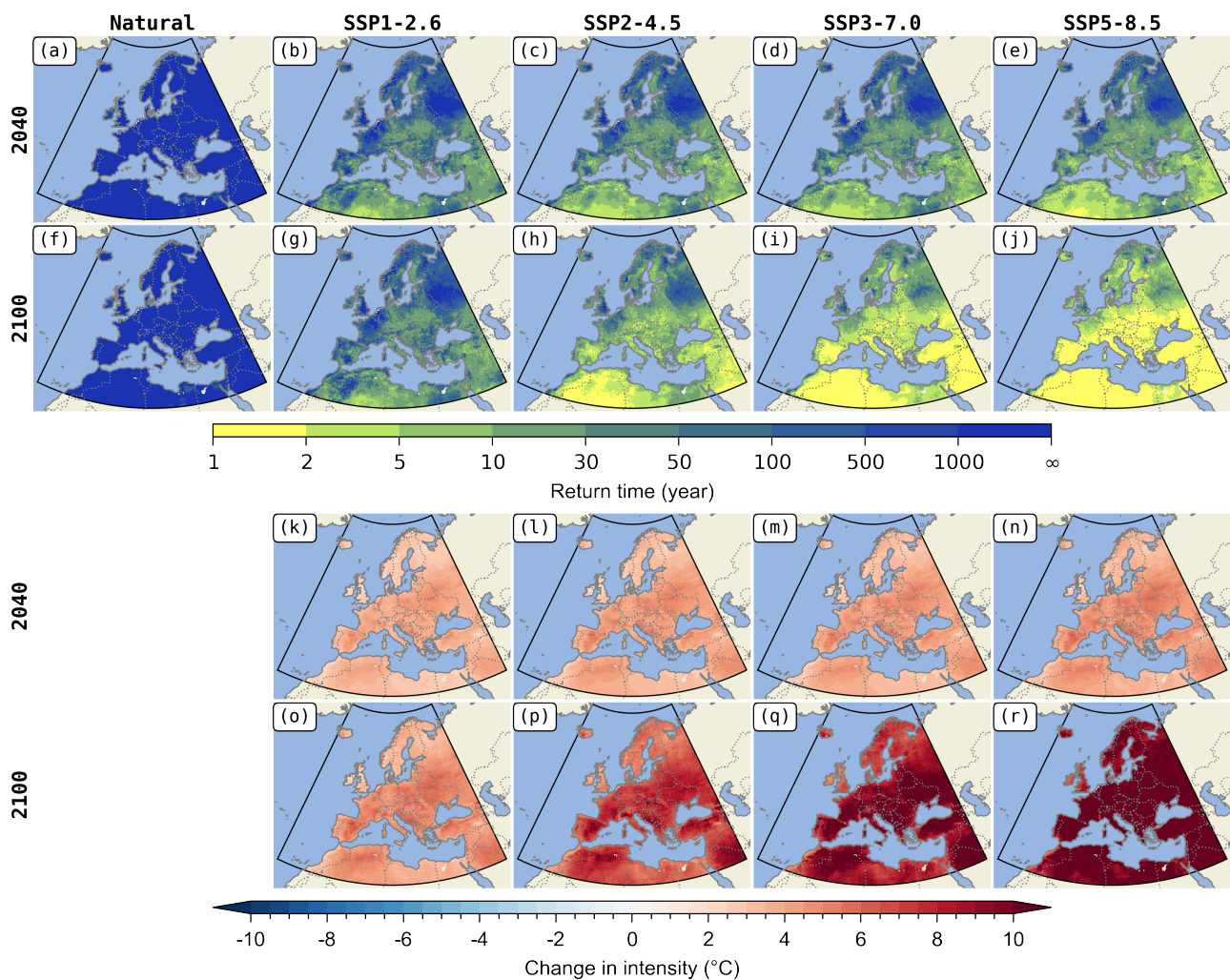
**Figure S6.** Lower confidence interval (quantile 2.5%) of **a.** Return time of the maximum observed between 1940 and 2024 in TX3x over Europe, in 2024, without human influence. **b.** Same as a., but for the mean of all scenarios. **c.** Change in intensity in 2024.



**Figure S7.** Upper confidence interval (quantile 97.5%) of **a.** Return time of the maximum observed between 1940 and 2024 in TX3x over Europe, in 2024, without human influence. **b.** Same as a., but for the mean of all scenarios. **c.** Change in intensity in 2024.



**Figure S8.** Lower confidence interval (quantile 2.5%) of projection of return time (1st and 2nd row) and change in intensity (3rd and 4th row) in 2040 (1st and 3rd row) and 2100 (2nd and 4th row) of the attribution of the maximum event observed in TX3x between 1940 and 2024. In columns: in the counter-factual world and for the four scenarios SSP1-2.6, SSP2-4.5, SSP3-7.0 and SSP5-8.5.



**Figure S9.** Upper confidence interval (quantile 97.5%) of projection of return time (1st and 2nd row) and change in intensity (3rd and 4th row) in 2040 (1st and 3rd row) and 2100 (2nd and 4th row) of the attribution of the maximum event observed in TX3x between 1940 and 2024. In columns: in the counter-factual world and for the four scenarios SSP1-2.6, SSP2-4.5, SSP3-7.0 and SSP5-8.5.

| Area  | Country            | ISO | Percent Area | Area | Country                | ISO | Percent Area |
|-------|--------------------|-----|--------------|------|------------------------|-----|--------------|
| AFR-N | Algeria            | DZA | 64.2%        | EU-N | Finland                | FIN | 100%         |
|       | Egypt              | EGY | 50.8%        |      | Iceland                | ISL | 89.3%        |
|       | Libya              | LBY | 57.4%        |      | Ireland                | IRL | 100%         |
|       | Morocco            | MAR | 100%         |      | Latvia                 | LVA | 100%         |
|       | Tunisia            | TUN | 100%         |      | Lithuania              | LTU | 100%         |
| ASI-S | Iran               | IRN | 2.1%         | EU-S | Norway                 | NOR | 100%         |
| ASI-W | Armenia            | ARM | 76.9%        |      | Sweden                 | SWE | 100%         |
|       | Cyprus             | CYP | 100%         |      | United Kingdom         | GBR | 100%         |
|       | Georgia            | GEO | 88.5%        |      | Albania                | ALB | 100%         |
|       | Iraq               | IRQ | 79.5%        |      | Bosnia and Herzegovina | BIH | 100%         |
| EU-E  | Israel             | ISR | 100%         |      | Croatia                | HRV | 100%         |
|       | Jordan             | JOR | 100%         | EU-W | Greece                 | GRC | 100%         |
|       | Lebanon            | LBN | 100%         |      | Italy                  | ITA | 100%         |
|       | Saudi Arabia       | SAU | 25.8%        |      | Kosovo                 | XKO | 100%         |
|       | Syria              | SYR | 100%         |      | Macedonia              | MKD | 100%         |
|       | Türkiye            | TUR | 100%         |      | Montenegro             | MNE | 100%         |
|       | Belarus            | BLR | 100%         |      | Portugal               | PRT | 97.6%        |
|       | Bulgaria           | BGR | 100%         |      | Serbia                 | SRB | 100%         |
|       | Czechia            | CZE | 100%         |      | Slovenia               | SVN | 100%         |
|       | Hungary            | HUN | 100%         |      | Spain                  | ESP | 100%         |
|       | Moldova            | MDA | 100%         |      | Austria                | AUT | 100%         |
|       | Poland             | POL | 100%         |      | Belgium                | BEL | 100%         |
|       | Romania            | ROU | 100%         |      | France                 | FRA | 100%         |
|       | Russian Federation | RUS | 9.2%         |      | Germany                | DEU | 100%         |
|       | Slovakia           | SVK | 100%         |      | Luxembourg             | LUX | 100%         |
|       | Ukraine            | UKR | 100%         |      | Netherlands            | NLD | 100%         |
| EU-N  | Denmark            | DNK | 100%         |      | Switzerland            | CHE | 100%         |
|       | Estonia            | EST | 100%         |      |                        |     |              |

**Table S1.** List of countries in the Europe area, including the Mediterranean basin. The area column follows the UNSD M49 standard, and the ISO column follows the ISO-3166-1 standard.



| Area  | Country                | Code | Observed |      | Natural Only |   | SSP1-2.6 |      | SSP2-4.5 |      | SSP3-7.0 |      | SSP5-8.5 |      |
|-------|------------------------|------|----------|------|--------------|---|----------|------|----------|------|----------|------|----------|------|
| AFR-N | Algeria                | DZA  | 10       | +2   | > 1000       | 0 | 2        | +2.3 | 2        | +2.7 | 2        | +2.7 | 1        | +3.1 |
|       | Egypt                  | EGY  | 10       | +1.3 | 100          | 0 | 10       | +1.5 | 10       | +1.7 | 10       | +1.7 | 5        | +1.9 |
|       | Libya                  | LBY  | 10       | +1.5 | > 1000       | 0 | 5        | +1.8 | 5        | +2.1 | 5        | +2.1 | 2        | +2.3 |
|       | Morocco                | MAR  | 10       | +1.5 | > 1000       | 0 | 10       | +1.8 | 5        | +2   | 5        | +2   | 5        | +2.3 |
|       | Tunisia                | TUN  | 10       | +1.9 | > 1000       | 0 | 10       | +2.2 | 5        | +2.6 | 5        | +2.6 | 5        | +2.8 |
| ASI-S | Iran                   | IRN  | 5        | +1.5 | 1000         | 0 | 2        | +1.8 | 2        | +2.1 | 2        | +2.1 | 1        | +2.4 |
| ASI-W | Armenia                | ARM  | 5        | +1.7 | 500          | 0 | 2        | +2   | 2        | +2.3 | 2        | +2.3 | 2        | +2.6 |
|       | Cyprus                 | CYP  | 10       | +1.3 | 100          | 0 | 5        | +1.5 | 5        | +1.8 | 5        | +1.8 | 5        | +2   |
|       | Georgia                | GEO  | 10       | +1.7 | > 1000       | 0 | 5        | +2   | 5        | +2.3 | 5        | +2.3 | 2        | +2.6 |
|       | Iraq                   | IRQ  | 5        | +2   | > 1000       | 0 | 2        | +2.3 | 2        | +2.7 | 2        | +2.7 | 1        | +3.1 |
|       | Israel                 | ISR  | 10       | +1.4 | 100          | 0 | 10       | +1.7 | 5        | +2   | 5        | +2   | 5        | +2.2 |
|       | Jordan                 | JOR  | 10       | +1.9 | > 1000       | 0 | 5        | +2.3 | 5        | +2.7 | 5        | +2.6 | 2        | +3   |
|       | Lebanon                | LBN  | 10       | +1.5 | 100          | 0 | 5        | +1.8 | 5        | +2   | 5        | +2   | 2        | +2.3 |
|       | Saudi Arabia           | SAU  | 10       | +2.1 | > 1000       | 0 | 2        | +2.5 | 2        | +3   | 2        | +3   | 1        | +3.4 |
|       | Syria                  | SYR  | 10       | +1.9 | > 1000       | 0 | 5        | +2.2 | 2        | +2.5 | 2        | +2.5 | 2        | +2.8 |
|       | Türkiye                | TUR  | 10       | +1.7 | > 1000       | 0 | 5        | +2   | 5        | +2.4 | 5        | +2.4 | 2        | +2.7 |
| EU-E  | Belarus                | BLR  | 30       | +1.6 | 500          | 0 | 10       | +2   | 10       | +2.2 | 10       | +2.2 | 10       | +2.5 |
|       | Bulgaria               | BGR  | 30       | +1.9 | > 1000       | 0 | 10       | +2.2 | 10       | +2.5 | 10       | +2.5 | 5        | +2.8 |
|       | Czechia                | CZE  | 5        | +1.5 | 100          | 0 | 5        | +1.8 | 2        | +2   | 2        | +2.1 | 2        | +2.3 |
|       | Hungary                | HUN  | 10       | +1.6 | 500          | 0 | 5        | +1.9 | 5        | +2.2 | 5        | +2.2 | 2        | +2.5 |
|       | Moldova                | MDA  | 10       | +2   | > 1000       | 0 | 10       | +2.4 | 5        | +2.7 | 5        | +2.8 | 5        | +3.1 |
|       | Poland                 | POL  | 10       | +1.5 | 100          | 0 | 5        | +1.8 | 5        | +2   | 5        | +2   | 5        | +2.2 |
|       | Romania                | ROU  | 10       | +1.8 | > 1000       | 0 | 10       | +2.1 | 5        | +2.5 | 5        | +2.5 | 5        | +2.7 |
|       | Russian Federation     | RUS  | 30       | +1   | 500          | 0 | 10       | +1.2 | 10       | +1.4 | 10       | +1.4 | 10       | +1.6 |
|       | Slovakia               | SVK  | 10       | +1.7 | 500          | 0 | 5        | +2.1 | 2        | +2.4 | 2        | +2.4 | 2        | +2.7 |
|       | Ukraine                | UKR  | 10       | +1.8 | > 1000       | 0 | 5        | +2.2 | 5        | +2.5 | 5        | +2.5 | 5        | +2.8 |
| EU-N  | Denmark                | DNK  | 10       | +0.7 | 100          | 0 | 10       | +0.9 | 10       | +1   | 10       | +1   | 10       | +1.2 |
|       | Estonia                | EST  | 10       | +1.2 | 500          | 0 | 5        | +1.4 | 5        | +1.6 | 5        | +1.6 | 5        | +1.8 |
|       | Finland                | FIN  | 10       | +0.6 | 100          | 0 | 10       | +0.8 | 5        | +0.9 | 5        | +0.9 | 5        | +1   |
|       | Iceland                | ISL  | 30       | +0.7 | 100          | 0 | 10       | +0.9 | 10       | +1   | 10       | +1   | 10       | +1.2 |
|       | Ireland                | IRL  | 10       | +0.7 | 50           | 0 | 10       | +0.8 | 10       | +0.9 | 10       | +1   | 10       | +1.1 |
|       | Latvia                 | LVA  | 10       | +1.2 | 100          | 0 | 5        | +1.4 | 5        | +1.6 | 5        | +1.6 | 5        | +1.8 |
|       | Lithuania              | LTU  | 10       | +1.1 | 100          | 0 | 5        | +1.4 | 5        | +1.5 | 5        | +1.6 | 5        | +1.7 |
|       | Norway                 | NOR  | 30       | +0.6 | 100          | 0 | 10       | +0.7 | 10       | +0.8 | 10       | +0.8 | 10       | +0.9 |
|       | Sweden                 | SWE  | 10       | +0.6 | 100          | 0 | 10       | +0.7 | 10       | +0.8 | 10       | +0.9 | 5        | +1   |
|       | United Kingdom         | GBR  | 50       | +0.6 | 500          | 0 | 50       | +0.7 | 30       | +0.9 | 30       | +0.9 | 30       | +1   |
| EU-S  | Albania                | ALB  | 5        | +1.6 | > 1000       | 0 | 5        | +1.9 | 2        | +2.2 | 2        | +2.2 | 2        | +2.4 |
|       | Bosnia and Herzegovina | BIH  | 10       | +1.9 | > 1000       | 0 | 5        | +2.3 | 2        | +2.6 | 2        | +2.7 | 2        | +2.9 |
|       | Croatia                | HRV  | 10       | +1.8 | > 1000       | 0 | 5        | +2.1 | 2        | +2.5 | 2        | +2.5 | 2        | +2.7 |
|       | Greece                 | GRC  | 10       | +1.7 | > 1000       | 0 | 10       | +2   | 5        | +2.3 | 5        | +2.3 | 5        | +2.5 |
|       | Italy                  | ITA  | 10       | +1.6 | > 1000       | 0 | 10       | +2   | 5        | +2.3 | 5        | +2.3 | 5        | +2.5 |

|      |             |     |     |      |        |   |    |      |    |      |    |      |    |      |
|------|-------------|-----|-----|------|--------|---|----|------|----|------|----|------|----|------|
|      | Kosovo      | XKO | 30  | +1.9 | > 1000 | 0 | 10 | +2.3 | 5  | +2.7 | 5  | +2.7 | 5  | +3   |
|      | Macedonia   | MKD | 10  | +1.9 | > 1000 | 0 | 10 | +2.3 | 5  | +2.7 | 5  | +2.7 | 5  | +3   |
|      | Montenegro  | MNE | 10  | +2   | > 1000 | 0 | 5  | +2.4 | 2  | +2.7 | 2  | +2.8 | 2  | +3.1 |
|      | Portugal    | PRT | 30  | +1.3 | > 1000 | 0 | 30 | +1.5 | 10 | +1.8 | 10 | +1.8 | 10 | +2   |
|      | Serbia      | SRB | 10  | +1.8 | > 1000 | 0 | 5  | +2.1 | 5  | +2.5 | 5  | +2.5 | 5  | +2.8 |
|      | Slovenia    | SVN | 10  | +1.8 | 500    | 0 | 5  | +2.2 | 5  | +2.5 | 5  | +2.5 | 5  | +2.8 |
|      | Spain       | ESP | 10  | +1.9 | > 1000 | 0 | 10 | +2.2 | 5  | +2.6 | 5  | +2.6 | 5  | +2.9 |
| EU-W | Austria     | AUT | 10  | +1.5 | 100    | 0 | 5  | +1.8 | 5  | +2.1 | 5  | +2.1 | 2  | +2.3 |
|      | Belgium     | BEL | 50  | +1.4 | > 1000 | 0 | 30 | +1.6 | 30 | +1.9 | 30 | +1.9 | 10 | +2.1 |
|      | France      | FRA | 30  | +1.6 | > 1000 | 0 | 30 | +1.9 | 10 | +2.2 | 10 | +2.2 | 10 | +2.5 |
|      | Germany     | DEU | 10  | +1.3 | 500    | 0 | 10 | +1.6 | 10 | +1.8 | 10 | +1.8 | 5  | +2   |
|      | Luxembourg  | LUX | 30  | +1.6 | 500    | 0 | 10 | +1.9 | 10 | +2.2 | 10 | +2.1 | 10 | +2.4 |
|      | Netherlands | NLD | 100 | +1.3 | > 1000 | 0 | 50 | +1.6 | 30 | +1.8 | 30 | +1.8 | 30 | +2   |
|      | Switzerland | CHE | 10  | +1.7 | > 1000 | 0 | 10 | +2   | 5  | +2.3 | 5  | +2.3 | 5  | +2.6 |

**Table S2.** Lower bound of the 95% confidence interval (quantile 2.5%) for return periods and change in intensity in 2040 in TX3x over the Europe. In columns: values are given for a world without human influence (Natural Only) and 4 CMIP6 scenarios. Observed values correspond to the year 2024. For each column, the first value is the return period, rounded to the nearest 1, 2, 5, 10, 30, 50, 100, 500 and 1000 years. The second is the difference with the world without human influence (i.e. this is an estimator of local climate change extremes at the end of the century).



| Area  | Country                | Code | Observed |      | Natural Only |   | SSP1-2.6 |      | SSP2-4.5 |      | SSP3-7.0 |      | SSP5-8.5 |      |
|-------|------------------------|------|----------|------|--------------|---|----------|------|----------|------|----------|------|----------|------|
| AFR-N | Algeria                | DZA  | > 1000   | +3   | > 1000       | 0 | 50       | +3.6 | 10       | +4   | 10       | +4   | 5        | +4.3 |
|       | Egypt                  | EGY  | 100      | +2.3 | > 1000       | 0 | 50       | +2.7 | 50       | +3.1 | 50       | +3.1 | 30       | +3.3 |
|       | Libya                  | LBY  | 50       | +2.4 | > 1000       | 0 | 30       | +2.9 | 10       | +3.3 | 10       | +3.3 | 10       | +3.5 |
|       | Morocco                | MAR  | > 1000   | +2.5 | > 1000       | 0 | 500      | +3   | 500      | +3.4 | 100      | +3.4 | > 1000   | +3.7 |
|       | Tunisia                | TUN  | 1000     | +2.9 | > 1000       | 0 | 100      | +3.5 | 50       | +3.9 | 100      | +3.9 | 50       | +4.2 |
| ASI-S | Iran                   | IRN  | 50       | +2.6 | > 1000       | 0 | 10       | +3.2 | 10       | +3.7 | 10       | +3.7 | 5        | +4.1 |
| ASI-W | Armenia                | ARM  | 30       | +2.9 | > 1000       | 0 | 10       | +3.6 | 10       | +4   | 10       | +4   | 5        | +4.4 |
|       | Cyprus                 | CYP  | 100      | +2.2 | > 1000       | 0 | 50       | +2.6 | 30       | +3   | 30       | +2.9 | 30       | +3.2 |
|       | Georgia                | GEO  | 100      | +3.1 | > 1000       | 0 | 50       | +3.8 | 30       | +4.2 | 30       | +4.2 | 10       | +4.6 |
|       | Iraq                   | IRQ  | 50       | +3   | > 1000       | 0 | 10       | +3.6 | 5        | +4.1 | 5        | +4.1 | 5        | +4.4 |
|       | Israel                 | ISR  | 100      | +2.6 | > 1000       | 0 | 50       | +3.1 | 30       | +3.5 | 30       | +3.5 | 30       | +3.7 |
|       | Jordan                 | JOR  | 100      | +3   | > 1000       | 0 | 30       | +3.6 | 10       | +4   | 10       | +4   | 10       | +4.4 |
|       | Lebanon                | LBN  | 100      | +2.5 | > 1000       | 0 | 50       | +3   | 30       | +3.4 | 50       | +3.4 | 30       | +3.7 |
|       | Saudi Arabia           | SAU  | > 1000   | +3.2 | > 1000       | 0 | 30       | +3.9 | 10       | +4.4 | 10       | +4.4 | 5        | +4.8 |
|       | Syria                  | SYR  | 100      | +2.8 | > 1000       | 0 | 30       | +3.4 | 10       | +3.8 | 10       | +3.8 | 10       | +4.1 |
|       | Türkiye                | TUR  | > 1000   | +2.9 | > 1000       | 0 | 100      | +3.5 | 30       | +4   | 30       | +4   | 10       | +4.3 |
| EU-E  | Belarus                | BLR  | > 1000   | +3.7 | > 1000       | 0 | 500      | +4.4 | 100      | +4.8 | 100      | +4.9 | 100      | +5.3 |
|       | Bulgaria               | BGR  | 100      | +3.1 | > 1000       | 0 | 100      | +3.7 | 50       | +4.1 | 50       | +4.2 | 30       | +4.5 |
|       | Czechia                | CZE  | 50       | +3.4 | > 1000       | 0 | 30       | +4.1 | 10       | +4.5 | 10       | +4.6 | 10       | +4.9 |
|       | Hungary                | HUN  | 100      | +3.2 | > 1000       | 0 | 50       | +3.9 | 30       | +4.3 | 30       | +4.4 | 10       | +4.7 |
|       | Moldova                | MDA  | 100      | +3.5 | > 1000       | 0 | 100      | +4.3 | 50       | +4.6 | 50       | +4.7 | 30       | +5   |
|       | Poland                 | POL  | 100      | +3.5 | > 1000       | 0 | 50       | +4.1 | 50       | +4.5 | 50       | +4.6 | 30       | +4.9 |
|       | Romania                | ROU  | 500      | +3.3 | > 1000       | 0 | 100      | +4   | 50       | +4.4 | 50       | +4.4 | 30       | +4.8 |
|       | Russian Federation     | RUS  | > 1000   | +2.8 | > 1000       | 0 | 1000     | +3.4 | 500      | +3.8 | 500      | +3.8 | 500      | +4.1 |
|       | Slovakia               | SVK  | 100      | +3.6 | > 1000       | 0 | 50       | +4.4 | 30       | +4.8 | 30       | +4.8 | 10       | +5.2 |
|       | Ukraine                | UKR  | 500      | +3.5 | > 1000       | 0 | 100      | +4.2 | 50       | +4.6 | 50       | +4.7 | 30       | +5   |
| EU-N  | Denmark                | DNK  | 500      | +2.3 | > 1000       | 0 | 100      | +2.7 | 100      | +3   | 100      | +3   | 100      | +3.3 |
|       | Estonia                | EST  | 100      | +2.8 | > 1000       | 0 | 100      | +3.4 | 50       | +3.8 | 50       | +3.8 | 30       | +4.1 |
|       | Finland                | FIN  | 500      | +2.4 | > 1000       | 0 | 100      | +2.8 | 100      | +3.2 | 100      | +3.2 | 100      | +3.4 |
|       | Iceland                | ISL  | > 1000   | +2.4 | > 1000       | 0 | 1000     | +2.8 | 500      | +3.1 | 500      | +3.2 | 500      | +3.4 |
|       | Ireland                | IRL  | 100      | +1.7 | > 1000       | 0 | 100      | +2.1 | 100      | +2.3 | 100      | +2.3 | 100      | +2.5 |
|       | Latvia                 | LVA  | 100      | +2.9 | > 1000       | 0 | 100      | +3.6 | 50       | +3.9 | 50       | +4   | 30       | +4.3 |
|       | Lithuania              | LTU  | 100      | +3.2 | > 1000       | 0 | 100      | +3.8 | 50       | +4.2 | 50       | +4.2 | 50       | +4.5 |
|       | Norway                 | NOR  | > 1000   | +2.3 | > 1000       | 0 | > 1000   | +2.8 | > 1000   | +3.1 | > 1000   | +3.1 | > 1000   | +3.4 |
|       | Sweden                 | SWE  | > 1000   | +2.4 | > 1000       | 0 | 1000     | +2.9 | 100      | +3.2 | 1000     | +3.2 | > 1000   | +3.5 |
|       | United Kingdom         | GBR  | > 1000   | +1.9 | > 1000       | 0 | > 1000   | +2.3 | > 1000   | +2.6 | > 1000   | +2.6 | > 1000   | +2.8 |
| EU-S  | Albania                | ALB  | 50       | +3   | > 1000       | 0 | 30       | +3.7 | 10       | +4.2 | 10       | +4.2 | 10       | +4.5 |
|       | Bosnia and Herzegovina | BIH  | 100      | +3.6 | > 1000       | 0 | 30       | +4.4 | 10       | +4.9 | 10       | +4.9 | 10       | +5.3 |
|       | Croatia                | HRV  | 100      | +3.4 | > 1000       | 0 | 30       | +4.1 | 30       | +4.6 | 30       | +4.6 | 10       | +4.9 |
|       | Greece                 | GRC  | 100      | +2.9 | > 1000       | 0 | 100      | +3.4 | 50       | +3.8 | 50       | +3.8 | 30       | +4.1 |
|       | Italy                  | ITA  | > 1000   | +3   | > 1000       | 0 | 100      | +3.6 | 50       | +4   | 50       | +4   | 30       | +4.3 |

|      |             |     |        |      |        |   |        |      |        |      |        |      |      |      |
|------|-------------|-----|--------|------|--------|---|--------|------|--------|------|--------|------|------|------|
|      | Kosovo      | XKO | 100    | +3.6 | > 1000 | 0 | 100    | +4.4 | 50     | +4.9 | 50     | +4.9 | 30   | +5.4 |
|      | Macedonia   | MKD | 100    | +3.3 | > 1000 | 0 | 100    | +4   | 30     | +4.5 | 30     | +4.5 | 30   | +4.9 |
|      | Montenegro  | MNE | 100    | +3.7 | > 1000 | 0 | 50     | +4.5 | 30     | +5.1 | 30     | +5.1 | 10   | +5.5 |
|      | Portugal    | PRT | > 1000 | +2.5 | > 1000 | 0 | 500    | +3   | 100    | +3.4 | 100    | +3.4 | 100  | +3.7 |
|      | Serbia      | SRB | > 1000 | +3.3 | > 1000 | 0 | 50     | +4   | 30     | +4.5 | 30     | +4.5 | 30   | +4.9 |
|      | Slovenia    | SVN | 100    | +3.7 | > 1000 | 0 | 50     | +4.4 | 50     | +4.8 | 30     | +4.9 | 30   | +5.2 |
|      | Spain       | ESP | > 1000 | +3.2 | > 1000 | 0 | 100    | +3.8 | 50     | +4.3 | 50     | +4.3 | 30   | +4.6 |
| EU-W | Austria     | AUT | 100    | +3.2 | > 1000 | 0 | 100    | +3.9 | 30     | +4.3 | 30     | +4.3 | 30   | +4.7 |
|      | Belgium     | BEL | > 1000 | +3.3 | > 1000 | 0 | > 1000 | +3.9 | 1000   | +4.3 | 1000   | +4.3 | 500  | +4.6 |
|      | France      | FRA | > 1000 | +3.2 | > 1000 | 0 | 500    | +3.8 | 100    | +4.2 | 100    | +4.2 | 100  | +4.6 |
|      | Germany     | DEU | > 1000 | +3.1 | > 1000 | 0 | 500    | +3.7 | 100    | +4.1 | 100    | +4.1 | 100  | +4.4 |
|      | Luxembourg  | LUX | 1000   | +3.3 | > 1000 | 0 | 500    | +3.9 | 100    | +4.3 | 100    | +4.3 | 100  | +4.6 |
|      | Netherlands | NLD | > 1000 | +3.2 | > 1000 | 0 | > 1000 | +3.9 | > 1000 | +4.3 | > 1000 | +4.3 | 1000 | +4.6 |
|      | Switzerland | CHE | > 1000 | +3.1 | > 1000 | 0 | 100    | +3.7 | 100    | +4.2 | 50     | +4.2 | 30   | +4.5 |

**Table S3.** Upper bound of the 95% confidence interval (quantile 97.5%) for return periods and change in intensity in 2040 in TX3x over the Europe. In columns: values are given for a world without human influence (Natural Only) and 4 CMIP6 scenarios. Observed values correspond to the year 2024. For each column, the first value is the return period, rounded to the nearest 1, 2, 5, 10, 30, 50, 100, 500 and 1000 years. The second is the difference with the world without human influence (i.e. this is an estimator of local climate change extremes at the end of the century).



| Area  | Country                | Code | Observed |      | Natural Only |   | SSP1-2.6 | SSP2-4.5 | SSP3-7.0 | SSP5-8.5 |
|-------|------------------------|------|----------|------|--------------|---|----------|----------|----------|----------|
| AFR-N | Algeria                | DZA  | 10       | +2   | > 1000       | 0 | 1 +2.3   | 1 +3.9   | 1 +5.6   | 1 +6.7   |
|       | Egypt                  | EGY  | 10       | +1.3 | 100          | 0 | 5 +1.5   | 1 +2.6   | 1 +3.8   | 1 +4.6   |
|       | Libya                  | LBY  | 10       | +1.5 | > 1000       | 0 | 2 +1.8   | 1 +3     | 1 +4.4   | 1 +5.3   |
|       | Morocco                | MAR  | 10       | +1.5 | > 1000       | 0 | 5 +1.8   | 2 +3     | 1 +4.2   | 1 +5     |
|       | Tunisia                | TUN  | 10       | +1.9 | > 1000       | 0 | 5 +2.2   | 1 +3.6   | 1 +5.1   | 1 +6     |
| ASI-S | Iran                   | IRN  | 5        | +1.5 | 1000         | 0 | 1 +1.9   | 1 +3.2   | 1 +4.8   | 1 +6     |
| ASI-W | Armenia                | ARM  | 5        | +1.7 | 500          | 0 | 1 +2     | 1 +3.5   | 1 +5     | 1 +6     |
|       | Cyprus                 | CYP  | 10       | +1.3 | 100          | 0 | 2 +1.6   | 1 +2.6   | 1 +3.7   | 1 +4.4   |
|       | Georgia                | GEO  | 10       | +1.7 | > 1000       | 0 | 2 +2.1   | 1 +3.5   | 1 +5.2   | 1 +6.5   |
|       | Iraq                   | IRQ  | 5        | +2   | > 1000       | 0 | 1 +2.3   | 1 +3.9   | 1 +5.8   | 1 +7.1   |
|       | Israel                 | ISR  | 10       | +1.4 | 100          | 0 | 5 +1.8   | 1 +2.9   | 1 +3.9   | 1 +4.6   |
|       | Jordan                 | JOR  | 10       | +1.9 | > 1000       | 0 | 2 +2.3   | 1 +3.8   | 1 +5.4   | 1 +6.4   |
|       | Lebanon                | LBN  | 10       | +1.5 | 100          | 0 | 2 +1.9   | 1 +3     | 1 +4.1   | 1 +4.8   |
|       | Saudi Arabia           | SAU  | 10       | +2.1 | > 1000       | 0 | 1 +2.5   | 1 +4.3   | 1 +6.6   | 1 +8.1   |
|       | Syria                  | SYR  | 10       | +1.9 | > 1000       | 0 | 2 +2.2   | 1 +3.6   | 1 +5.1   | 1 +6     |
|       | Türkiye                | TUR  | 10       | +1.7 | > 1000       | 0 | 2 +2.1   | 1 +3.6   | 1 +5.2   | 1 +6.3   |
| EU-E  | Belarus                | BLR  | 30       | +1.6 | 500          | 0 | 5 +2.1   | 1 +3.4   | 1 +4.9   | 1 +6     |
|       | Bulgaria               | BGR  | 30       | +1.9 | > 1000       | 0 | 5 +2.3   | 1 +3.7   | 1 +5.3   | 1 +6.3   |
|       | Czechia                | CZE  | 5        | +1.5 | 100          | 0 | 2 +1.9   | 1 +3.2   | 1 +4.7   | 1 +5.8   |
|       | Hungary                | HUN  | 10       | +1.6 | 500          | 0 | 2 +2     | 1 +3.4   | 1 +4.9   | 1 +6.1   |
|       | Moldova                | MDA  | 10       | +2   | > 1000       | 0 | 5 +2.5   | 1 +4     | 1 +5.6   | 1 +6.7   |
|       | Poland                 | POL  | 10       | +1.5 | 100          | 0 | 2 +1.9   | 1 +3     | 1 +4.3   | 1 +5.2   |
|       | Romania                | ROU  | 10       | +1.8 | > 1000       | 0 | 5 +2.3   | 1 +3.7   | 1 +5.3   | 1 +6.4   |
|       | Russian Federation     | RUS  | 30       | +1   | 500          | 0 | 10 +1.3  | 2 +2.3   | 1 +3.4   | 1 +4.3   |
|       | Slovakia               | SVK  | 10       | +1.7 | 500          | 0 | 2 +2.2   | 1 +3.7   | 1 +5.4   | 1 +6.7   |
|       | Ukraine                | UKR  | 10       | +1.8 | > 1000       | 0 | 2 +2.3   | 1 +3.7   | 1 +5.3   | 1 +6.4   |
| EU-N  | Denmark                | DNK  | 10       | +0.7 | 100          | 0 | 5 +1     | 2 +1.7   | 1 +2.6   | 1 +3.4   |
|       | Estonia                | EST  | 10       | +1.2 | 500          | 0 | 2 +1.5   | 1 +2.5   | 1 +3.7   | 1 +4.6   |
|       | Finland                | FIN  | 10       | +0.6 | 100          | 0 | 5 +0.9   | 1 +1.5   | 1 +2.3   | 1 +3     |
|       | Iceland                | ISL  | 30       | +0.7 | 100          | 0 | 10 +1    | 2 +1.8   | 1 +3     | 1 +4.1   |
|       | Ireland                | IRL  | 10       | +0.7 | 50           | 0 | 10 +0.9  | 5 +1.5   | 2 +2.3   | 1 +3     |
|       | Latvia                 | LVA  | 10       | +1.2 | 100          | 0 | 2 +1.5   | 1 +2.6   | 1 +3.8   | 1 +4.7   |
|       | Lithuania              | LTU  | 10       | +1.1 | 100          | 0 | 2 +1.5   | 1 +2.5   | 1 +3.6   | 1 +4.5   |
|       | Norway                 | NOR  | 30       | +0.6 | 100          | 0 | 10 +0.8  | 2 +1.4   | 1 +2.2   | 1 +2.9   |
|       | Sweden                 | SWE  | 10       | +0.6 | 100          | 0 | 5 +0.8   | 2 +1.4   | 1 +2.2   | 1 +2.9   |
|       | United Kingdom         | GBR  | 50       | +0.6 | 500          | 0 | 30 +0.8  | 10 +1.5  | 2 +2.3   | 1 +3     |
| EU-S  | Albania                | ALB  | 5        | +1.6 | > 1000       | 0 | 2 +2     | 1 +3.4   | 1 +4.9   | 1 +6     |
|       | Bosnia and Herzegovina | BIH  | 10       | +1.9 | > 1000       | 0 | 2 +2.4   | 1 +4     | 1 +5.9   | 1 +7.2   |
|       | Croatia                | HRV  | 10       | +1.8 | > 1000       | 0 | 2 +2.3   | 1 +3.7   | 1 +5.4   | 1 +6.6   |
|       | Greece                 | GRC  | 10       | +1.7 | > 1000       | 0 | 5 +2     | 1 +3.4   | 1 +4.9   | 1 +5.9   |
|       | Italy                  | ITA  | 10       | +1.6 | > 1000       | 0 | 2 +2     | 1 +3.4   | 1 +4.8   | 1 +5.8   |

|      |             |     |     |      |        |   |    |      |   |      |   |      |   |      |
|------|-------------|-----|-----|------|--------|---|----|------|---|------|---|------|---|------|
|      | Kosovo      | XKO | 30  | +1.9 | > 1000 | 0 | 2  | +2.4 | 1 | +4.1 | 1 | +6.2 | 1 | +7.7 |
|      | Macedonia   | MKD | 10  | +1.9 | > 1000 | 0 | 2  | +2.4 | 1 | +4   | 1 | +5.9 | 1 | +7.1 |
|      | Montenegro  | MNE | 10  | +2   | > 1000 | 0 | 2  | +2.5 | 1 | +4.2 | 1 | +6.3 | 1 | +7.8 |
|      | Portugal    | PRT | 30  | +1.3 | > 1000 | 0 | 10 | +1.6 | 2 | +2.7 | 1 | +4   | 1 | +4.9 |
|      | Serbia      | SRB | 10  | +1.8 | > 1000 | 0 | 2  | +2.2 | 1 | +3.7 | 1 | +5.4 | 1 | +6.6 |
|      | Slovenia    | SVN | 10  | +1.8 | 500    | 0 | 2  | +2.3 | 1 | +3.7 | 1 | +5.3 | 1 | +6.3 |
|      | Spain       | ESP | 10  | +1.9 | > 1000 | 0 | 2  | +2.3 | 1 | +3.8 | 1 | +5.5 | 1 | +6.6 |
| EU-W | Austria     | AUT | 10  | +1.5 | 100    | 0 | 2  | +1.9 | 1 | +3.2 | 1 | +4.7 | 1 | +5.8 |
|      | Belgium     | BEL | 50  | +1.4 | > 1000 | 0 | 10 | +1.8 | 2 | +2.9 | 1 | +4.3 | 1 | +5.3 |
|      | France      | FRA | 30  | +1.6 | > 1000 | 0 | 10 | +2   | 2 | +3.4 | 1 | +4.9 | 1 | +6   |
|      | Germany     | DEU | 10  | +1.3 | 500    | 0 | 5  | +1.7 | 1 | +2.8 | 1 | +4.1 | 1 | +5.2 |
|      | Luxembourg  | LUX | 30  | +1.6 | 500    | 0 | 10 | +2   | 2 | +3.2 | 1 | +4.4 | 1 | +5.5 |
|      | Netherlands | NLD | 100 | +1.3 | > 1000 | 0 | 30 | +1.7 | 5 | +2.8 | 2 | +4.2 | 1 | +5.3 |
|      | Switzerland | CHE | 10  | +1.7 | > 1000 | 0 | 5  | +2.1 | 1 | +3.5 | 1 | +4.9 | 1 | +5.9 |

**Table S4.** Lower bound of the 95% confidence interval (quantile 2.5%) for return periods and change in intensity in 2100 in TX3x over the Europe. In columns: values are given for a world without human influence (Natural Only) and 4 CMIP6 scenarios. Observed values correspond to the year 2024. For each column, the first value is the return period, rounded to the nearest 1, 2 , 5 , 10, 30, 50, 100, 500 and 1000 years. The second is the difference with the world without human influence (i.e. this is an estimator of local climate change extremes at the end of the century).



| Area  | Country                | Code | Observed |      | Natural Only |   | SSP1-2.6 |      | SSP2-4.5 |      | SSP3-7.0 |       | SSP5-8.5 |       |
|-------|------------------------|------|----------|------|--------------|---|----------|------|----------|------|----------|-------|----------|-------|
| AFR-N | Algeria                | DZA  | > 1000   | +3   | > 1000       | 0 | > 1000   | +4.7 | 2        | +7.4 | 1        | +9.7  | 1        | +11.3 |
|       | Egypt                  | EGY  | 100      | +2.3 | > 1000       | 0 | 50       | +3.5 | 10       | +5.6 | 5        | +7.5  | 2        | +10.3 |
|       | Libya                  | LBY  | 50       | +2.4 | > 1000       | 0 | 30       | +3.8 | 5        | +6   | 2        | +8    | 1        | +10.9 |
|       | Morocco                | MAR  | > 1000   | +2.5 | > 1000       | 0 | > 1000   | +3.9 | > 1000   | +6.2 | > 1000   | +8.2  | > 1000   | +10   |
|       | Tunisia                | TUN  | 1000     | +2.9 | > 1000       | 0 | 100      | +4.5 | 10       | +6.8 | 2        | +8.9  | 1        | +11.8 |
| ASI-S | Iran                   | IRN  | 50       | +2.6 | > 1000       | 0 | 10       | +4.4 | 2        | +7.7 | 1        | +11.5 | 1        | +15.2 |
| ASI-W | Armenia                | ARM  | 30       | +2.9 | > 1000       | 0 | 10       | +4.6 | 2        | +7.6 | 1        | +10.7 | 1        | +15   |
|       | Cyprus                 | CYP  | 100      | +2.2 | > 1000       | 0 | 50       | +3.4 | 10       | +5.7 | 2        | +7.6  | 1        | +10   |
|       | Georgia                | GEO  | 100      | +3.1 | > 1000       | 0 | 50       | +4.9 | 5        | +7.8 | 2        | +10.7 | 1        | +14.7 |
|       | Iraq                   | IRQ  | 50       | +3   | > 1000       | 0 | 10       | +4.8 | 2        | +7.9 | 1        | +10.7 | 1        | +13.4 |
|       | Israel                 | ISR  | 100      | +2.6 | > 1000       | 0 | 50       | +3.9 | 10       | +5.9 | 5        | +7.6  | 2        | +9.8  |
|       | Jordan                 | JOR  | 100      | +3   | > 1000       | 0 | 30       | +4.7 | 5        | +7.3 | 1        | +9.7  | 1        | +12.6 |
|       | Lebanon                | LBN  | 100      | +2.5 | > 1000       | 0 | 50       | +3.9 | 10       | +6.1 | 2        | +8.2  | 2        | +10.6 |
|       | Saudi Arabia           | SAU  | > 1000   | +3.2 | > 1000       | 0 | 30       | +5.2 | 2        | +8.8 | 1        | +11.9 | 1        | +13.7 |
|       | Syria                  | SYR  | 100      | +2.8 | > 1000       | 0 | 30       | +4.4 | 2        | +6.8 | 1        | +8.9  | 1        | +11.7 |
|       | Türkiye                | TUR  | > 1000   | +2.9 | > 1000       | 0 | 50       | +4.6 | 5        | +7.4 | 2        | +10.2 | 1        | +13.8 |
| EU-E  | Belarus                | BLR  | > 1000   | +3.7 | > 1000       | 0 | 500      | +5.5 | 30       | +8.1 | 10       | +10.7 | 2        | +14   |
|       | Bulgaria               | BGR  | 100      | +3.1 | > 1000       | 0 | 100      | +4.8 | 10       | +7.2 | 2        | +9.6  | 2        | +12.7 |
|       | Czechia                | CZE  | 50       | +3.4 | > 1000       | 0 | 30       | +5.2 | 5        | +7.7 | 2        | +10.1 | 1        | +13.5 |
|       | Hungary                | HUN  | 100      | +3.2 | > 1000       | 0 | 30       | +5.1 | 5        | +7.8 | 2        | +10.5 | 1        | +14.3 |
|       | Moldova                | MDA  | 100      | +3.5 | > 1000       | 0 | 100      | +5.4 | 10       | +8   | 2        | +10.3 | 1        | +13.3 |
|       | Poland                 | POL  | 100      | +3.5 | > 1000       | 0 | 50       | +5.1 | 10       | +7.4 | 5        | +9.4  | 2        | +11.8 |
|       | Romania                | ROU  | 500      | +3.3 | > 1000       | 0 | 100      | +5.1 | 10       | +7.7 | 2        | +10.3 | 1        | +13.6 |
|       | Russian Federation     | RUS  | > 1000   | +2.8 | > 1000       | 0 | 500      | +4.3 | 100      | +6.6 | > 1000   | +8.8  | 50       | +11.9 |
|       | Slovakia               | SVK  | 100      | +3.6 | > 1000       | 0 | 30       | +5.5 | 5        | +8.4 | 2        | +11.2 | 1        | +15   |
|       | Ukraine                | UKR  | 500      | +3.5 | > 1000       | 0 | 50       | +5.3 | 10       | +8.1 | 2        | +10.7 | 1        | +14.3 |
| EU-N  | Denmark                | DNK  | 500      | +2.3 | > 1000       | 0 | 100      | +3.4 | 50       | +5.2 | 10       | +6.8  | 5        | +8.9  |
|       | Estonia                | EST  | 100      | +2.8 | > 1000       | 0 | 50       | +4.3 | 10       | +6.4 | 5        | +8.3  | 2        | +10.7 |
|       | Finland                | FIN  | 500      | +2.4 | > 1000       | 0 | 100      | +3.5 | 50       | +5.5 | 10       | +7.3  | 10       | +9.9  |
|       | Iceland                | ISL  | > 1000   | +2.4 | > 1000       | 0 | 500      | +3.5 | 100      | +5.4 | 50       | +7.1  | 10       | +9.9  |
|       | Ireland                | IRL  | 100      | +1.7 | > 1000       | 0 | 100      | +2.6 | 30       | +3.9 | 10       | +5    | 10       | +6.4  |
|       | Latvia                 | LVA  | 100      | +2.9 | > 1000       | 0 | 50       | +4.5 | 10       | +6.9 | 5        | +9.3  | 2        | +12.4 |
|       | Lithuania              | LTU  | 100      | +3.2 | > 1000       | 0 | 50       | +4.7 | 10       | +7   | 5        | +9.1  | 2        | +11.9 |
|       | Norway                 | NOR  | > 1000   | +2.3 | > 1000       | 0 | > 1000   | +3.5 | > 1000   | +5.3 | > 1000   | +7.1  | > 1000   | +9.5  |
|       | Sweden                 | SWE  | > 1000   | +2.4 | > 1000       | 0 | 500      | +3.6 | 100      | +5.5 | > 1000   | +7.4  | > 1000   | +9.9  |
|       | United Kingdom         | GBR  | > 1000   | +1.9 | > 1000       | 0 | > 1000   | +2.9 | 500      | +4.5 | 100      | +5.9  | 30       | +7.7  |
| EU-S  | Albania                | ALB  | 50       | +3   | > 1000       | 0 | 30       | +4.9 | 5        | +7.8 | 1        | +10.8 | 1        | +15   |
|       | Bosnia and Herzegovina | BIH  | 100      | +3.6 | > 1000       | 0 | 30       | +5.7 | 5        | +8.9 | 1        | +12.1 | 1        | +16.5 |
|       | Croatia                | HRV  | 100      | +3.4 | > 1000       | 0 | 30       | +5.3 | 5        | +8.1 | 2        | +10.8 | 1        | +14.5 |
|       | Greece                 | GRC  | 100      | +2.9 | > 1000       | 0 | 50       | +4.4 | 10       | +6.8 | 2        | +9.1  | 1        | +12.1 |
|       | Italy                  | ITA  | > 1000   | +3   | > 1000       | 0 | 100      | +4.6 | 10       | +7.2 | 2        | +9.7  | 1        | +12.9 |

|      |             |     |        |      |        |   |        |      |     |      |    |       |    |       |
|------|-------------|-----|--------|------|--------|---|--------|------|-----|------|----|-------|----|-------|
|      | Kosovo      | XKO | 100    | +3.6 | > 1000 | 0 | 100    | +5.9 | 10  | +9.5 | 2  | +13.7 | 1  | +19.3 |
|      | Macedonia   | MKD | 100    | +3.3 | > 1000 | 0 | 50     | +5.3 | 5   | +8.6 | 2  | +12   | 1  | +17.2 |
|      | Montenegro  | MNE | 100    | +3.7 | > 1000 | 0 | 50     | +6   | 5   | +9.8 | 1  | +13.7 | 1  | +18.6 |
|      | Portugal    | PRT | > 1000 | +2.5 | > 1000 | 0 | 500    | +3.9 | 50  | +5.9 | 10 | +7.7  | 5  | +10.2 |
|      | Serbia      | SRB | > 1000 | +3.3 | > 1000 | 0 | 50     | +5.3 | 10  | +8.3 | 2  | +11.5 | 1  | +15.9 |
|      | Slovenia    | SVN | 100    | +3.7 | > 1000 | 0 | 50     | +5.5 | 10  | +7.9 | 2  | +10.1 | 1  | +13   |
|      | Spain       | ESP | > 1000 | +3.2 | > 1000 | 0 | 100    | +4.9 | 10  | +7.5 | 2  | +9.8  | 1  | +12.8 |
| EU-W | Austria     | AUT | 100    | +3.2 | > 1000 | 0 | 50     | +4.9 | 10  | +7.5 | 2  | +10   | 1  | +13.5 |
|      | Belgium     | BEL | > 1000 | +3.3 | > 1000 | 0 | > 1000 | +4.8 | 100 | +7   | 10 | +8.7  | 5  | +11   |
|      | France      | FRA | > 1000 | +3.2 | > 1000 | 0 | 500    | +4.8 | 30  | +7.3 | 5  | +9.6  | 2  | +12.7 |
|      | Germany     | DEU | > 1000 | +3.1 | > 1000 | 0 | 100    | +4.7 | 30  | +7   | 5  | +9.2  | 2  | +12.3 |
|      | Luxembourg  | LUX | 1000   | +3.3 | > 1000 | 0 | 100    | +4.8 | 30  | +6.9 | 10 | +8.4  | 5  | +10.9 |
|      | Netherlands | NLD | > 1000 | +3.2 | > 1000 | 0 | > 1000 | +4.8 | 100 | +7   | 30 | +8.9  | 10 | +11.2 |
|      | Switzerland | CHE | > 1000 | +3.1 | > 1000 | 0 | 100    | +4.8 | 10  | +7.3 | 2  | +9.8  | 1  | +13.3 |

**Table S5.** Upper bound of the 95% confidence interval (quantile 97.5%) for return periods and change in intensity in 2100 in TX3x over the Europe. In columns: values are given for a world without human influence (Natural Only) and 4 CMIP6 scenarios. Observed values correspond to the year 2024. For each column, the first value is the return period, rounded to the nearest 1, 2, 5, 10, 30, 50, 100, 500 and 1000 years. The second is the difference with the world without human influence (i.e. this is an estimator of local climate change extremes at the end of the century).