

Supplementary materials for the article
“Changes in temperature-precipitation
correlations over Europe: Are climate models
reliable?”

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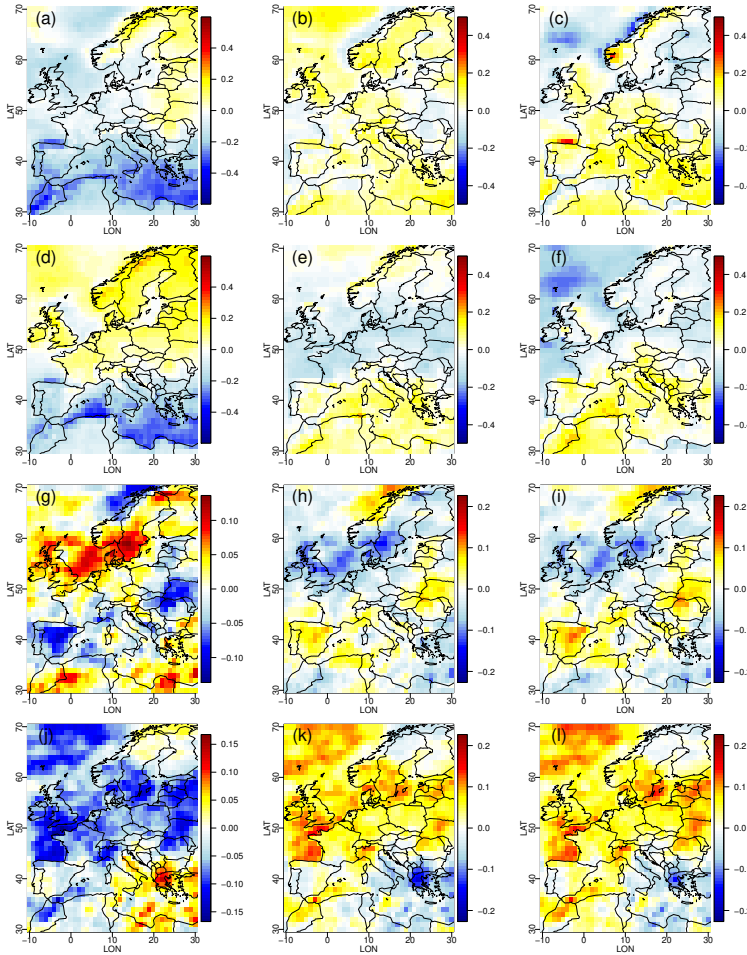
2 *Supplementary material for “Changes in temperature-precipitation correlations”*

Fig. SM.1 First two rows: (a, d) Maps of 1980-1999 ERA5 inter-variable (temperature, precipitation) correlations; (b, e) Biases of CMIP6 inter-variable correlations with respect to ERA5 correlations; (c, e) Biases of CESM inter-variable correlations with respect to ERA5 correlations. Last two rows: (g, j) Maps of changes (from 1980-1999 to 2000-2019) in ERA5 inter-variable (temperature, precipitation) correlations; (h, k) Biases of CMIP6 in changes of inter-variable correlations; (i, l) Biases of CESM in changes of inter-variable correlations. First row (a, b, c) and third one (g, h, i) correspond to spring results, while second (d, e, f) and fourth (j, k, l) ones correspond to fall results.

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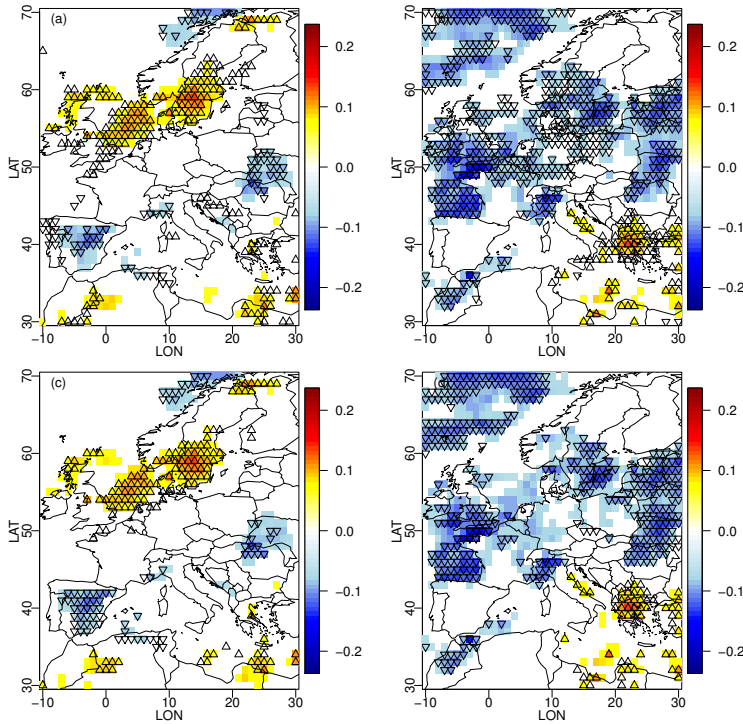


Fig. SM.2 Colours: significant changes in ERA5 (temperature vs. precipitation) Pearson correlations from 1980-1999 to 2000-2019. Symbols: upper triangles show where the ERA5 change in correlation is higher than the 95th percentile from the ensemble of correlation changes; lower triangles correspond to ERA5 change in correlation lower than the 5th percentile. Results are shown for CMIP6 (a, b) and CESM (c, d), for spring (a, c) and fall (b, d).

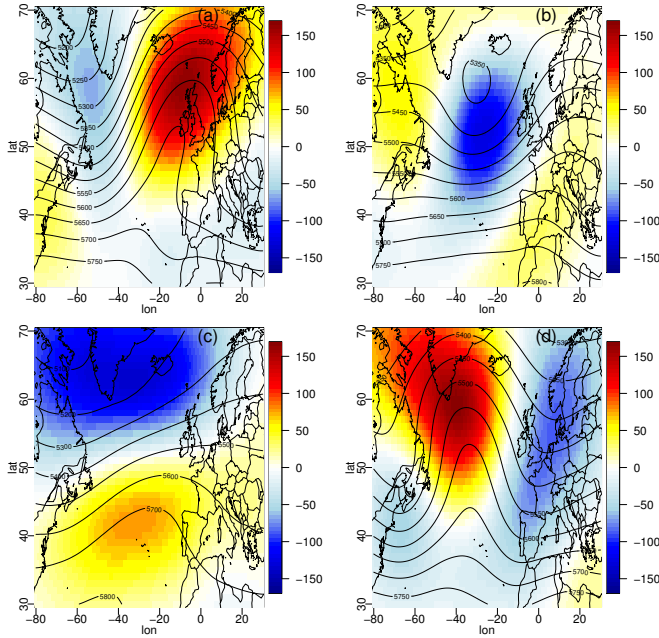


Fig. SM.3 Composite maps of the 4 ERA5 spring clusters obtained from the k-means algorithm applied to daily fields of z500 over the north Atlantic region. Colours correspond to z500 anomalies and contours to raw z500.

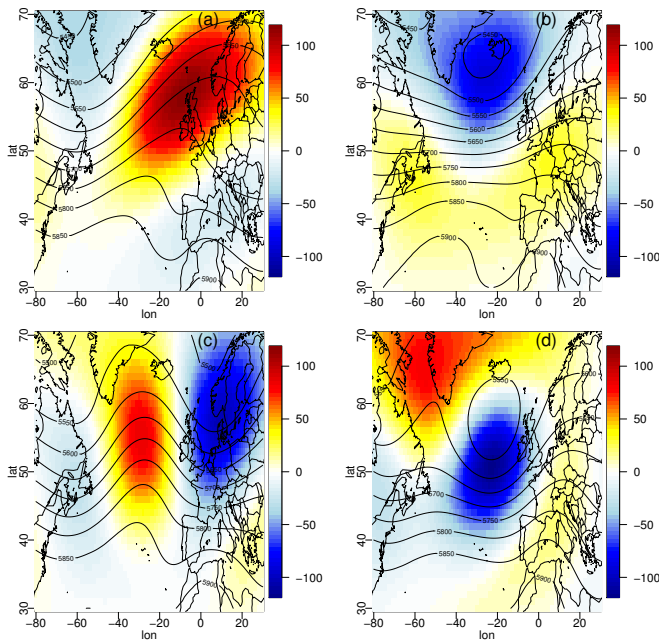


Fig. SM.4 Same as Fig. SM.3 but for summer.

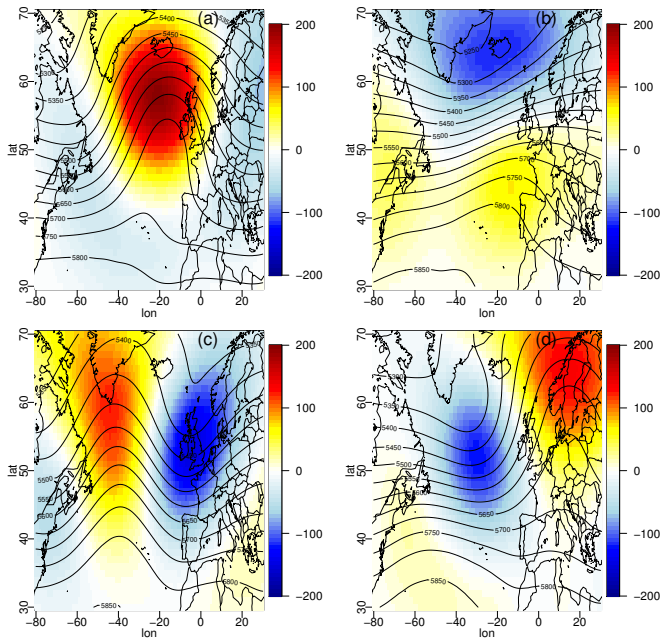


Fig. SM.5 Same as Fig. SM.3 but for fall.

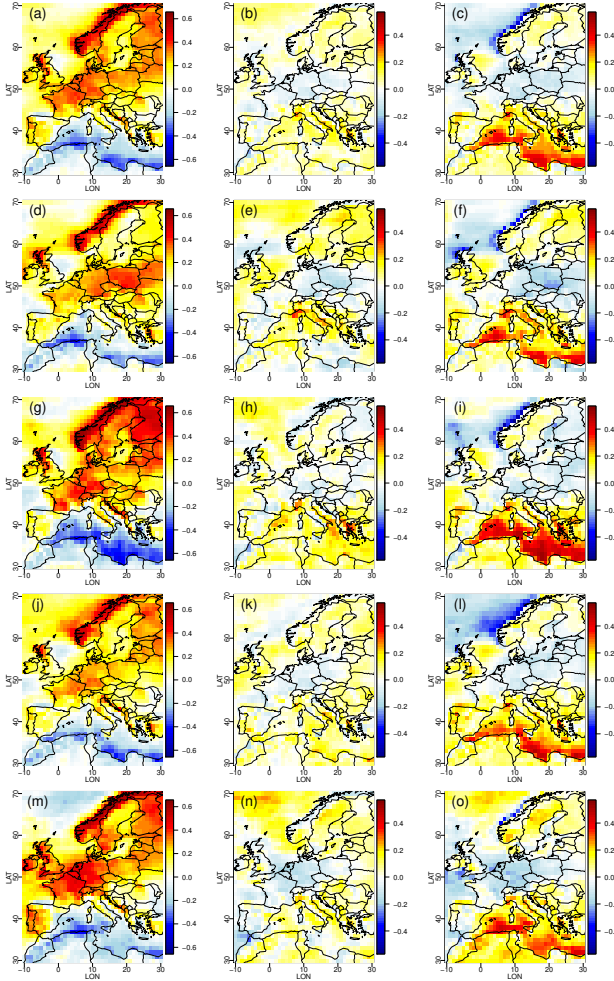


Fig. SM.6 (a, d, g, j, m): Maps of ERA5 winter inter-variable (temperature, precipitation) correlations without clustering (a) and conditionally on clusters 1 to 4 (d, g, j, m, respectively). Second column (b, e, h, k, n) corresponds to the biases of CMIP6 inter-variable correlations with respect to ERA5 correlations, without clustering (b) and for clusters 1 to 4 (e, h, k, n). Right column (c, f, i, l, o) is equivalent to second column but for CESM.

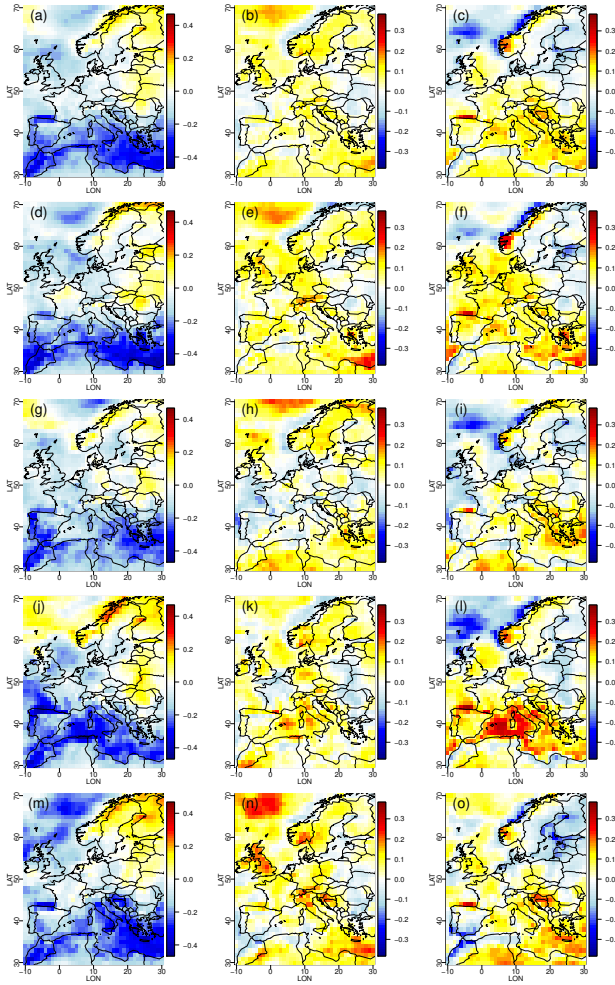


Fig. SM.7 Same as Figure SM.6 but for spring.

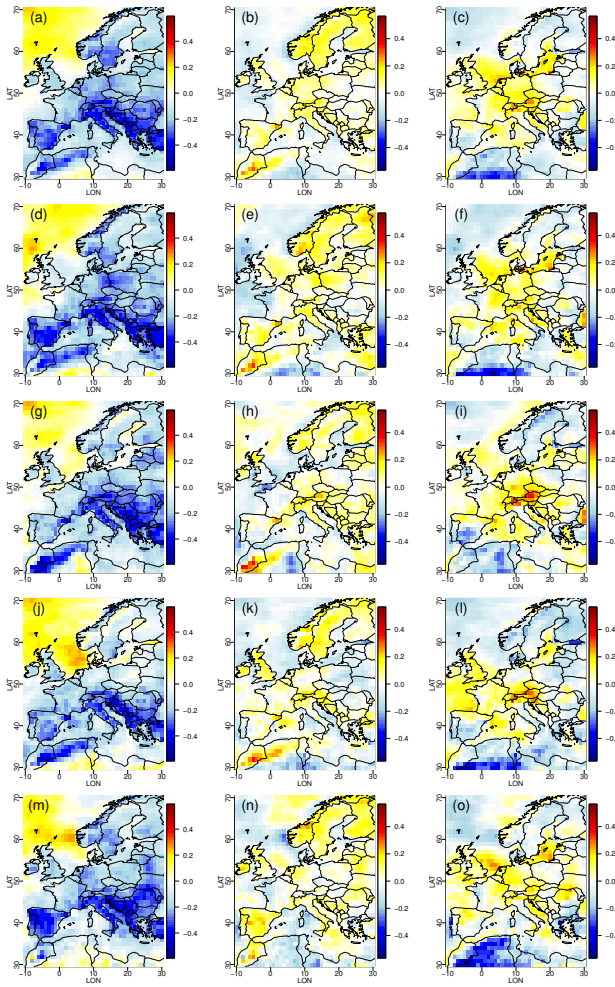


Fig. SM.8 Same as Figure SM.6 but for summer.

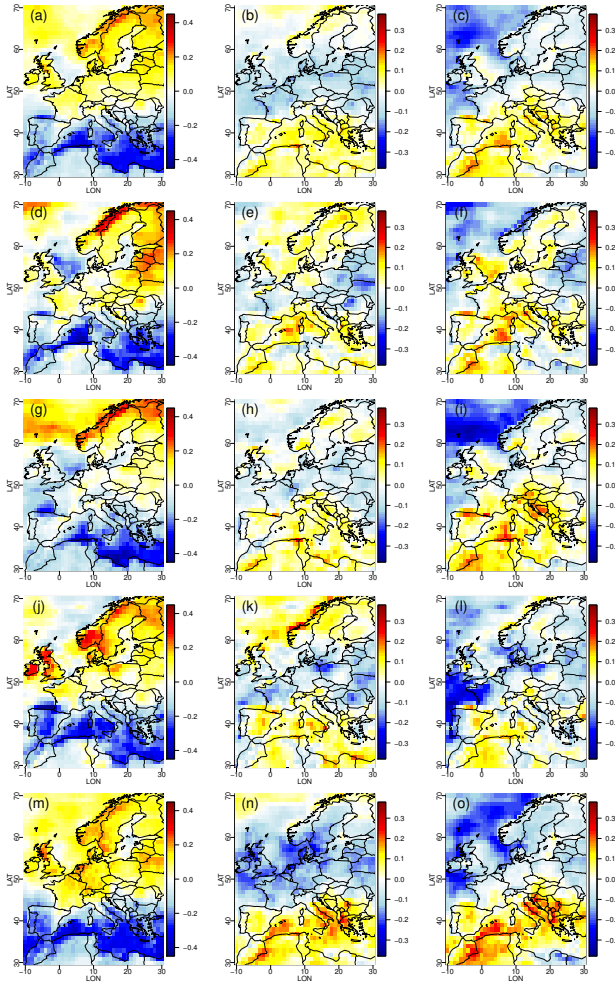


Fig. SM.9 Same as Figure SM.6 but for fall.

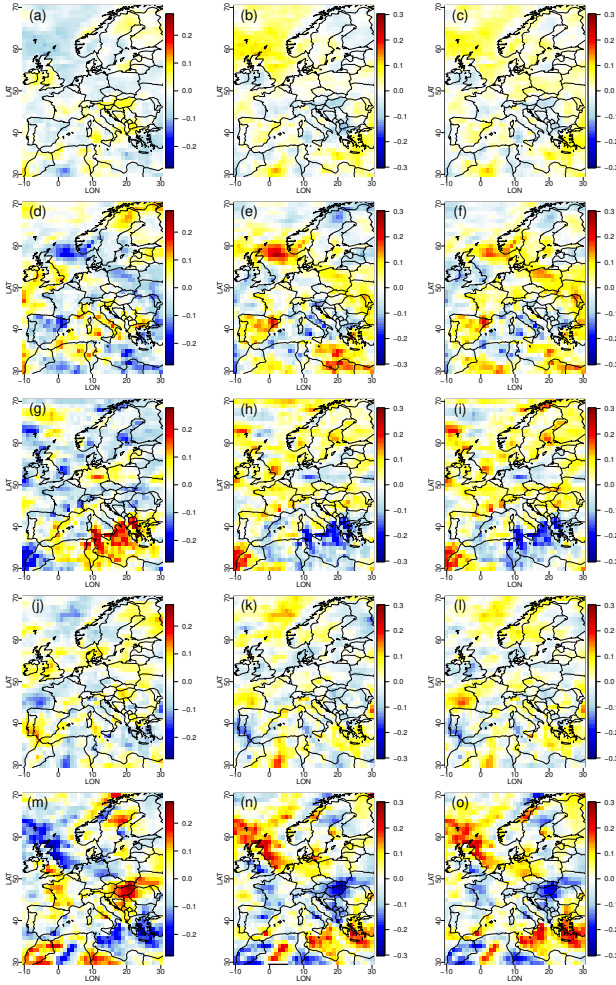


Fig. SM.10 Same as Fig. SM.6 but for biases in changes of winter inter-variable correlations from 1980-1999 to 2000-2019, with respect to the change observed in ERA5: (a, d, g, j, m): Maps of ERA5 winter changes (from 1980-1999 to 2000-2019) in inter-variable (temperature, precipitation) correlations without clustering (a) and conditionally on clusters 1 to 4 (d, g, j, m, respectively). Second column (b, e, h, k, n) corresponds to the biases of CMIP6 changes in inter-variable correlations with respect to ERA5 correlations, without clustering (b) and for clusters 1 to 4 (e, h, k, n). Right column (c, f, i, l, o) is equivalent to second column but for CESM.

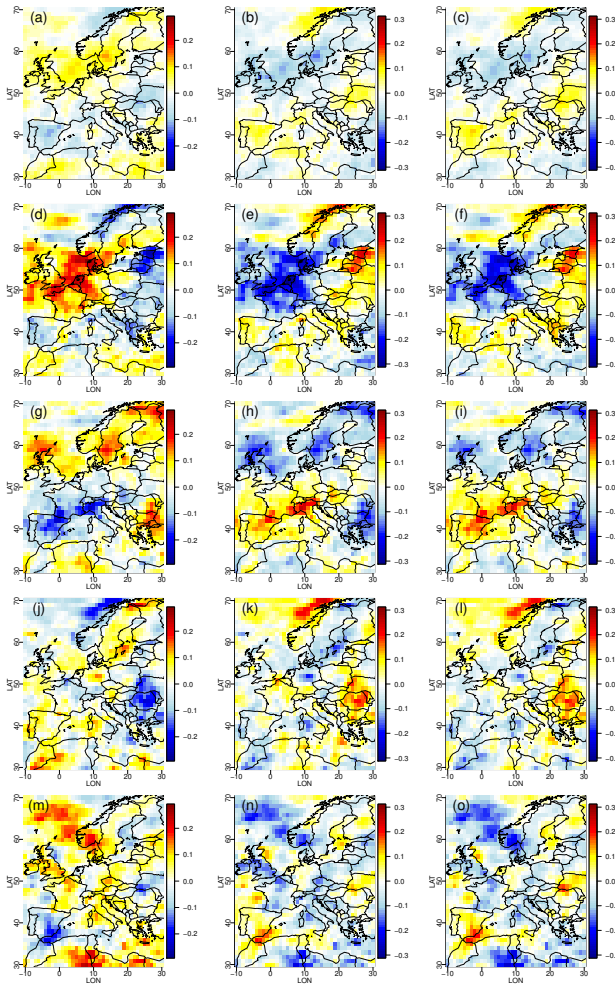


Fig. SM.11 Same as Figure SM.10 but for spring.

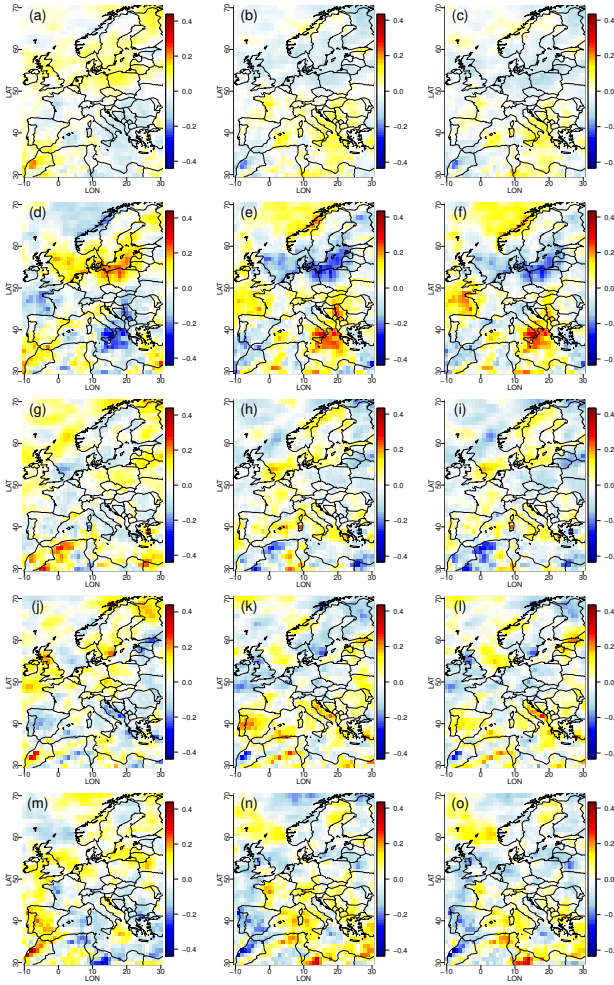


Fig. SM.12 Same as Figure SM.10 but for summer.

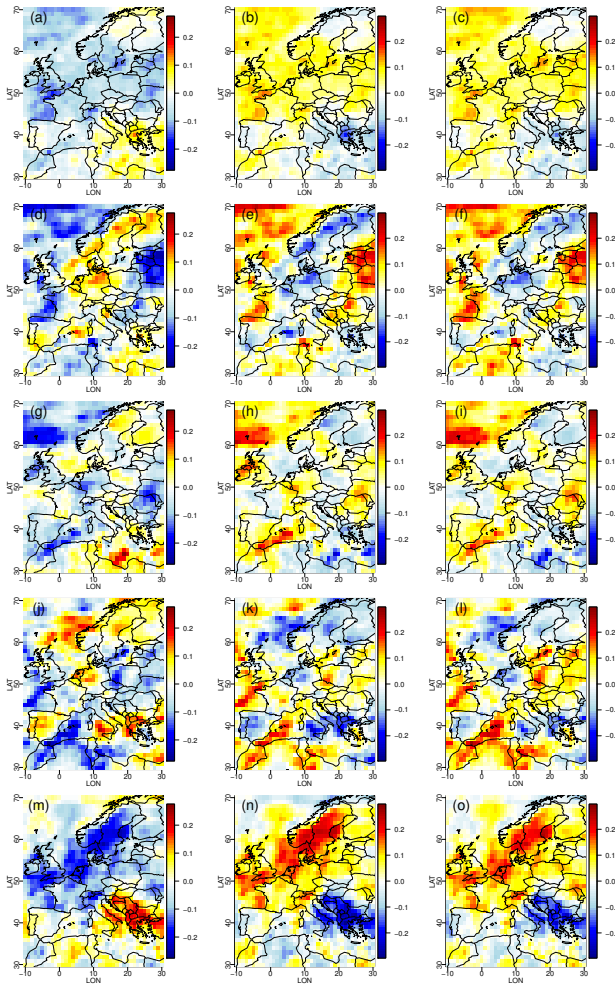


Fig. SM.13 Same as Figure SM.10 but for fall.

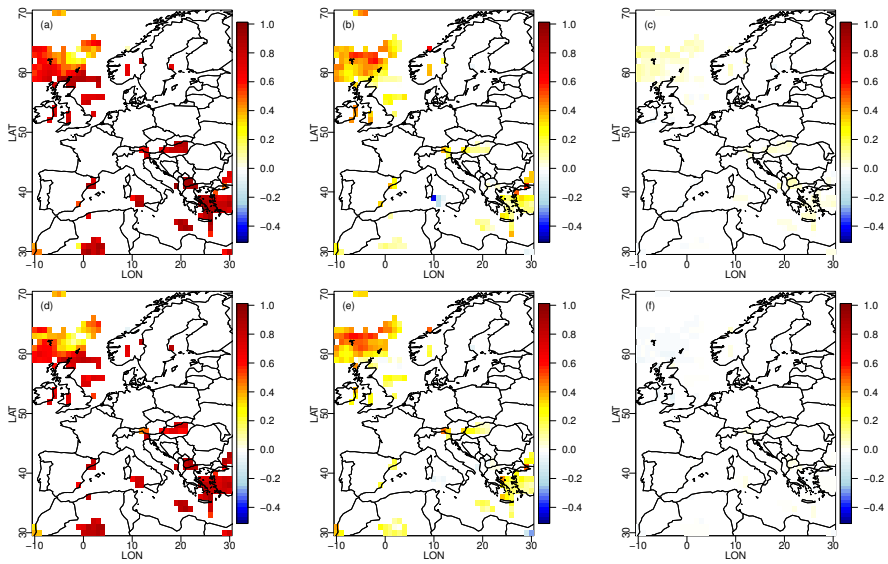


Fig. SM.14 Maps of mean influence values of the three **WRCI** components — (a, d) **P**, (b, e) **M**, (c, f) **n** — to the biases in changes of temperature-precipitation correlations from 1980-1999 to 2000-2019 in winter for (a, b, c) **CMIP6** and (d, e, f) **CESM**.

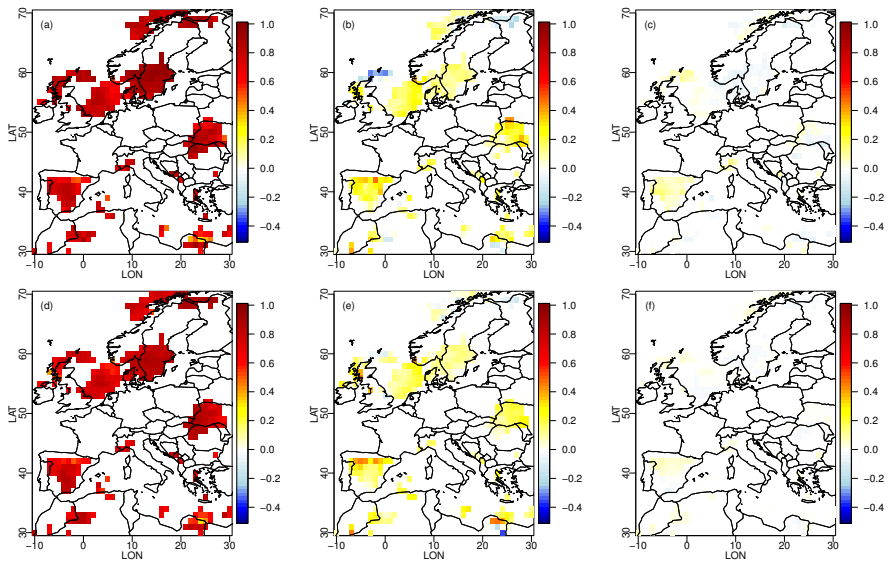


Fig. SM.15 Same as Fig. SM.14 but for spring.

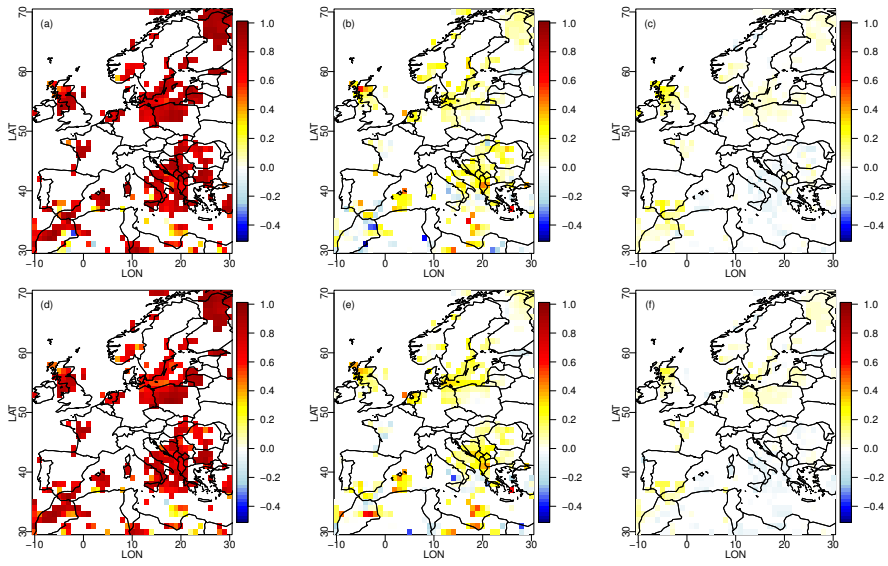


Fig. SM.16 Same as Fig. SM.14 but for summer.

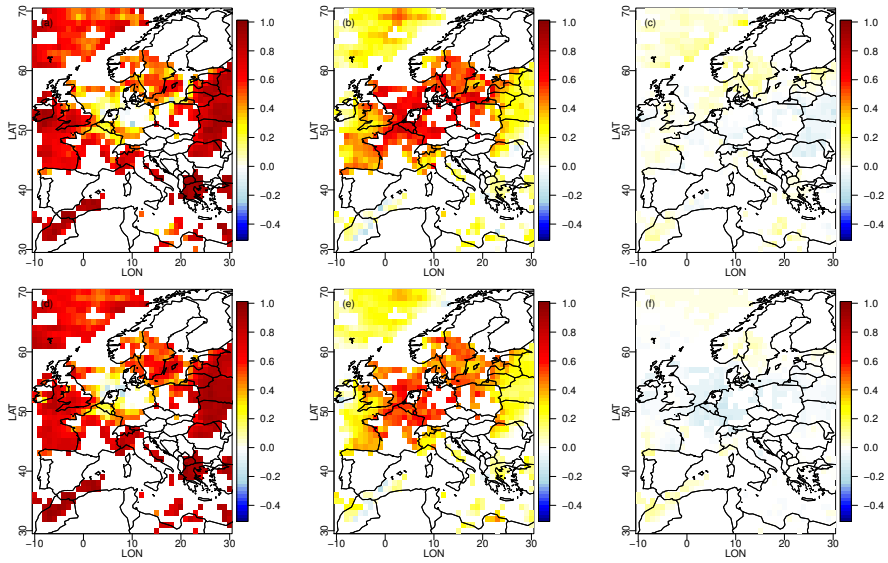


Fig. SM.17 Same as Fig. SM.14 but for fall.

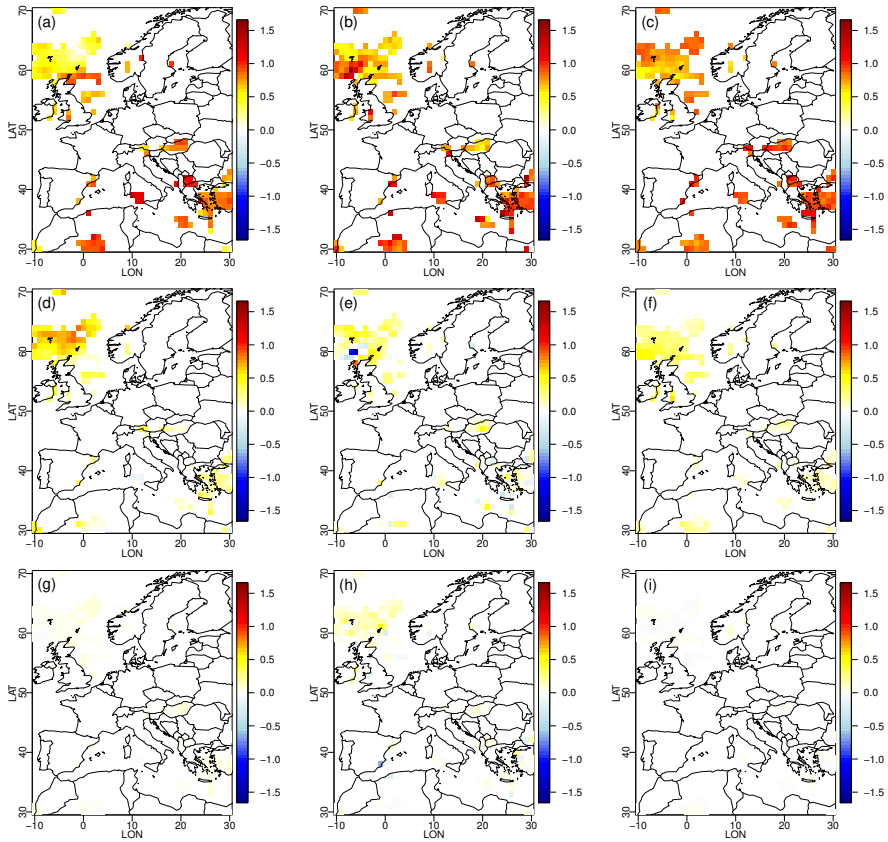


Fig. SM.18 Maps of mean contribution values of the three **WRCI** components — (a, b, c) **P**, (d, e, f) **M**, (g, h, i) **n** — to the biases in changes of temperature-precipitation correlations from 1980-1999 to 2000-2019 for (a, d, g) ERA5, (b, e, h) CMIP6 and (c, f, i) CESM, in winter.

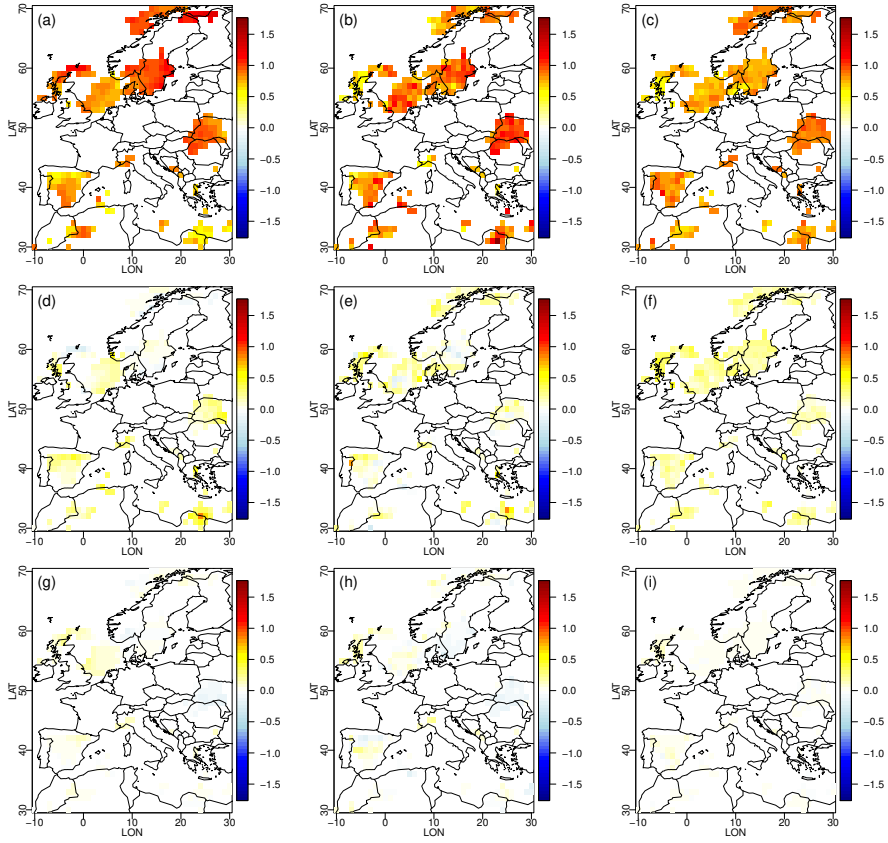


Fig. SM.19 Same as Fig. SM.18 but for spring.

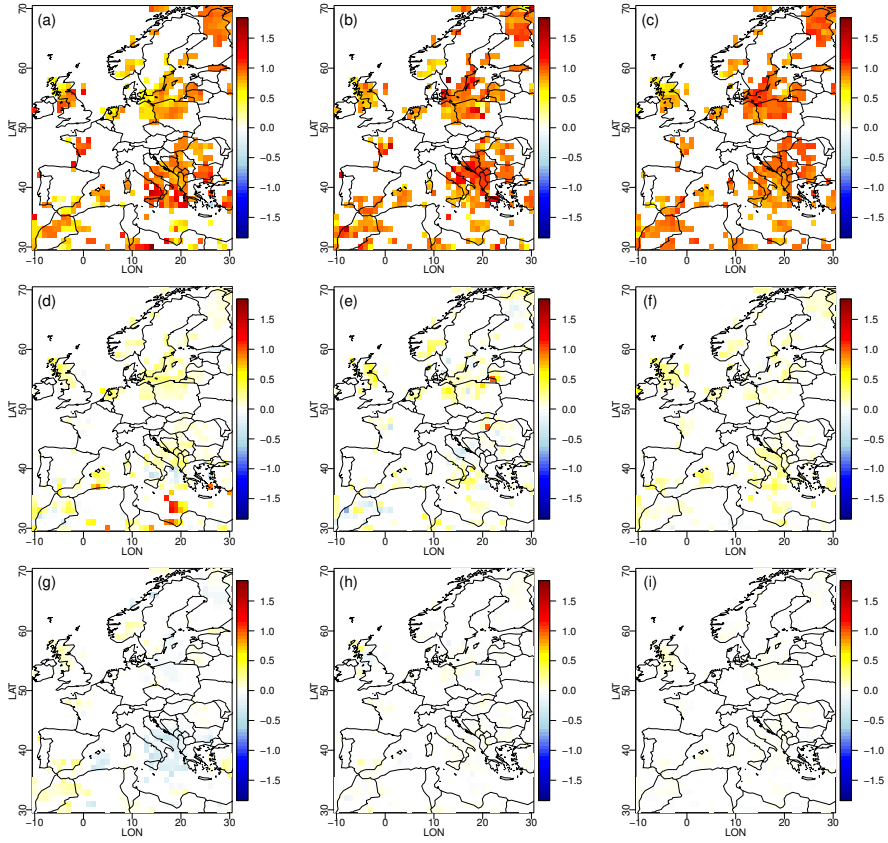


Fig. SM.20 Same as Fig. SM.18 but for summer.

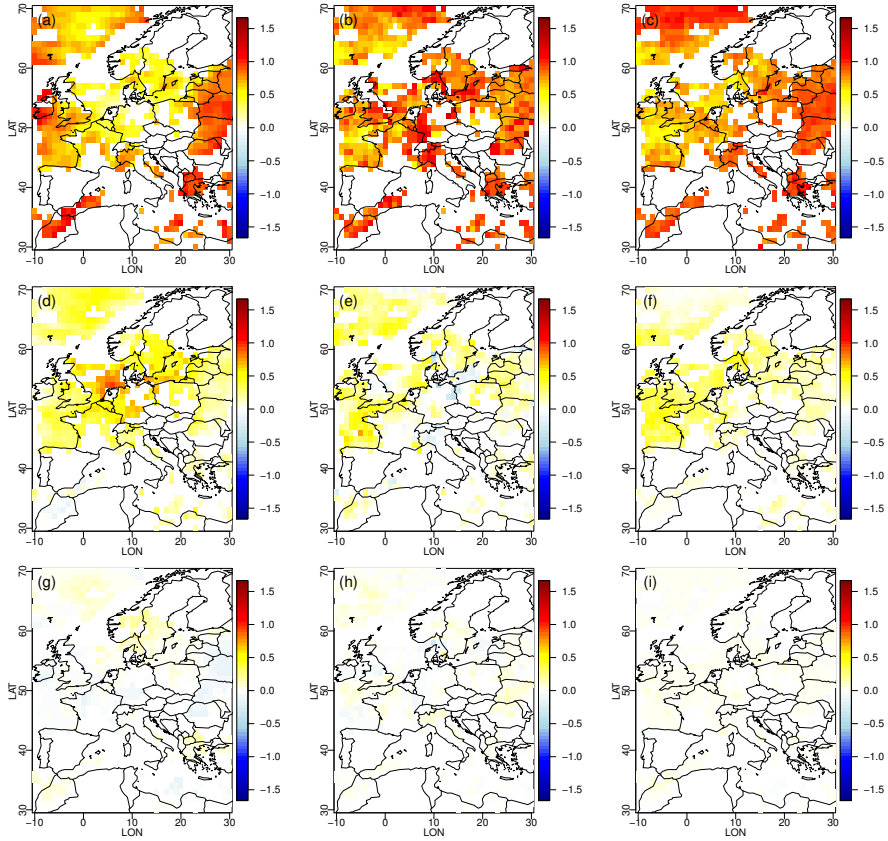


Fig. SM.21 Same as Fig. SM.18 but for fall.

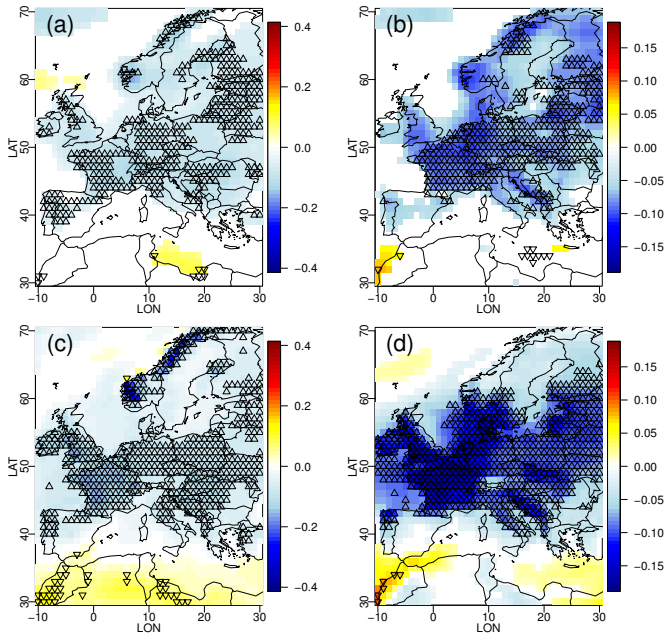


Fig. SM.22 Same as Figure 7 but for spring and fall. Colours: Significant mean differences in correlations from 1981-2000 to 2081-2100; Symbols: upper triangles show where $\pi_0 > 0.95$; lower triangles correspond to $\pi_0 < 0.05$. Results are shown for CMIP6 (a, b) and CESM (c,d), for spring (a, c) and fall (b, d).