



Supplement of

Climate field reconstructions for the North Atlantic region of annual and seasonal resolution spanning CE 1241–1970

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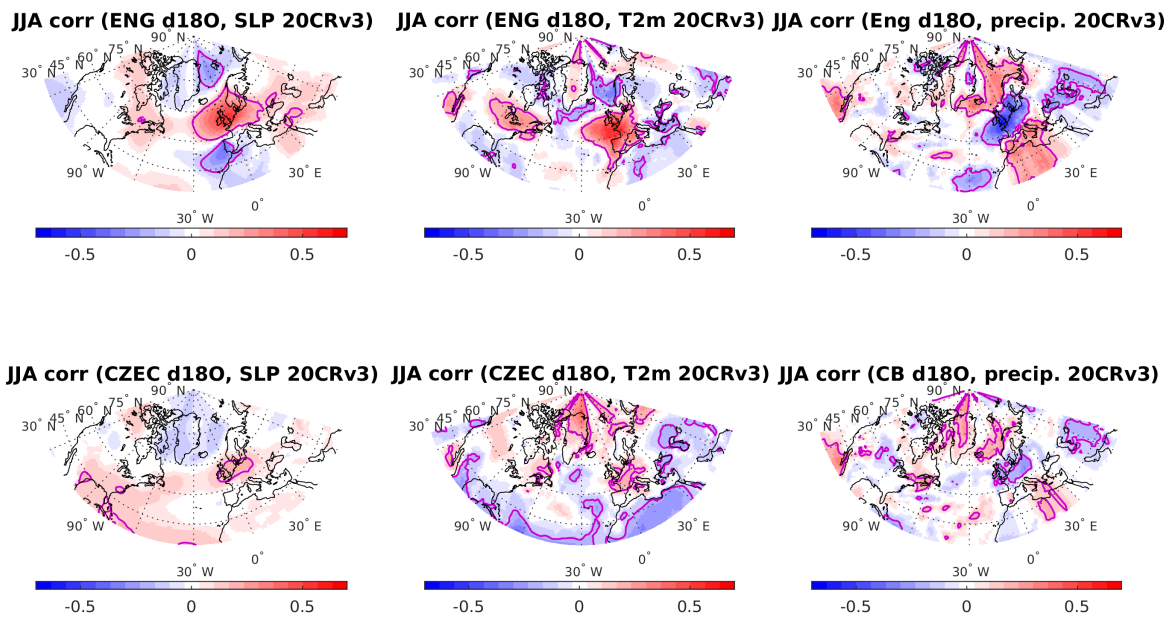


Figure S1: Upper panel: Correlation between $\delta^{18}\text{O}_{\text{cell}}$ ENG and JJA 20CRv3 SLP, T2m and precipitation amount. Lower panel: Correlation between $\delta^{18}\text{O}_{\text{cell}}$ CZEC and JJA 20CRv3 SLP, T2m and precipitation amount.

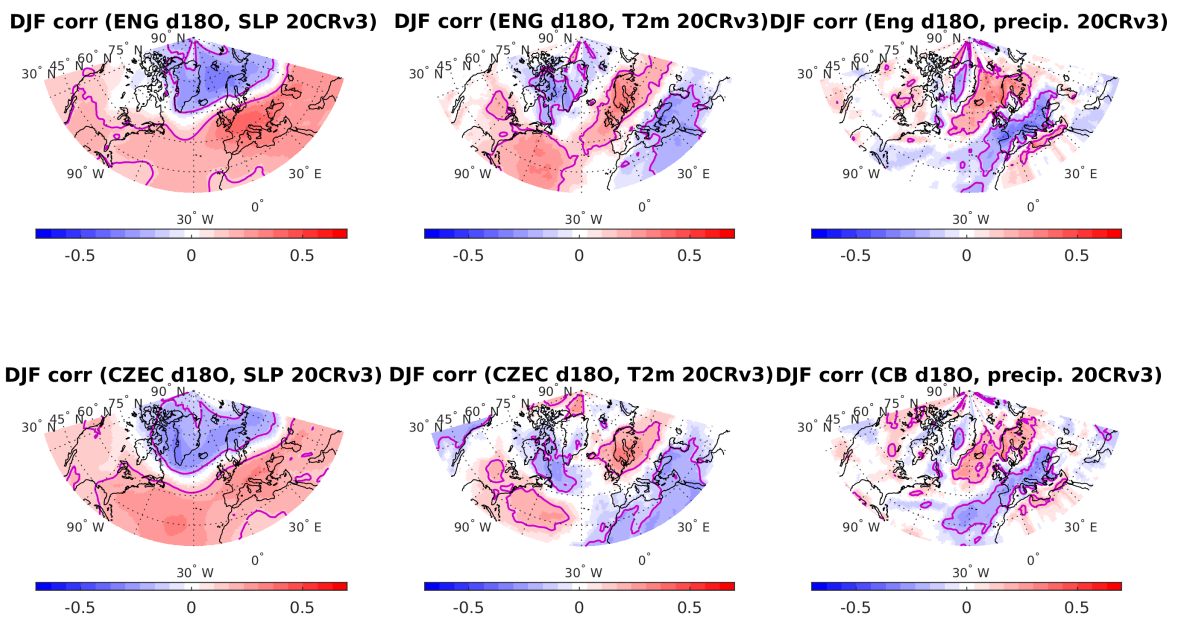


Figure S2: Same as Figure S1 but for DJF.

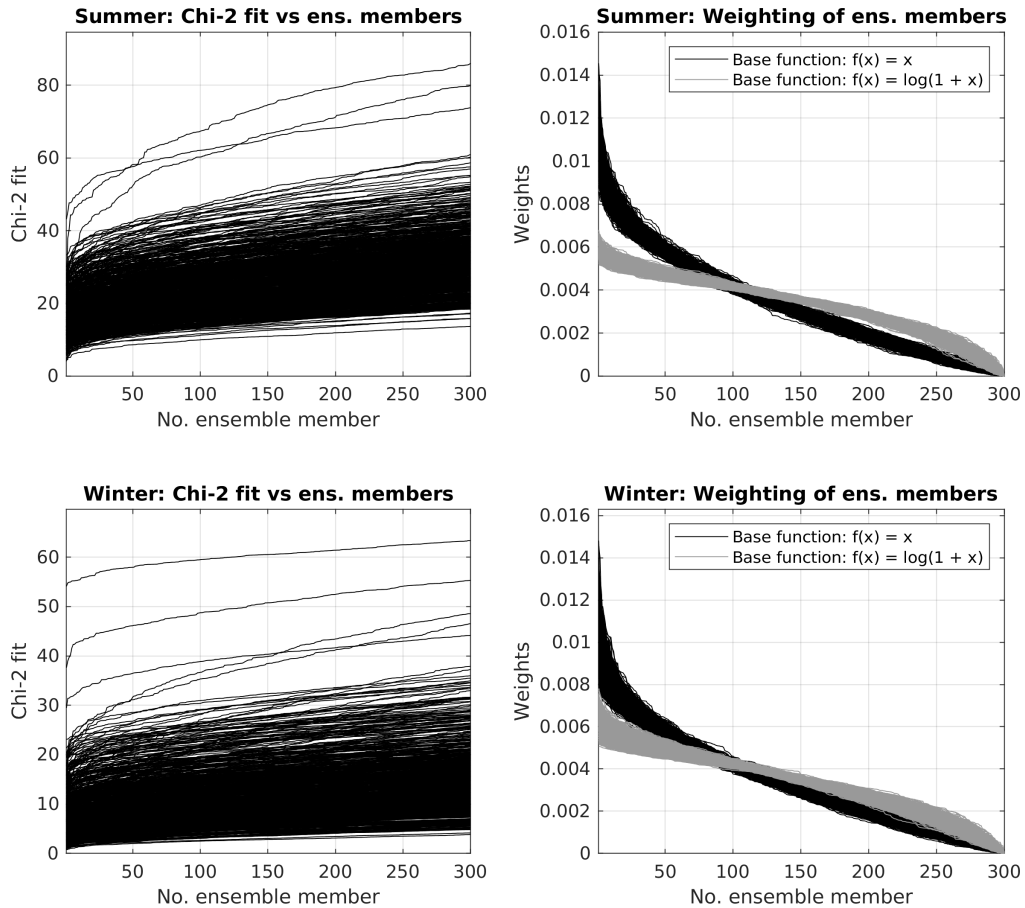


Figure S3: Upper panel. (left) Chi-2 distance for all years as function of ensemble member for summer. (right) Weighting function for summer ensemble mean based on Chi-2 distance (left), with the raw weights (black) and logarithmic transformed (grey). Lower panel. (left) Chi-2 distance for all years as function of ensemble member for winter. (right) Weighting function for winter ensemble mean based on Chi-2 distance (left), with the raw weights (black) and logarithmic transformed (grey).

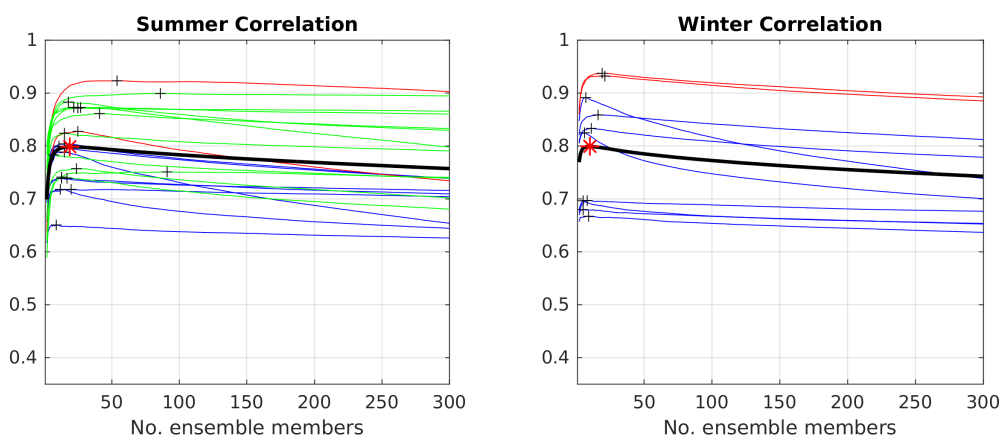


Figure S4: Upper panel: Correlation between reconstructed data at proxy sties and proxy data versus number of ensemble members for summer and winter. The curves indicate correlations for tree-ring data (green), ice core $\delta^{18}O$ (blue) and tree-ring $\delta^{18}O_{cell}$ (red). The bold black curve is the mean for all data. (+) or (*) marks maximum correlation.

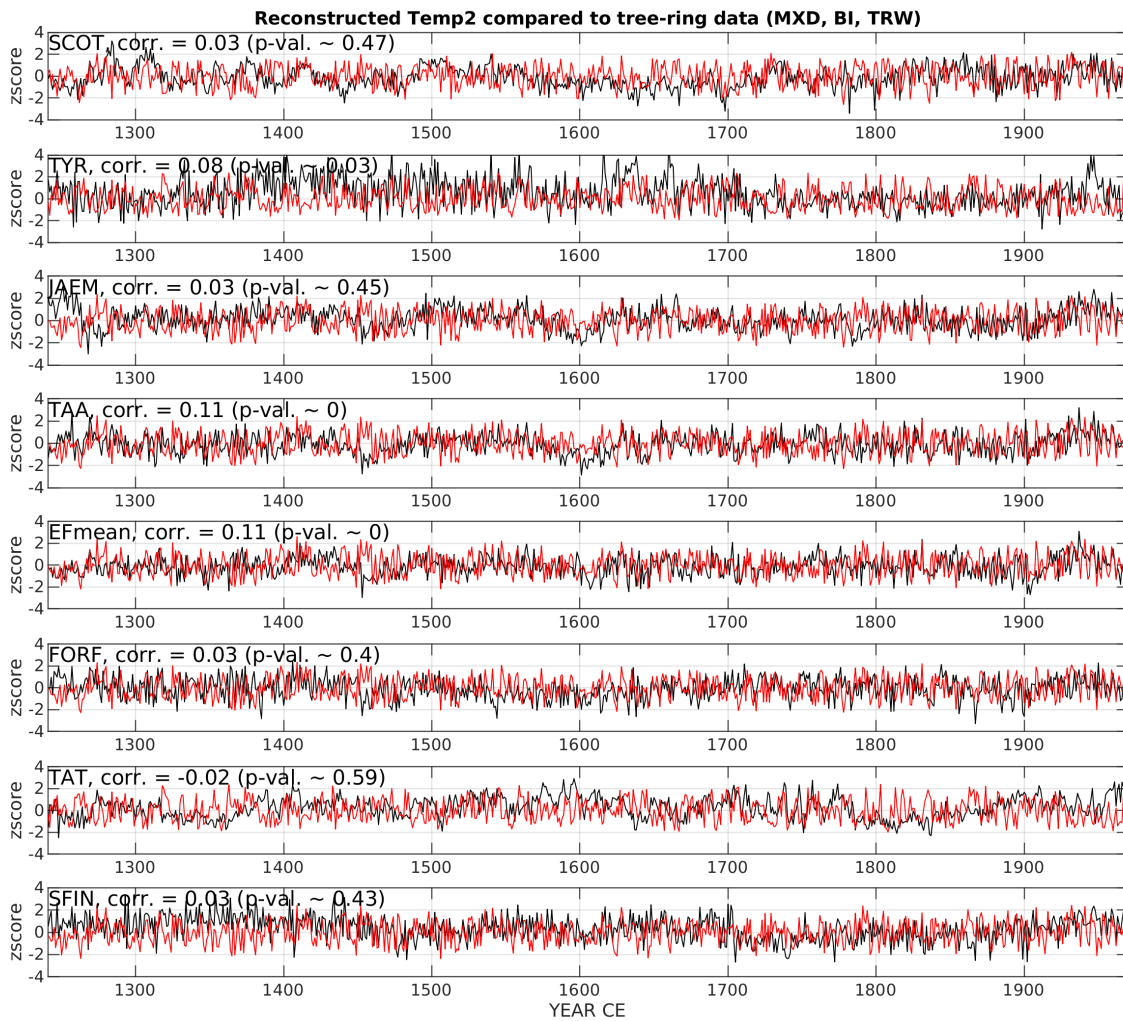


Figure S5: European tree-ring data predicted by RECON_{IC}.

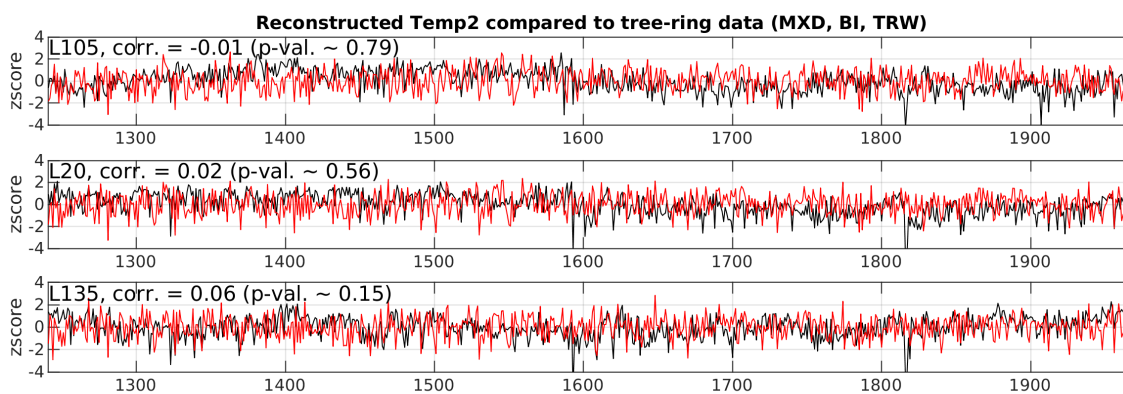


Figure S6: Canadian tree-ring data predicted by RECON_{IC}.

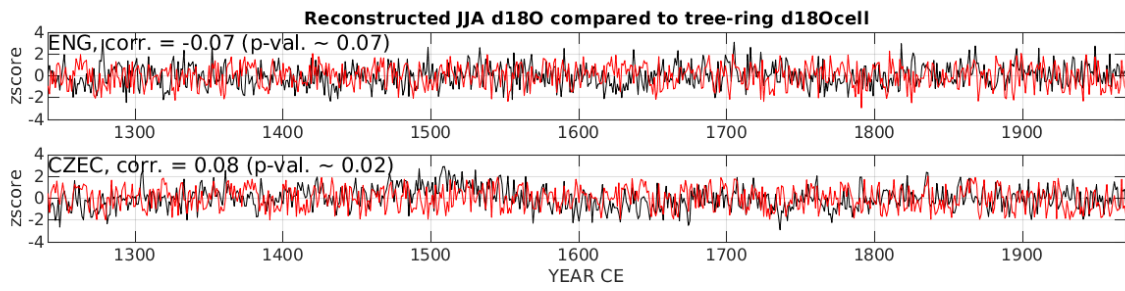


Figure S7: European $\delta^{18}\text{O}_{\text{cell}}$ predicted by RECON_{IC} JJA $\delta^{18}\text{O}$.

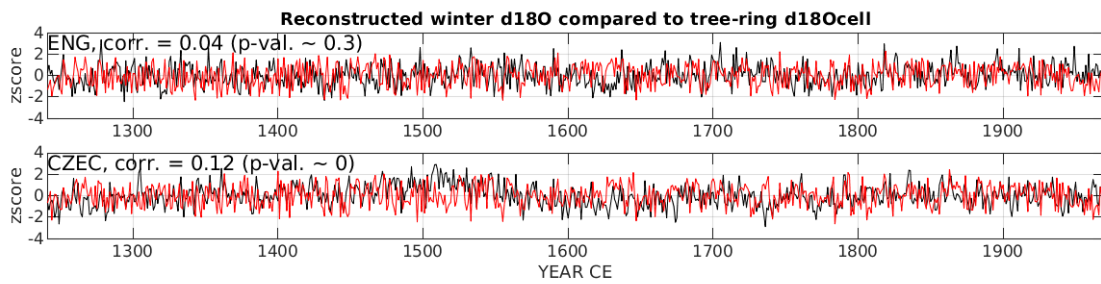


Figure S8: European $\delta^{18}\text{O}_{\text{cell}}$ predicted by RECON_{IC} winter $\delta^{18}\text{O}$.

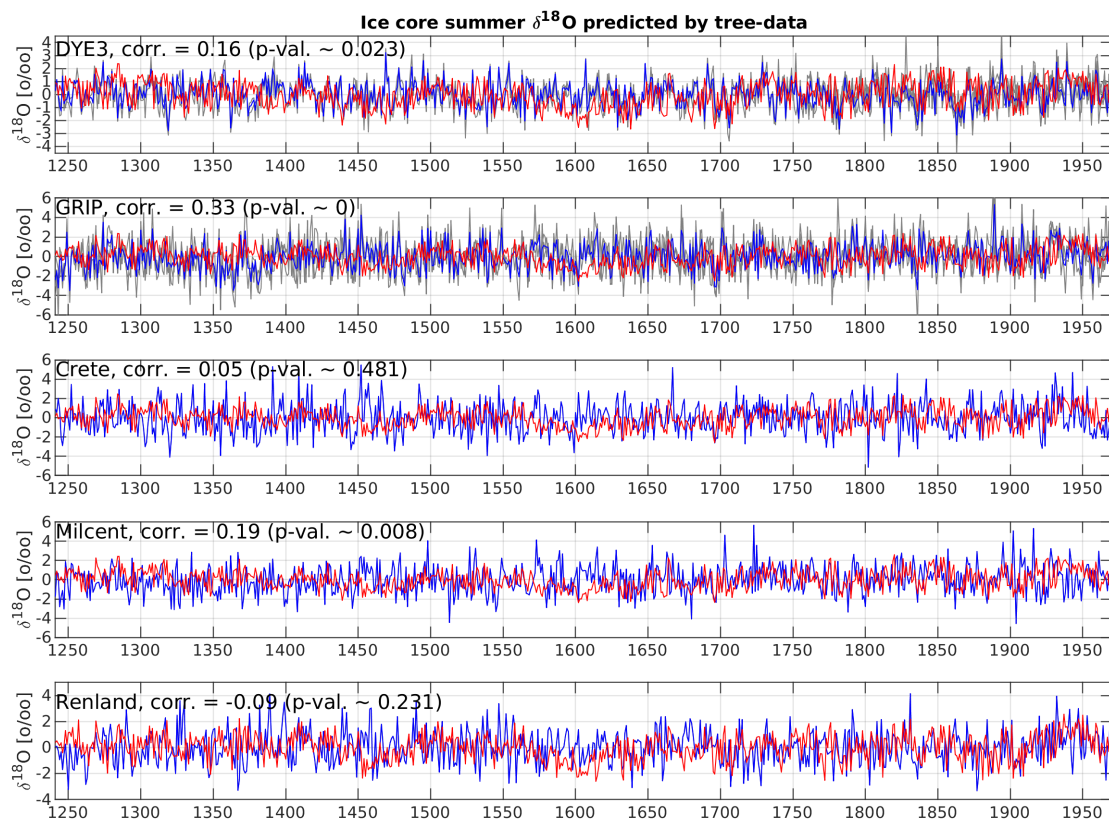


Figure S9: Greenland ice core summer $\delta^{18}\text{O}$ predicted by RECON_{TR}.

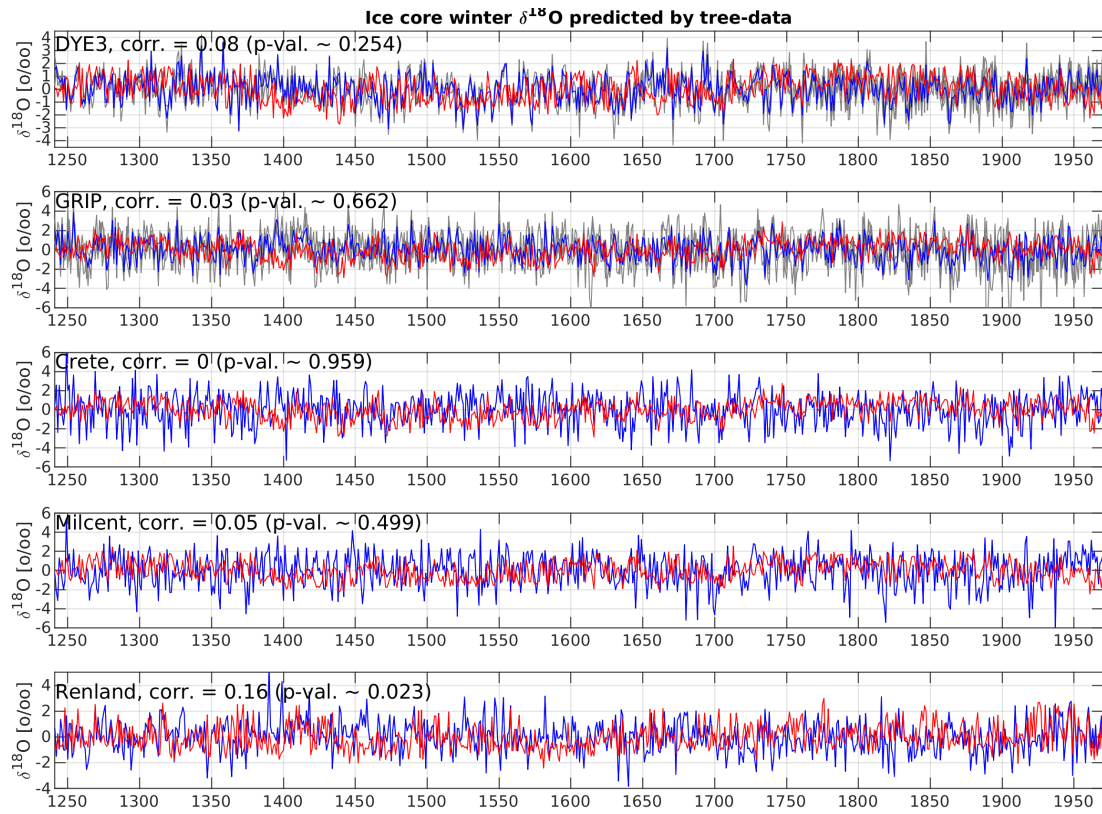


Figure S10: Greenland ice core winter $\delta^{18}\text{O}$ predicted by RECON_{TR}.

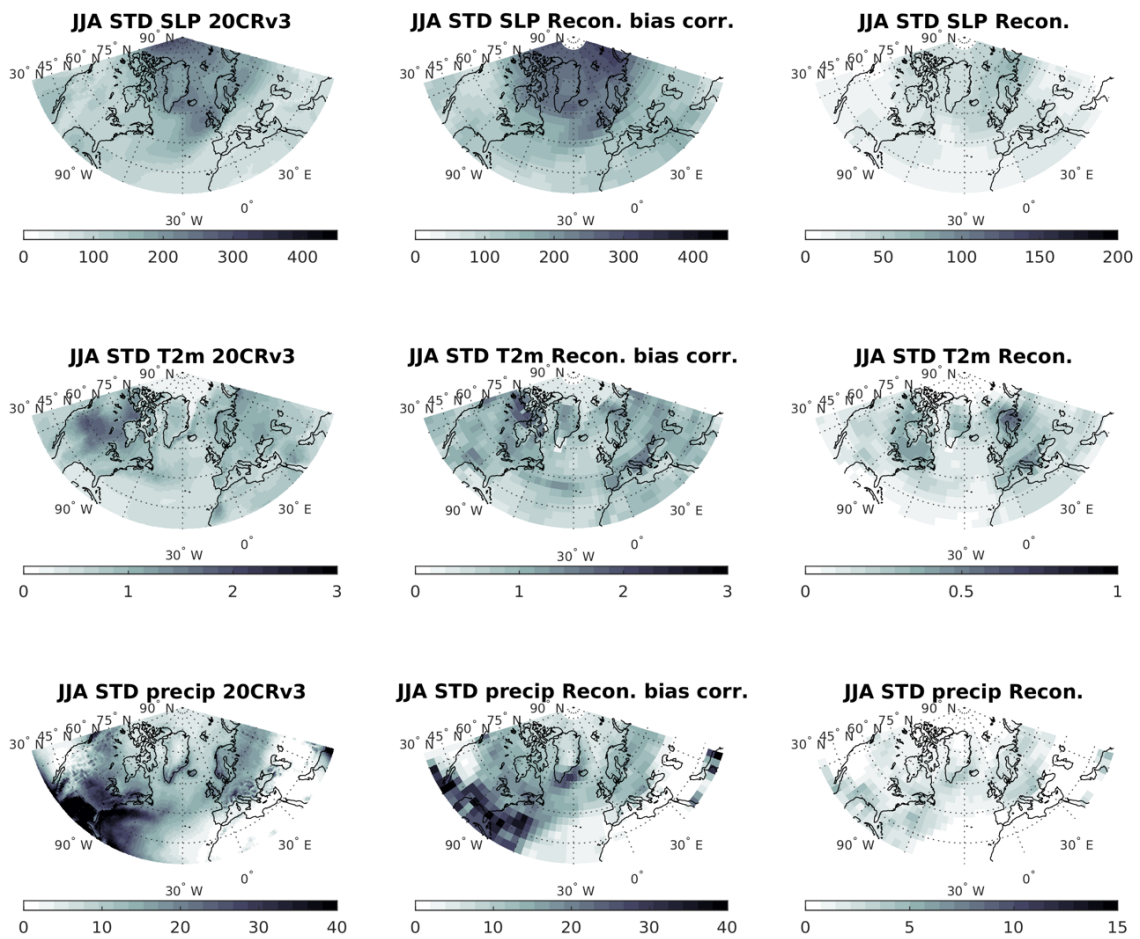


Figure S11: Upper panel: Standard deviation of JJA SLP from 20CRv3, SAT25 with variance correction and SAT25 without variance correction. Middle panel: Standard deviation of JJA T2m from 20CRv3, SAT25 with variance correction and SAT25 without variance correction. Lower panel: Standard deviation of JJA precipitation from 20CRv3, SAT25 with variance correction and SAT25 without variance correction. Note the different scale for plots of SAT25 without variance correction.

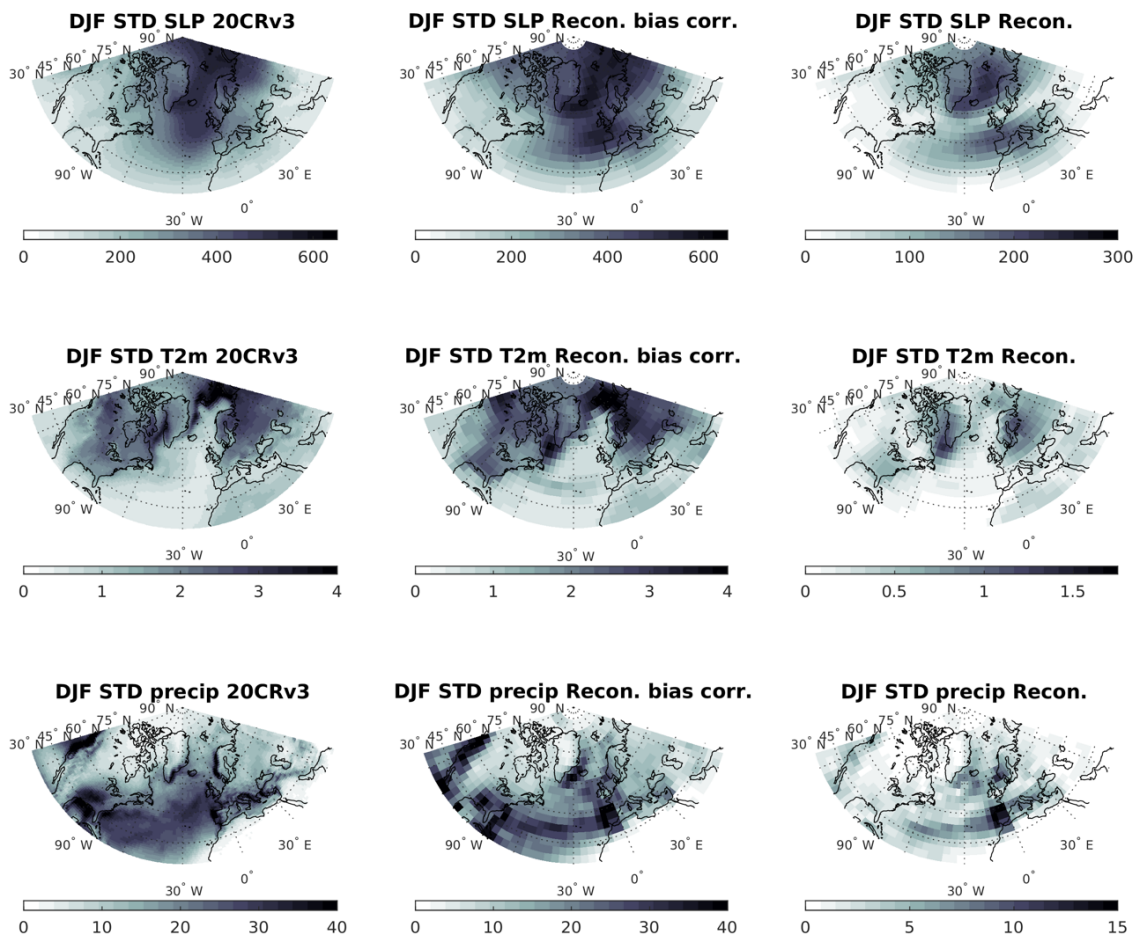


Figure S12: Same as S11, but for DJF.

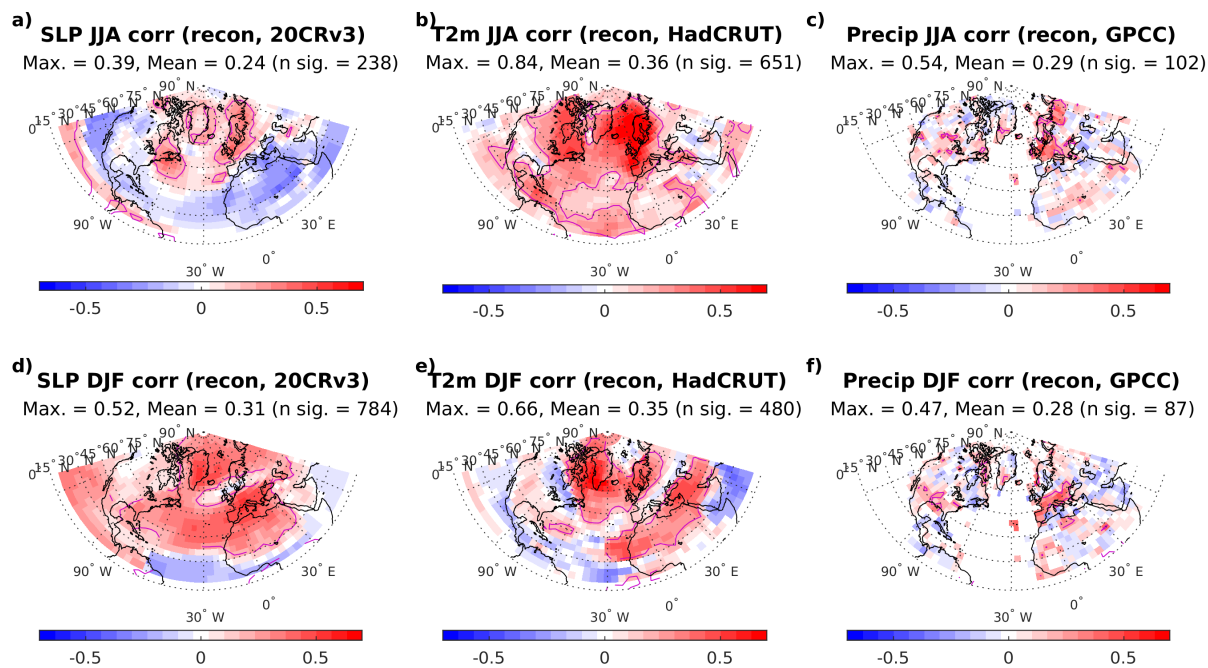


Figure S13: Point-wise correlation for CE 1850-1970 between reconstructed and 20CRv3 SLP, HadCRUT5 T2m and GPCC precipitation for JJA mean (a-c) and DJF mean (d-f) data. The maximum correlation, mean significant correlation and number of grid points with significant correlation are indicated for each subplot. Contour indicates $p = 0.01$.

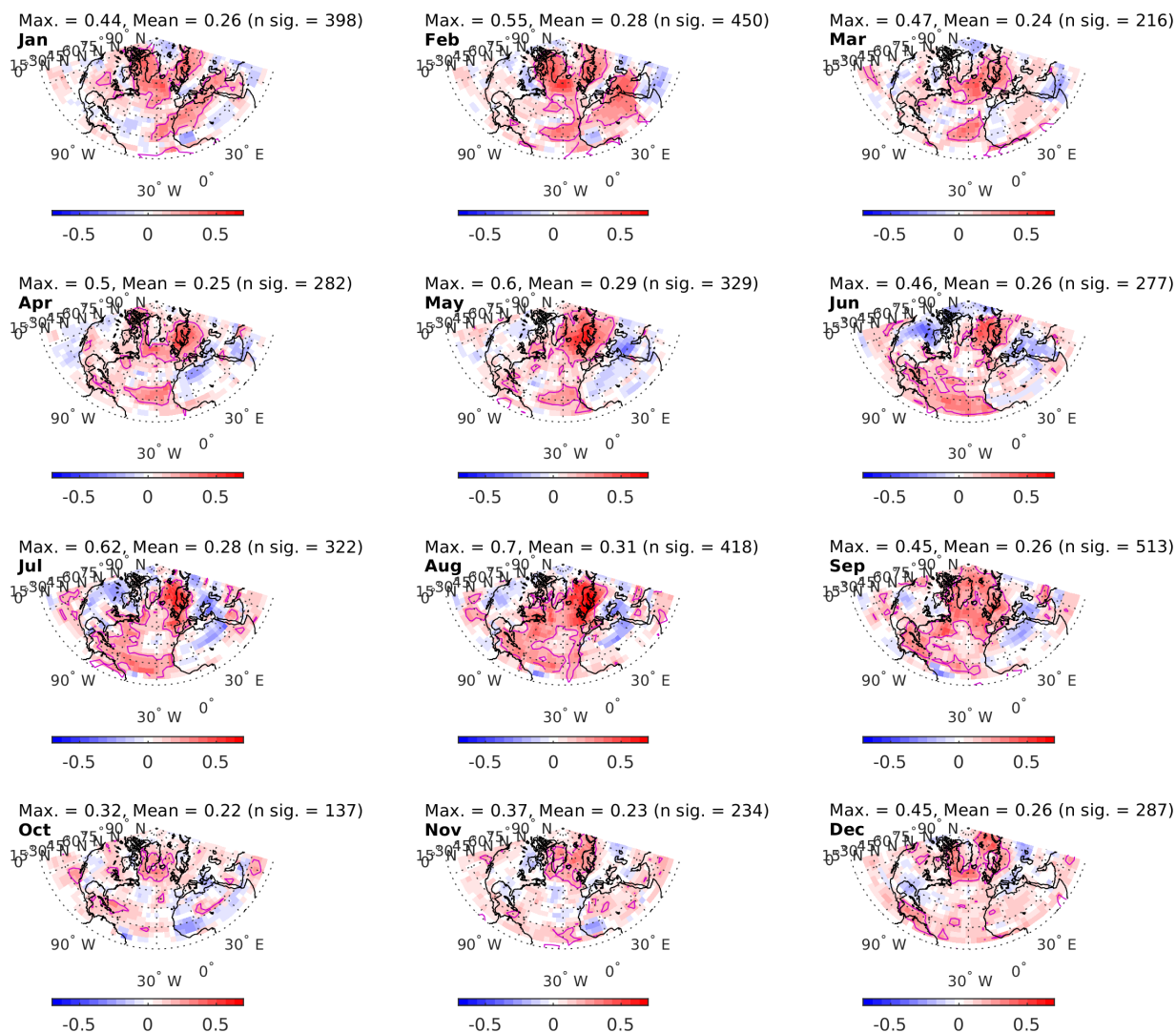


Figure S14: Point-wise correlation for CE 1850-1970 between SAT25 and 20CRv3 monthly T2m. The maximum correlation, mean significant correlation and number of grid points with significant correlation are indicated for each subplot. Contour indicates $p = 0.01$.

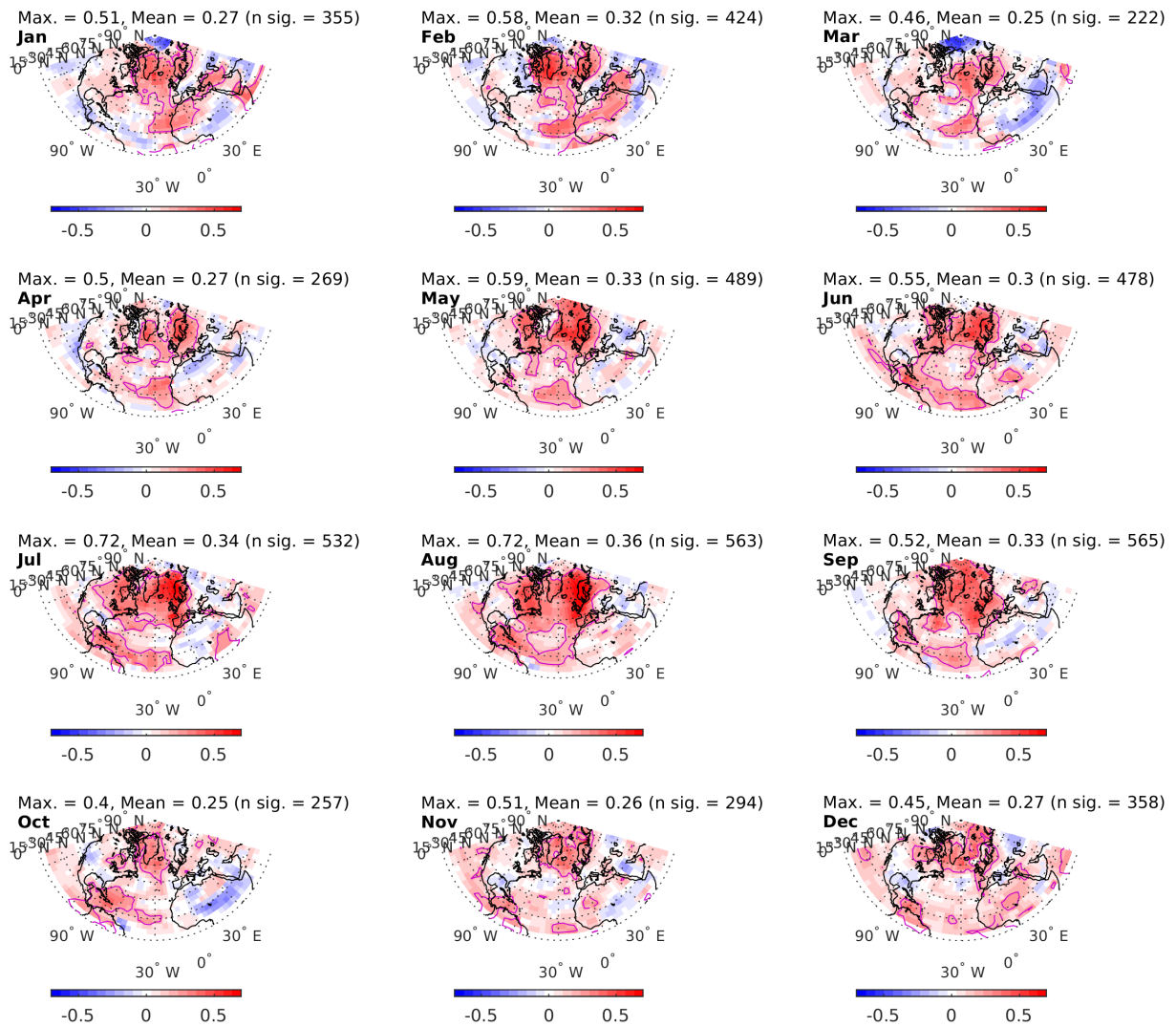


Figure S15: Point-wise correlation for CE 1850-1970 between SAT25 and HadCRUT5 monthly T2m. The maximum correlation, mean significant correlation and number of grid points with significant correlation are indicated for each subplot. Contour indicates $p = 0.01$.

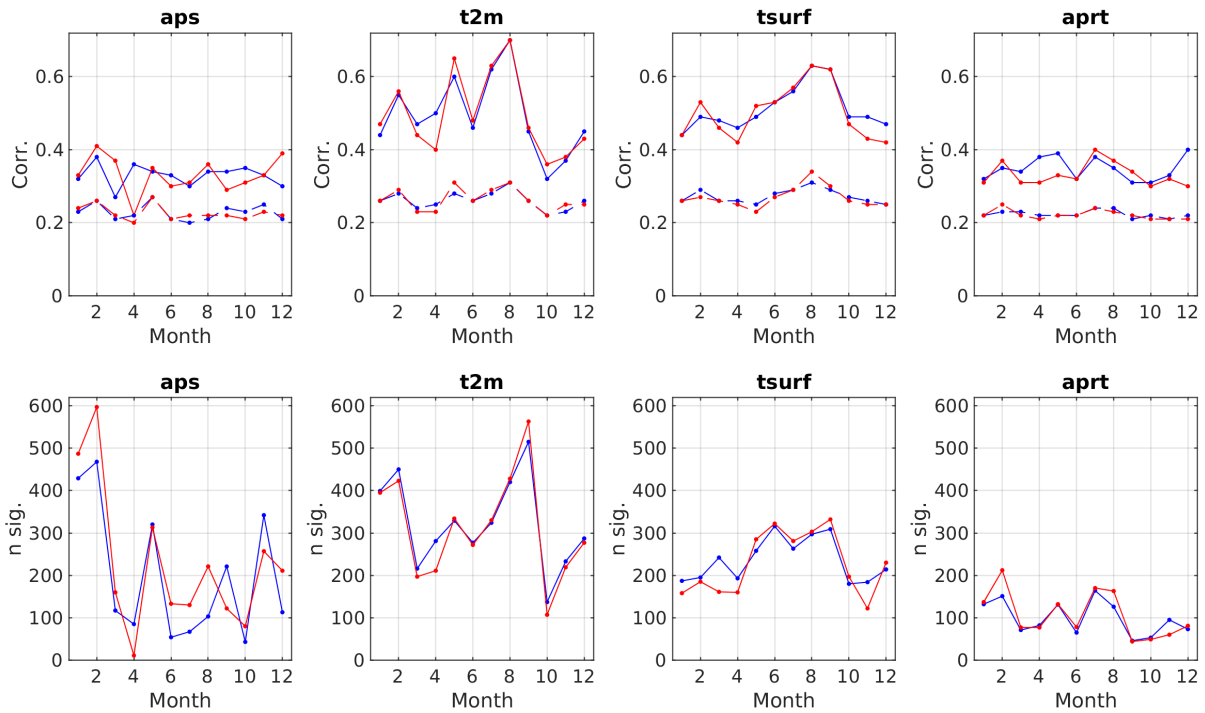


Figure S16: Comparison of performance of monthly reconstructions to the 20CRv3 (COBE2 SST for tsurf) for atmospheric surface pressure (aps), 2m temperature (t2m), surface temperature of ocean (tsurf) and total precipitation (aprt). Red shows the results if the months of the model output are extracted using separate evaluation of the summer and winter season, while blue shows the results if the months are extracted with simultaneously evaluating summer and winter, i.e., summer and winter months are from the same model year. Upper panel: full lines show maximum correlation and dashed lines mean significant correlation. Lower panel: number of grid points with significant correlation.

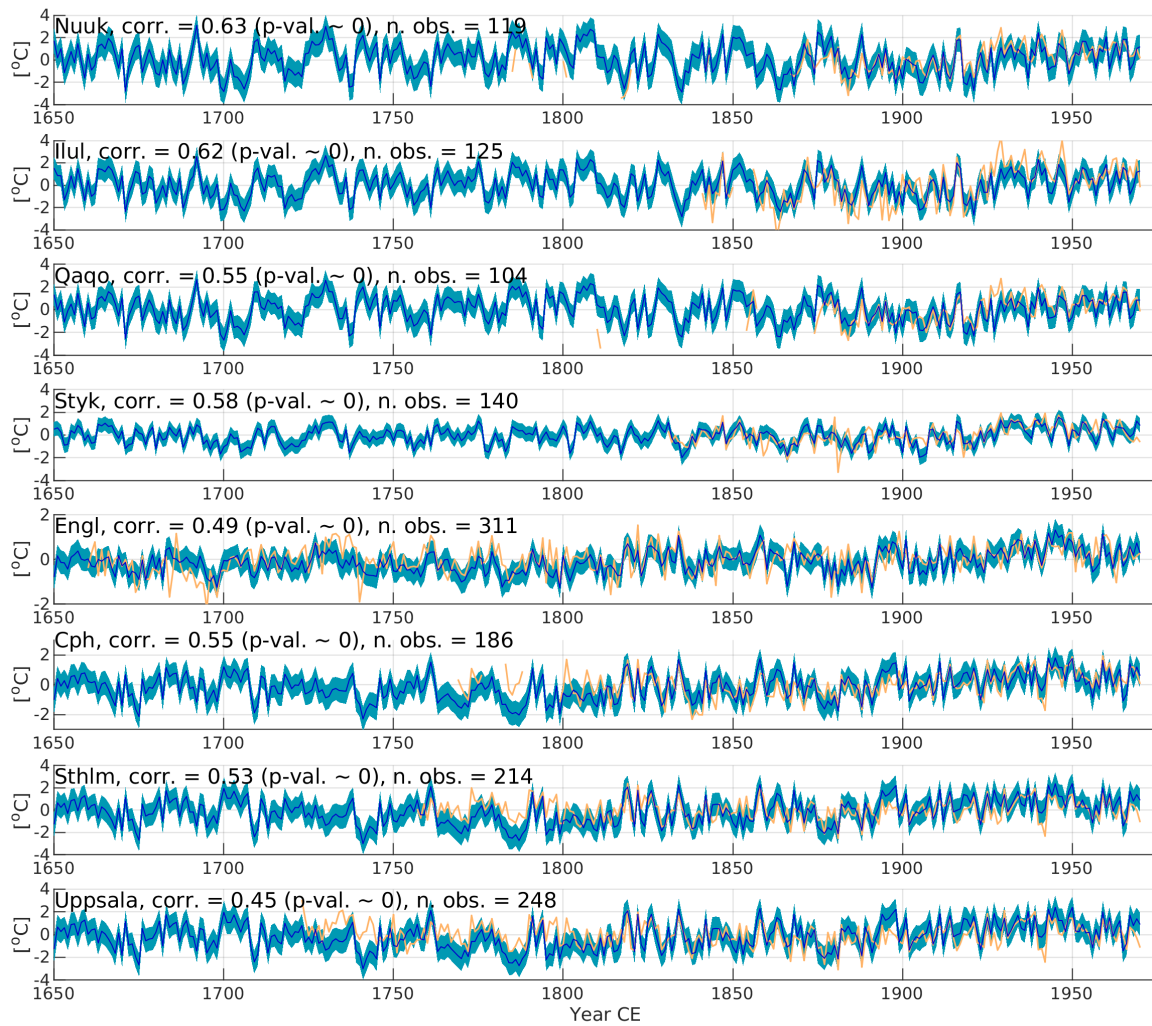


Figure S17: Time series of reconstructed (blue) and observed (yellow) **annual** temperature for Nuuk, Ilulissat, Qaqortoq, Stykkisholmur, Central England, Copenhagen, Stockholm, and Uppsala. The correlation (corr.) and number of years in the observations (n. obs.) are indicated for each site. The blue shading indicated ± 1 std dev of the ensemble reconstructed temperature.

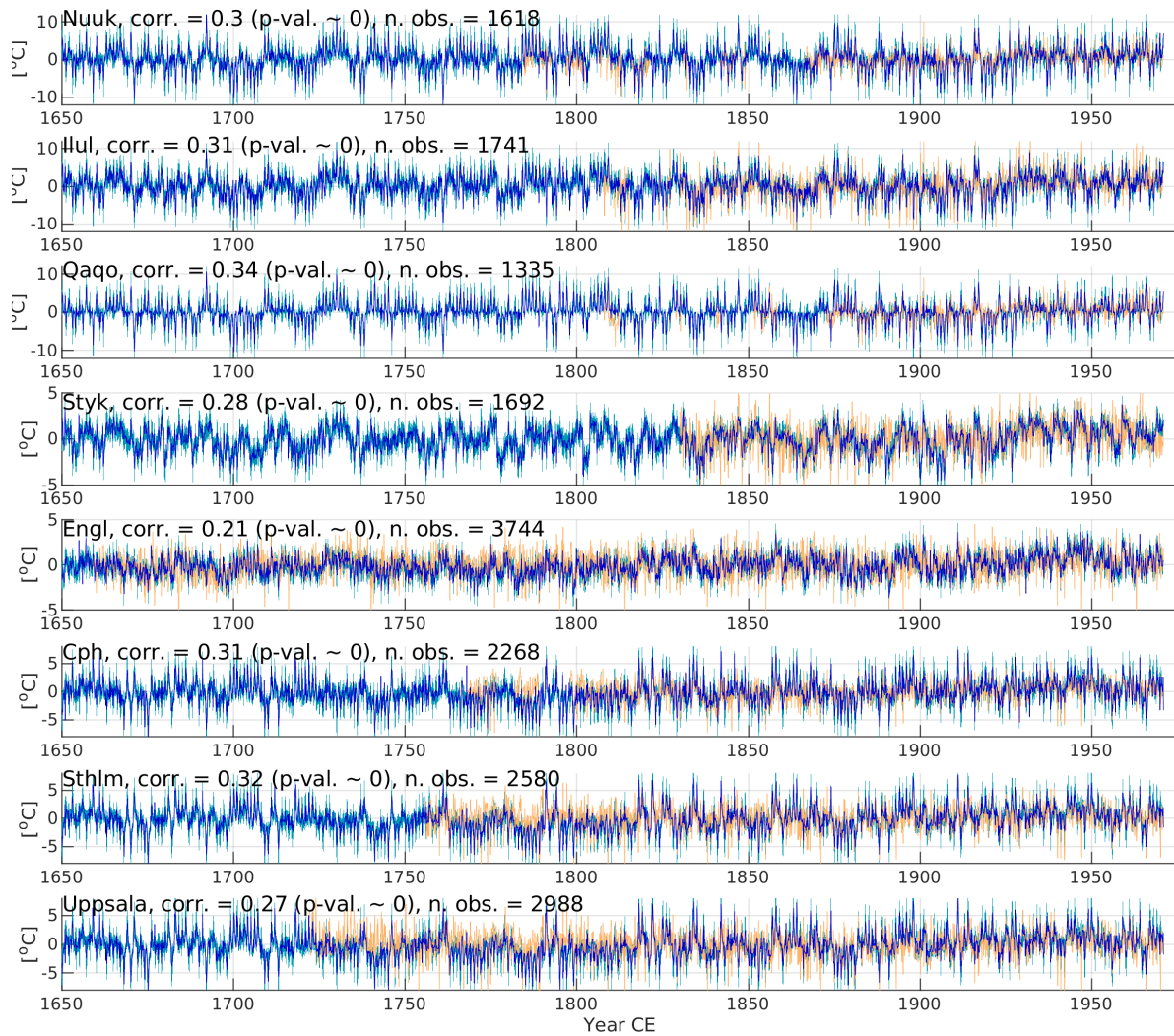


Figure S18: Time series of reconstructed (blue) and observed (yellow) **monthly** temperature for Nuuk, Ilulissat, Qaqortoq, Stykkisholmur, Central England, Copenhagen, Stockholm, and Uppsala. The correlation (corr.) and number of months in the observations (n. obs.) are indicated for each site. The blue shading indicated ± 1 std dev of the ensemble reconstructed temperature.

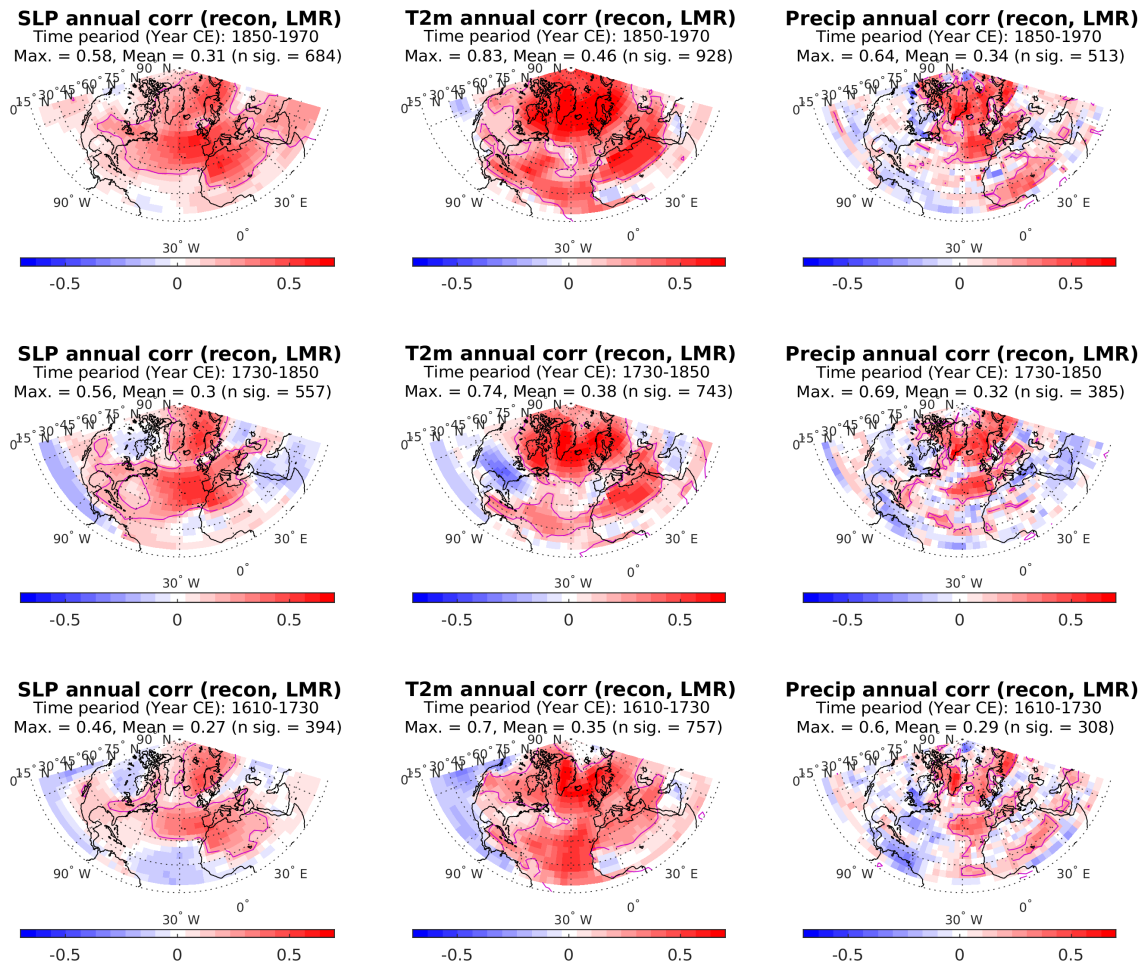


Figure S19: Point-wise correlation between SAT25 and annual mean Last Millennium Reanalysis (LMR v2.1) SLP, T2m and precipitation for time intervals (top to bottom) 1850-1970, 1730-1850 and 1610-1730. The maximum correlation, mean significant correlation and number of grid points with significant correlation are indicated for each subplot. Contour indicates $p = 0.01$.

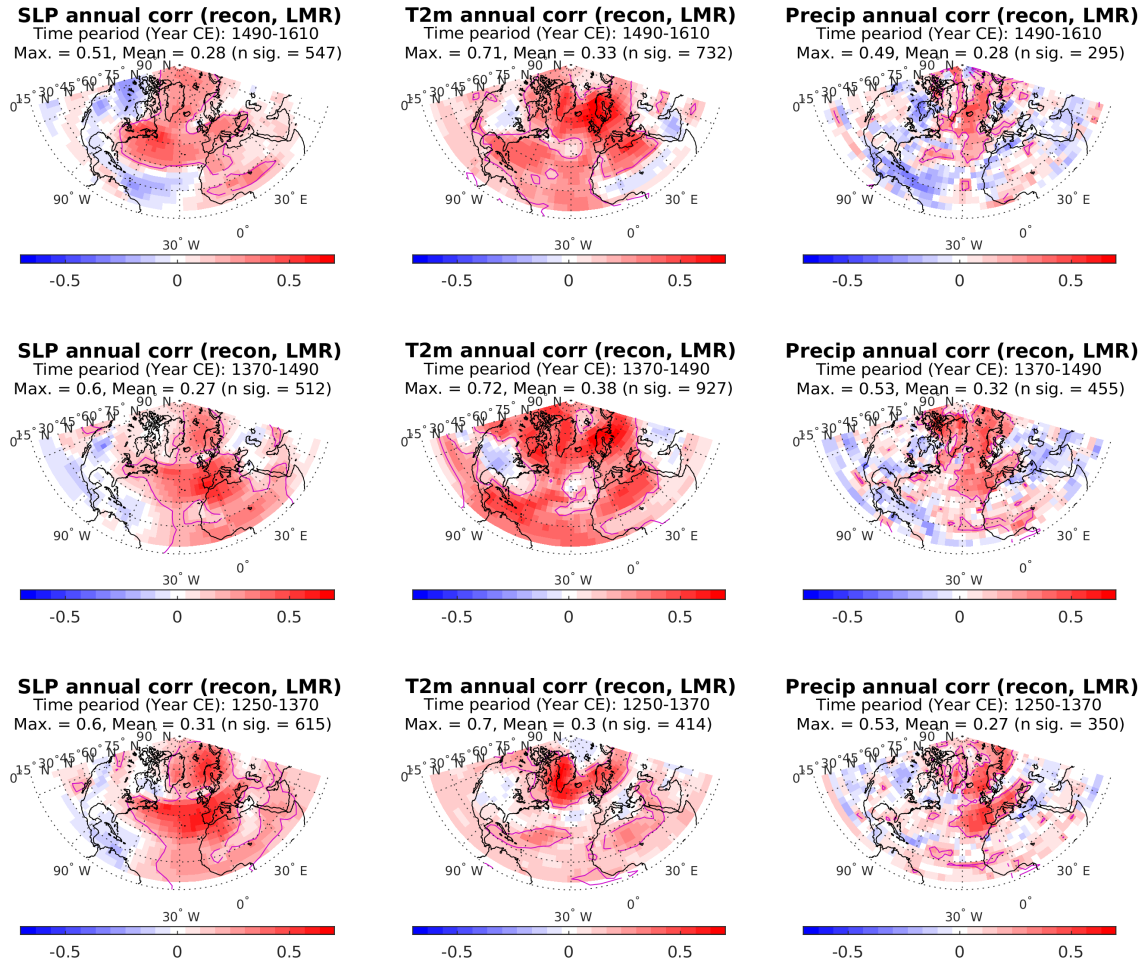


Figure S20: Point-wise correlation between SAT25 and annual mean Last Millennium Reanalysis (LMR v2.1) SLP, T2m and precipitation for time intervals (top to bottom) 1490-1610, 1370-1490 and 1250-1370. The maximum correlation, mean significant correlation and number of grid points with significant correlation are indicated for each subplot. Contour indicates $p = 0.01$.

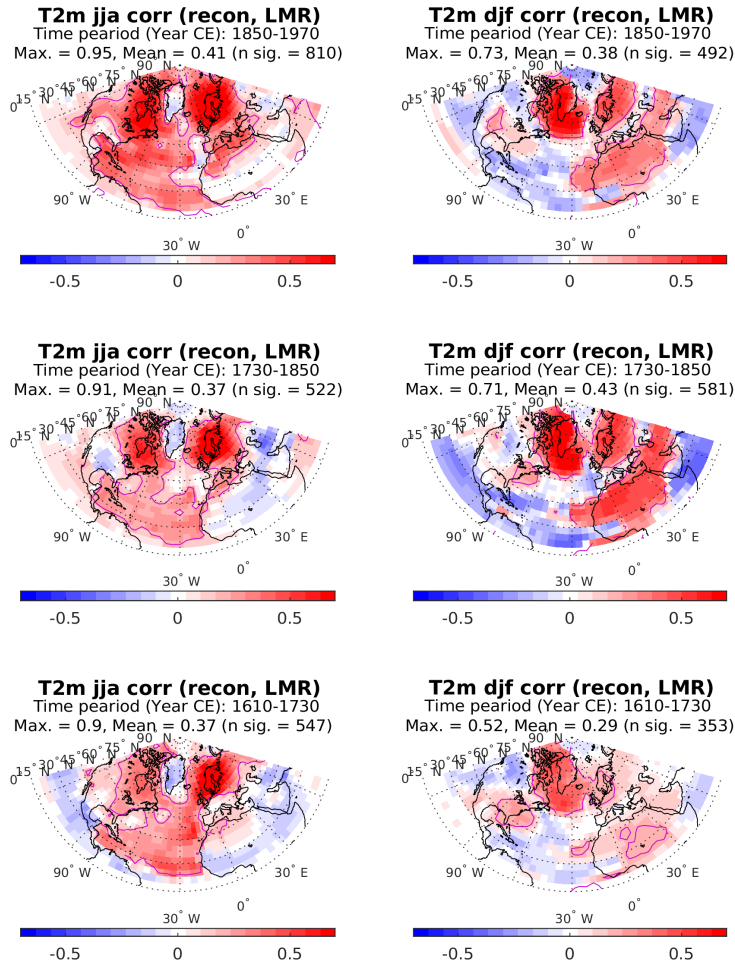


Figure S21: Point-wise correlation between SAT25 and JJA and DJF Last Millennium Reanalysis (LMR Seasonal) T2m for time intervals (top to bottom) 1850-1970, 1730-1850 and 1610-1730. The maximum correlation, mean significant correlation and number of grid points with significant correlation are indicated for each subplot. Contour indicates $p = 0.01$.

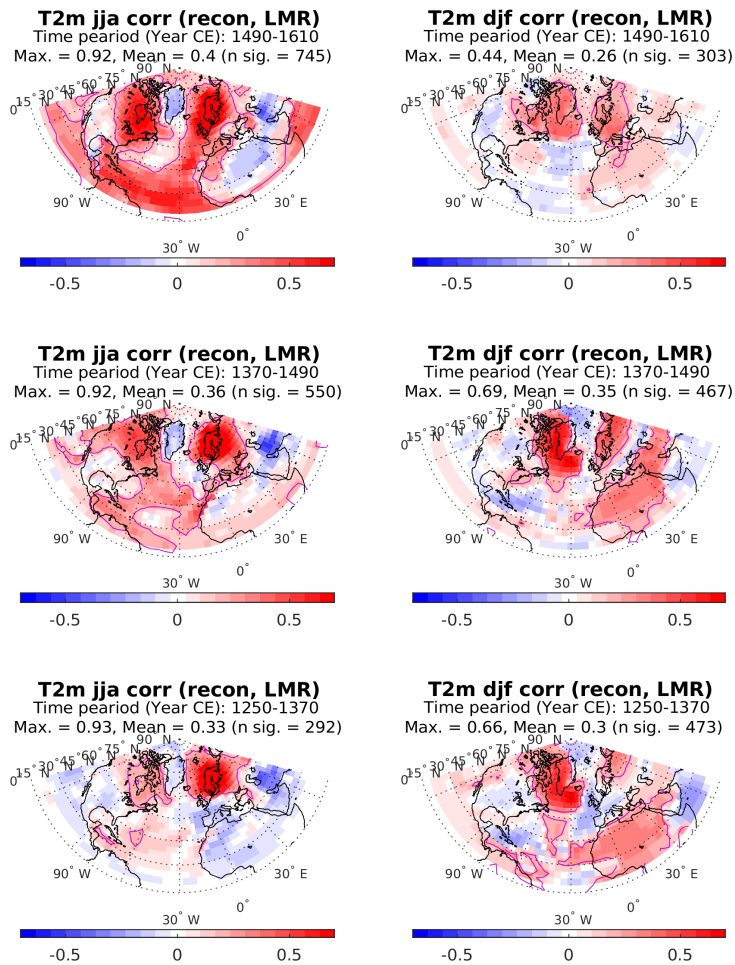


Figure S22: Point-wise correlation between SAT25 and JJA and DJF Last Millennium Reanalysis (LMR Seasonal) T2m for time intervals (top to bottom) 1490-1610, 1370-1490 and 1250-1370. The maximum correlation, mean significant correlation and number of grid points with significant correlation are indicated for each subplot. Contour indicates $p = 0.01$.

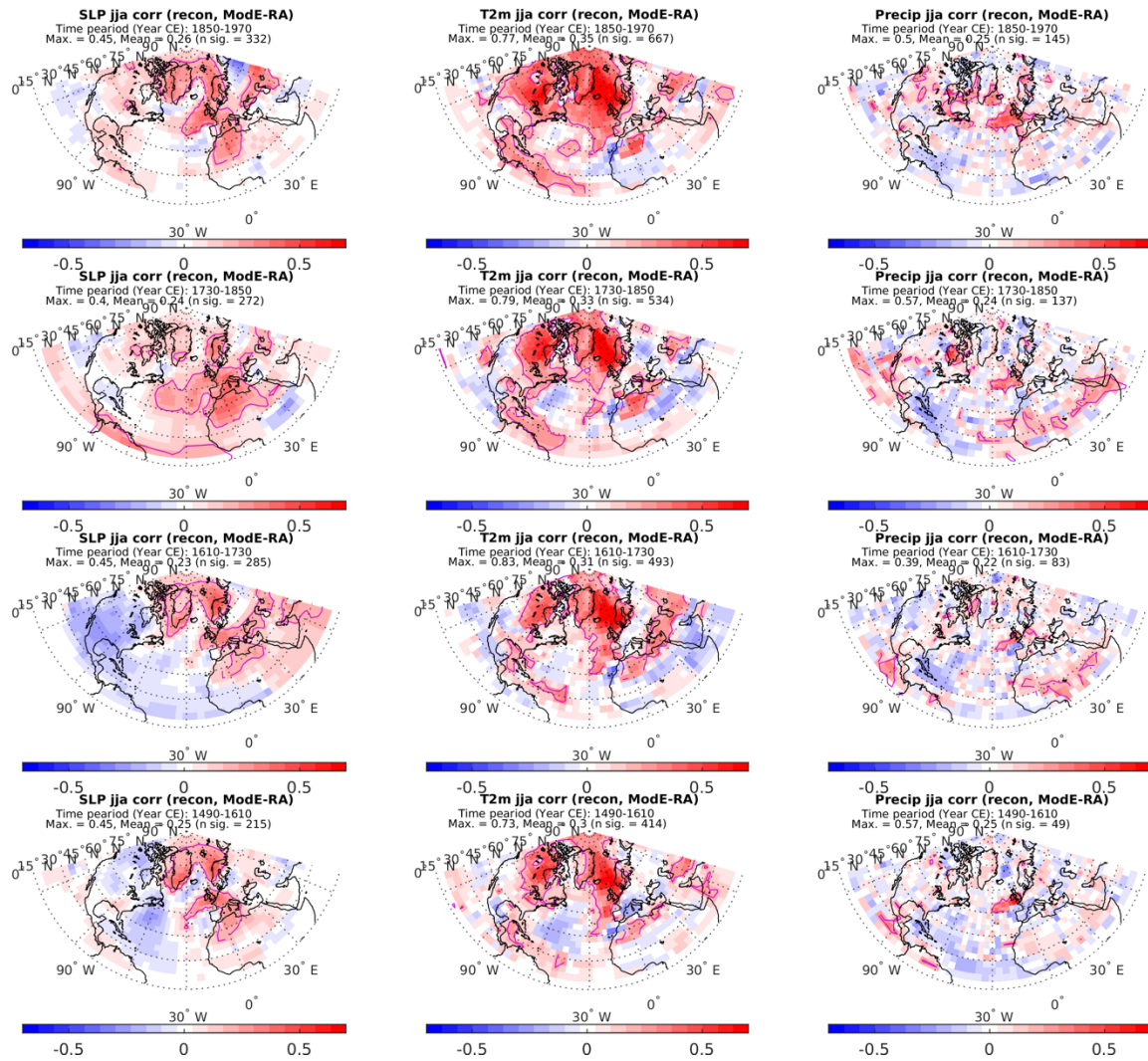


Figure S23: Point-wise correlation between SAT25 and JJA ModE-RA SLP, T2m and precipitation for time intervals (top to bottom) 1850-1970, 1730-1850, 1610-1730 and 1490-1730. The maximum correlation, mean significant correlation and number of grid points with significant correlation are indicated for each subplot. Contour indicates $p = 0.01$.

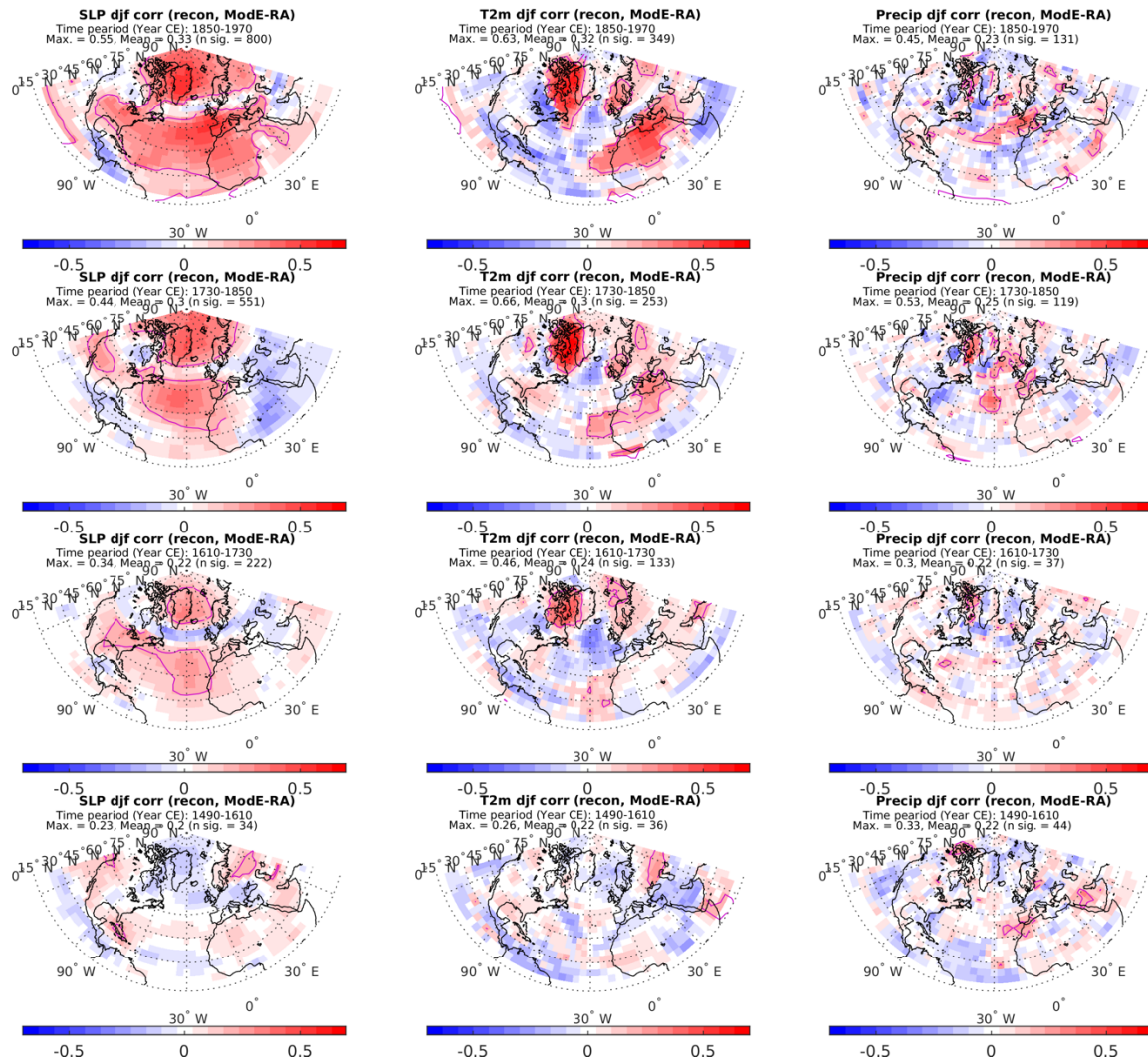


Figure S24: Point-wise correlation between SAT25 and DJF ModE-RA SLP, T2m and precipitation for time intervals (top to bottom) 1850-1970, 1730-1850, 1610-1730 and 1490-1730. The maximum correlation, mean significant correlation and number of grid points with significant correlation are indicated for each subplot. Contour indicates $p = 0.01$.

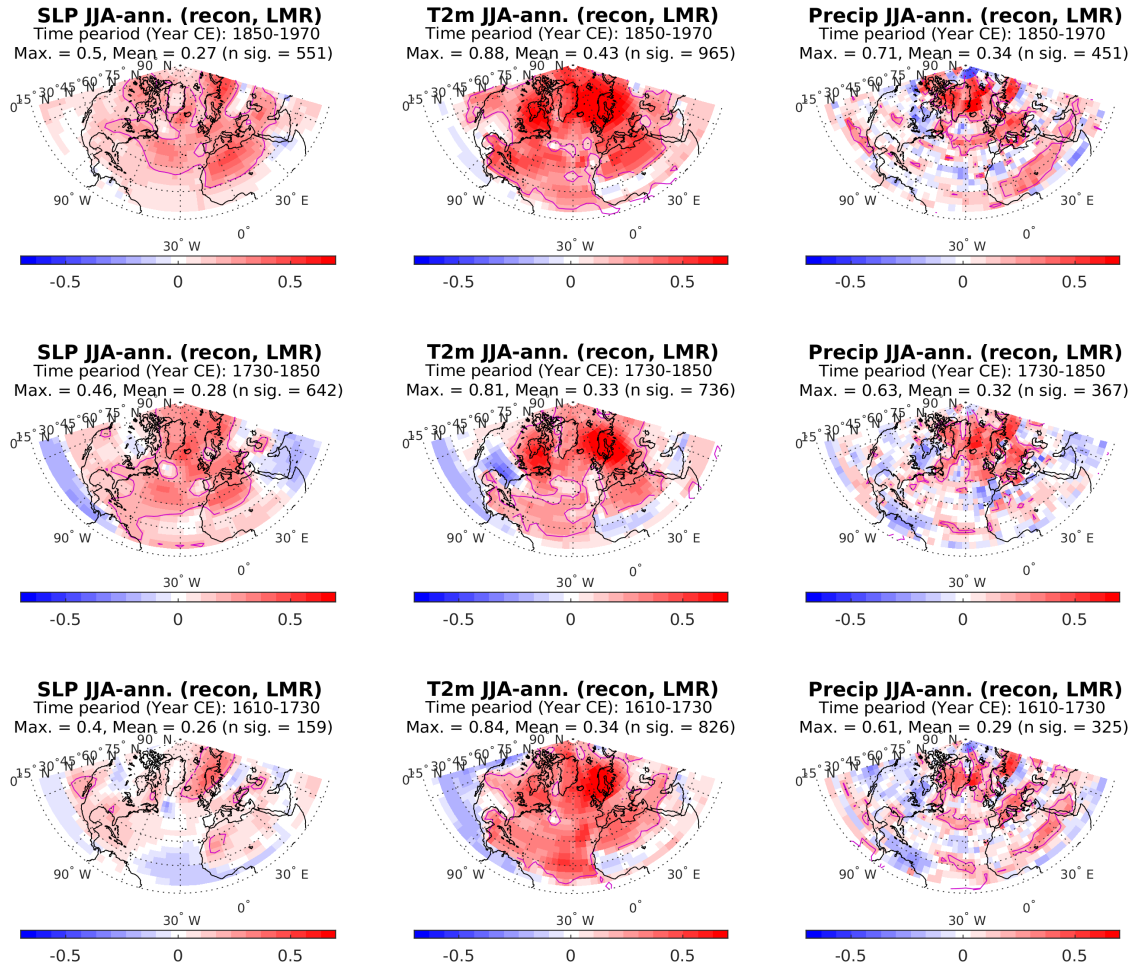


Figure S25: Point-wise correlation between JJA SAT25 and annual mean Last Millennium Reanalysis (LMR v2.1) SLP, T2m and precipitation for time intervals (top to bottom) 1850-1970, 1730-1850 and 1610-1730. The maximum correlation, mean significant correlation and number of grid points with significant correlation are indicated for each subplot. Contour indicates $p = 0.01$.

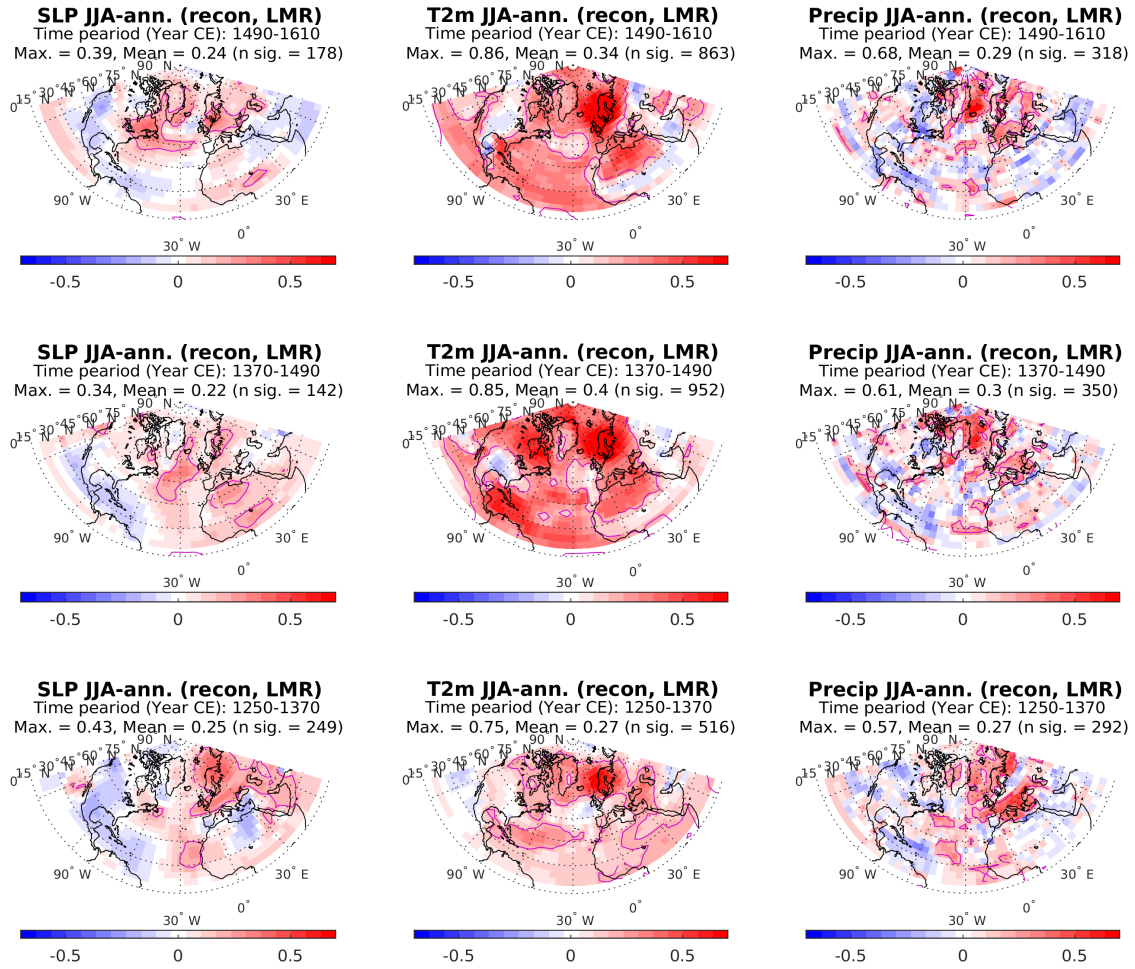


Figure S26: Point-wise correlation between JJA SAT25 and annual mean Last Millennium Reanalysis (LMR v2.1) SLP, T2m and precipitation for time intervals (top to bottom) 1490-1610, 1370-1490 and 1250-1370. The maximum correlation, mean significant correlation and number of grid points with significant correlation are indicated for each subplot. Contour indicates $p = 0.01$.

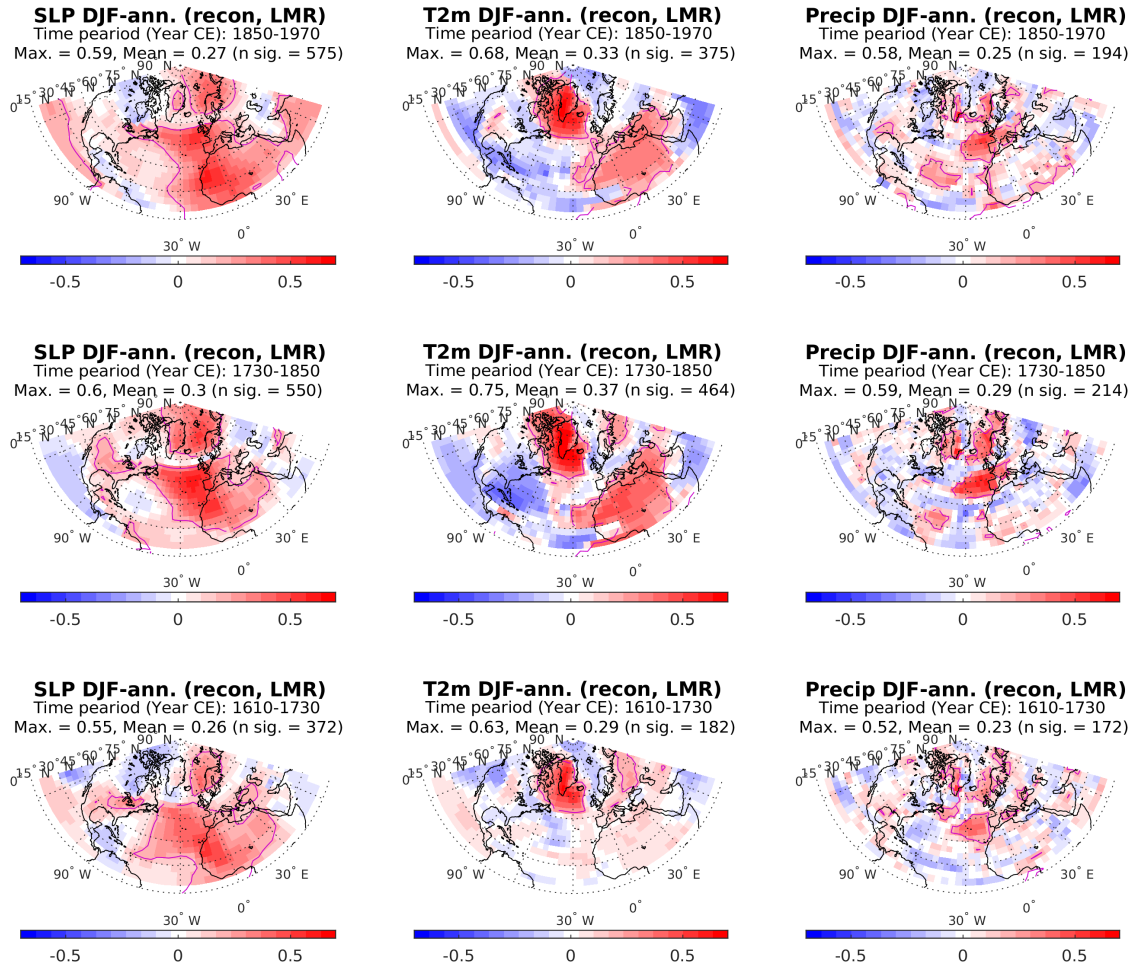


Figure S27: Point-wise correlation between DJF SAT25 and annual mean Last Millennium Reanalysis (LMR v2.1) SLP, T2m and precipitation for time intervals (top to bottom) 1850-1970, 1730-1850 and 1610-1730. The maximum correlation, mean significant correlation and number of grid points with significant correlation are indicated for each subplot. Contour indicates $p = 0.01$.

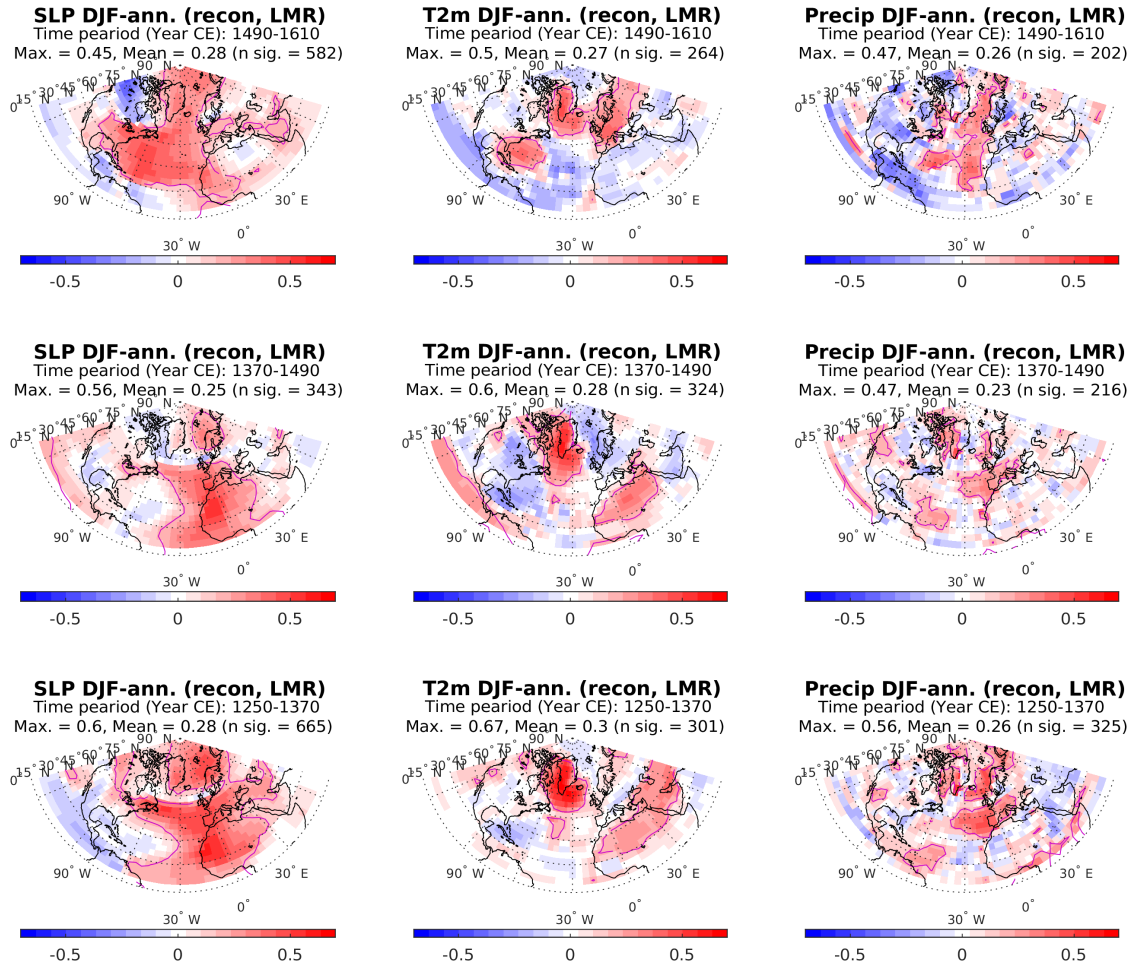


Figure S28: Point-wise correlation between DJF SAT25 and annual mean Last Millennium Reanalysis (LMR v2.1) SLP, T2m and precipitation for time intervals (top to bottom) 1490-1610, 1370-1490 and 1250-1370. The maximum correlation, mean significant correlation and number of grid points with significant correlation are indicated for each subplot. Contour indicates $p = 0.01$.