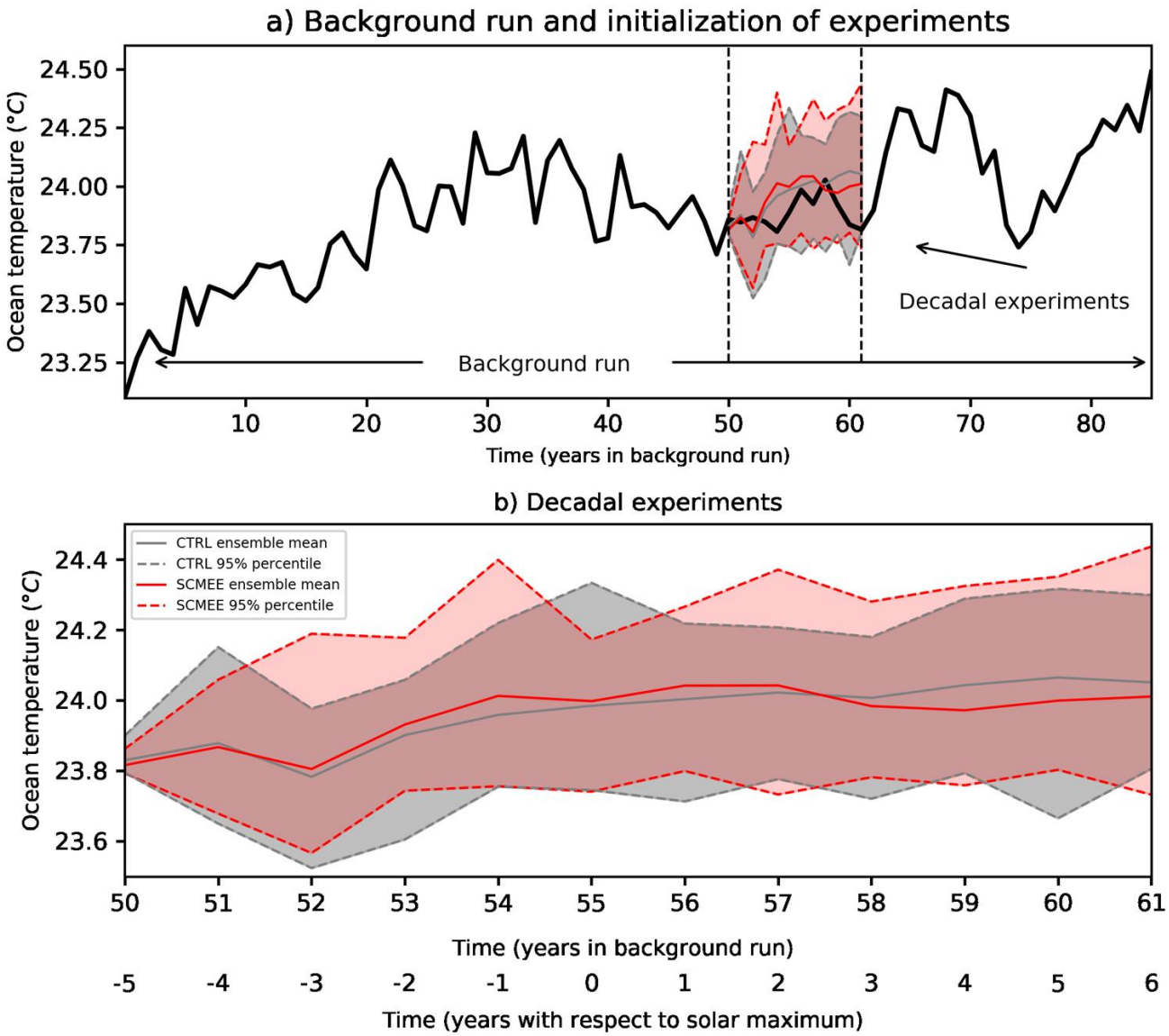

Figure S1. The black line in a) shows the multi-decadal evolution of the ocean temperatures in the background run in November within the 100-200m depth in a region in the Atlantic Ocean (70º-40º W, 25º-35ºN) corresponding to Fig. 6a. The background run has a constant solar forcing. The gray (red) lines and shadings branching from year 50 represent the ensemble means and 95% percentile spreads of the decadal experiments (25 CTRL and 50 SC+SCMEE ensemble members). The ensemble experiments are repeated in (b) for clarity.

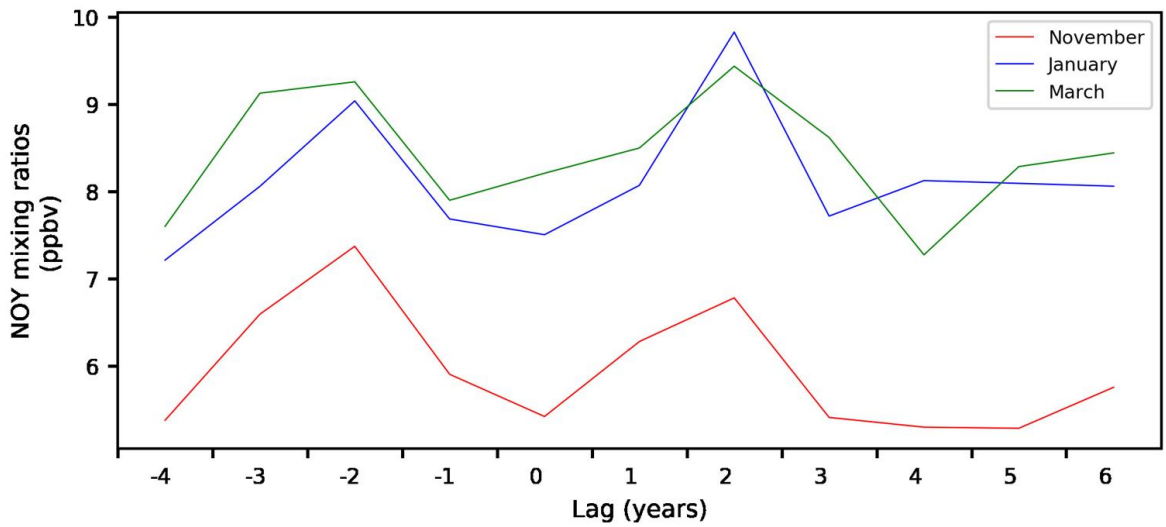

Figure S2. NOY mixing ratios over the solar cycle for three different months (November, January and March) at 1hPa. Shown are ensemble-mean anomalies.

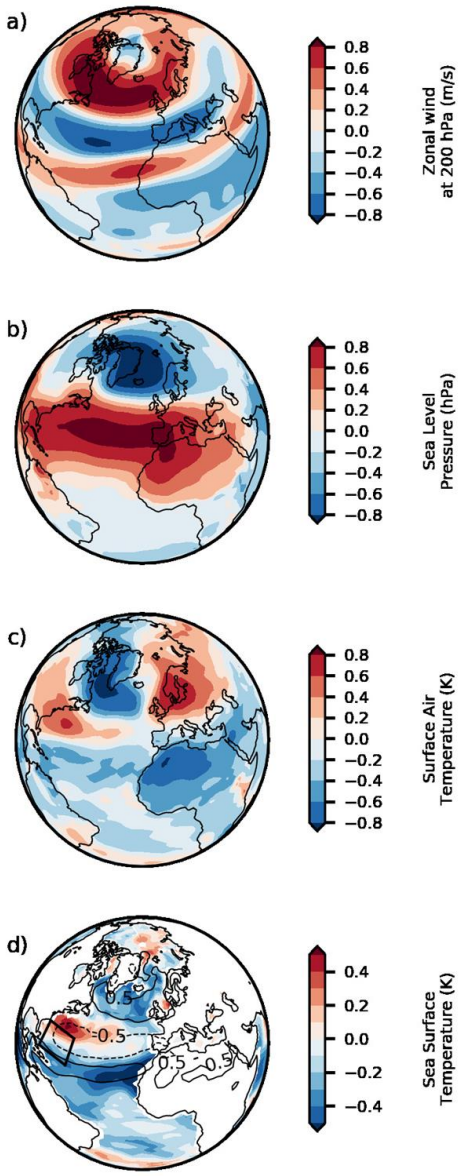

Figure S3. Correlation between the standardized DJF NAO index (the principal component of the 1st EOF) and the anomalies of the DJF a) zonal winds at 200 hPa (m/s), b) sea level pressure (hPa), c) surface air temperature (K) and d) sea surface temperatures (K) from the last 50 years of the background simulation. In d) the black square indicates the region where significant SST anomalies close to the middle lobe of the NAO tripole pattern were detected in Fig. 3a-b, and where ocean temperature profiles are shown in Fig. 6a.

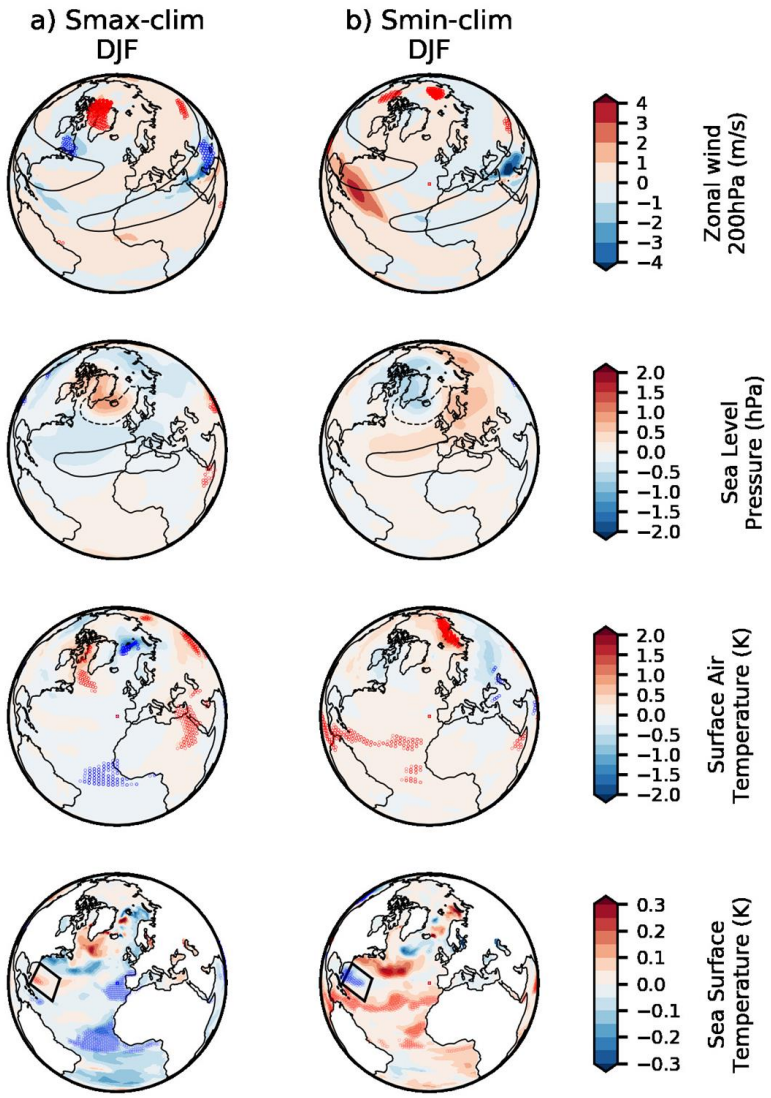

Figure S4. Anomalies (in filled contours) as in Fig. 3, but for the CTRL. Periods of Smax and Smin represent the corresponding years of the time series as in the SC and SCMEE experiments. Shown are ensemble-mean anomalies.

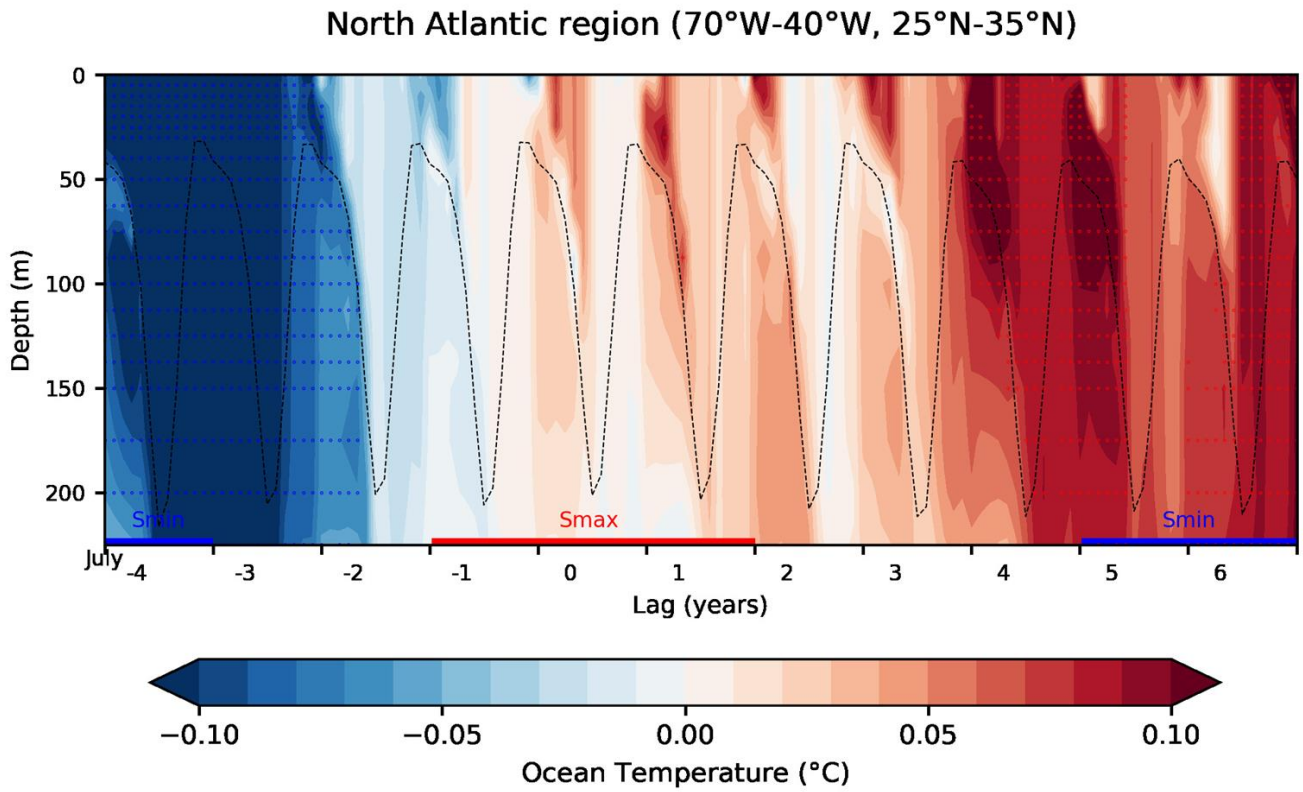

Figure S5. Anomalies as in Fig. 6a, but for the CTRL. Smax and Smin indicate years of solar forcing in the forced experiments for reference only. Shown are ensemble-mean anomalies.

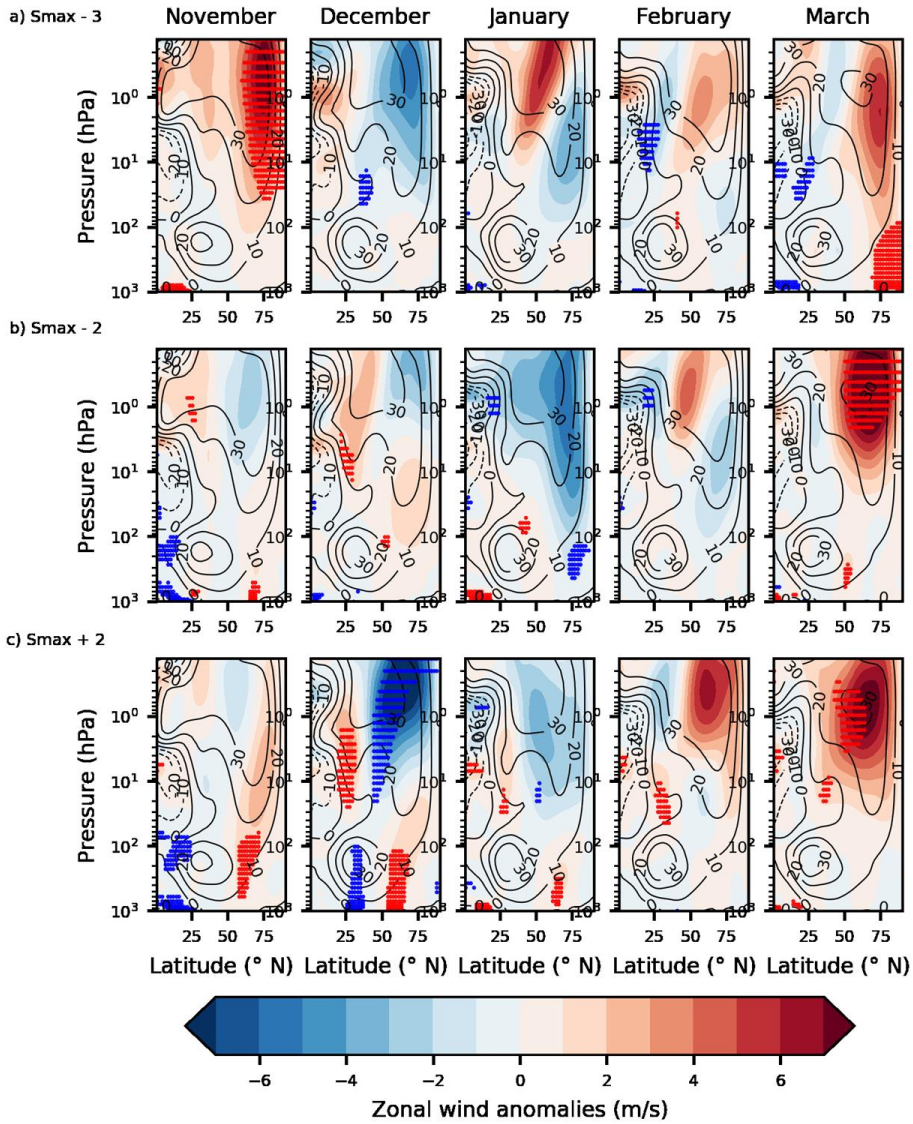

Figure S6. Anomalies as in Fig.7, but for the CTRL. MEEmax years (at lags -3, -2 and 2) indicate years of strong MEE forcing in the SCMEE experiment. Shown are ensemble-mean anomalies.

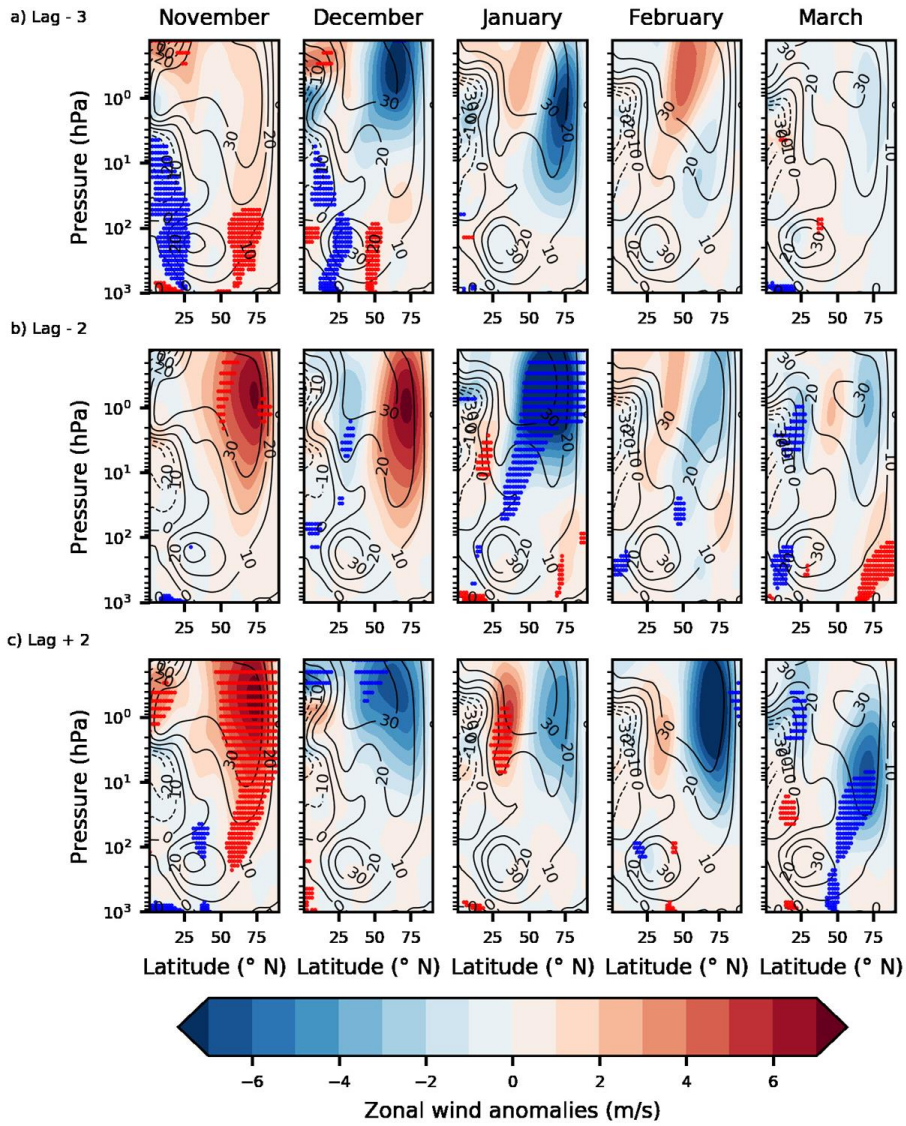

Figure S7. Anomalies as in Fig.7, but for the SC. MEEmax years (at lags -3, -2 and 2) indicate years of strong MEE forcing in the SCMEE experiment. Shown are ensemble-mean anomalies.