

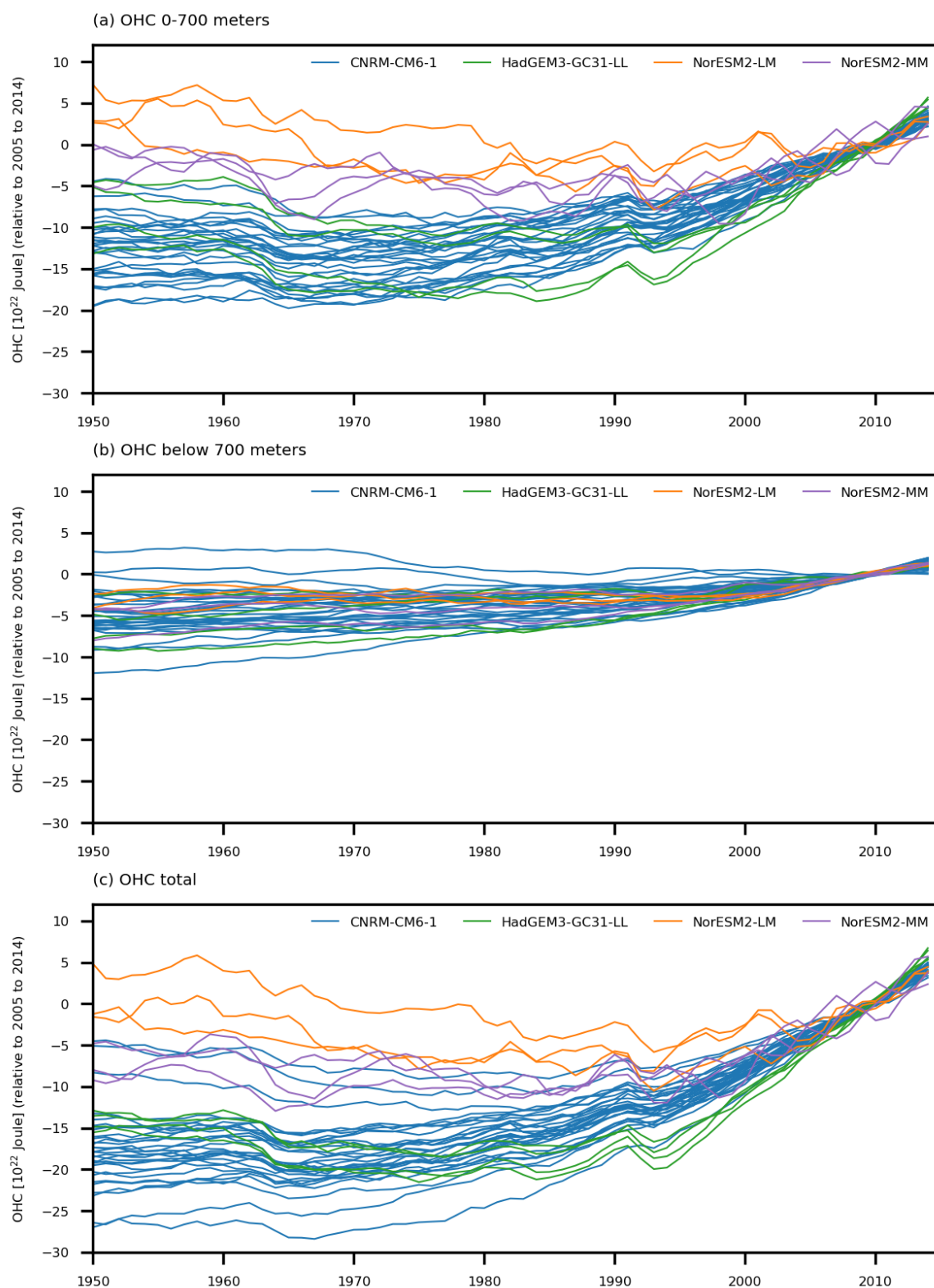


Figure S1: Time series of OHC (as anomalies relative to 2005 to 2014) from the historical climate model simulations from 1950 to 2014. The individual ensemble members are shown as separate lines. In (a) OHC for the upper 700 meters, in (b) OHC below 700 meters and in (c) the total OHC for the full ocean depth.

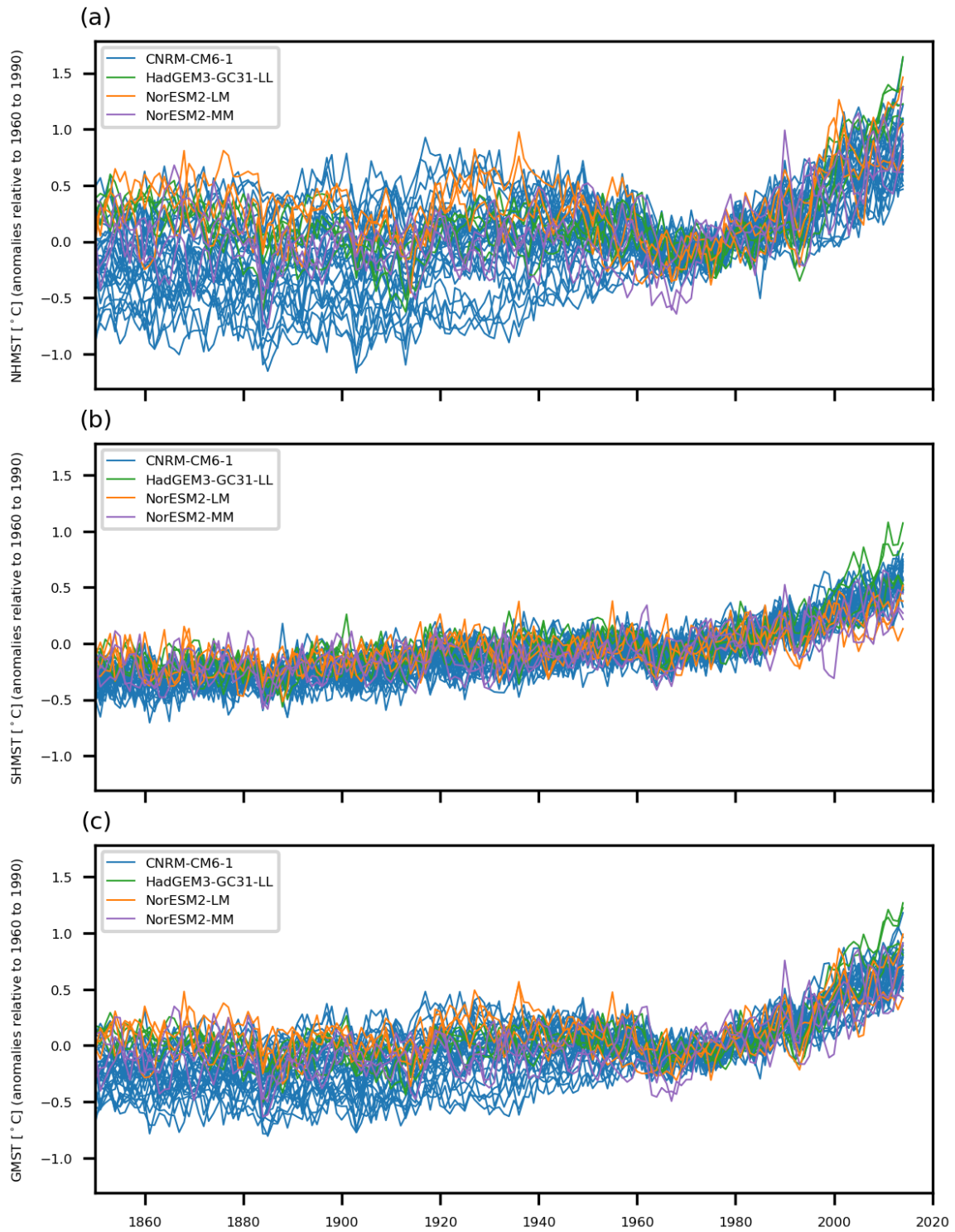


Figure S2: Time series of temperature (as anomalies relative to 1960 to 1990) from the historical climate model simulations from 1850 to 2014. The individual ensemble members are shown as separate lines. In (a) northern hemispheric mean surface temperature (NHMST), in (b) southern hemispheric mean surface temperature (SHMST), and in (c) global mean surface temperature (GMST).

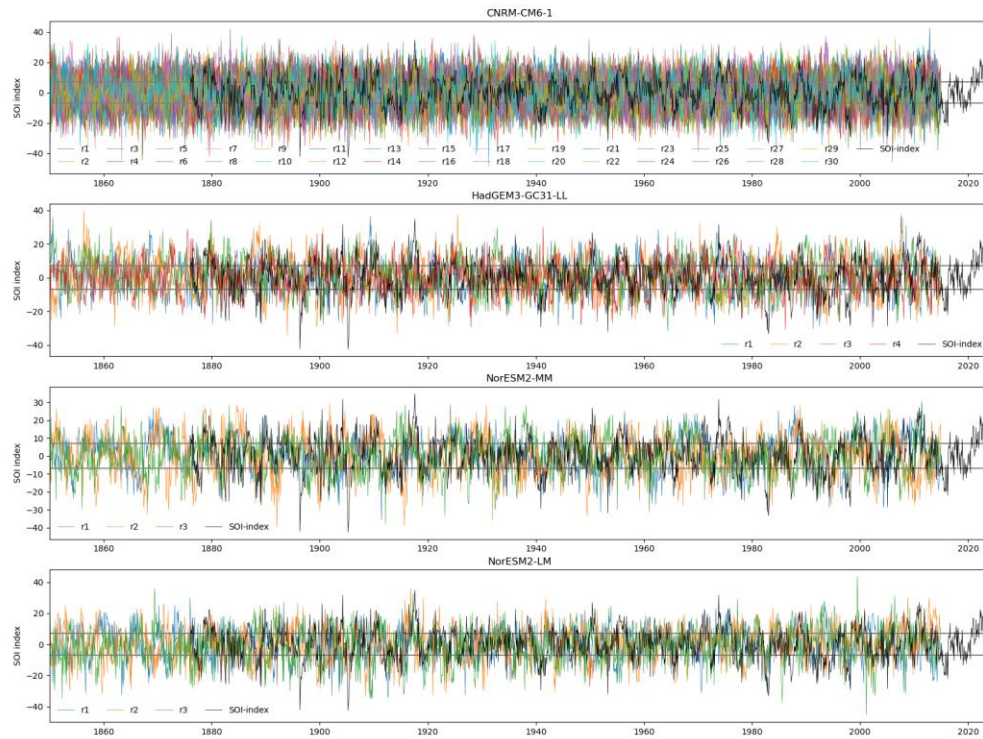


Figure S3: The calculated SOI index from 1850 to 2014 for the four climate models. Each ensemble member is plotted separately. For comparison, the observed Southern Oscillation Index, Bureau of Meteorology, Australia http://bom.gov.au/climate/enso/soi_monthly.txt (downloaded 23. June 2023) are shown in black.

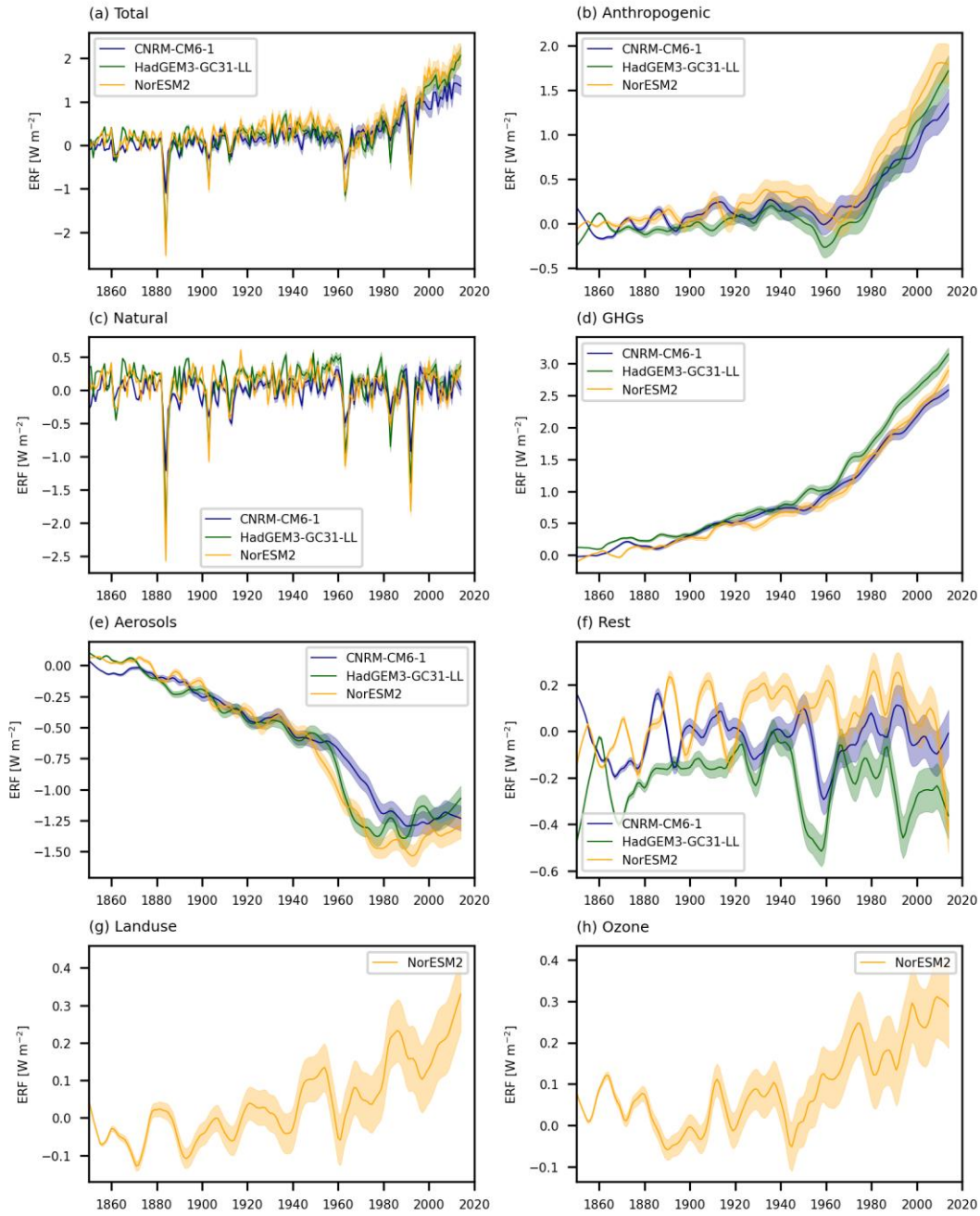


Figure S4: The prior ERF time series for the individual forcing components for each model. The prior median is shown as solid line and the 5th to 95th range as shading. For NorESM2, the same ERF time series are applied to both model versions.

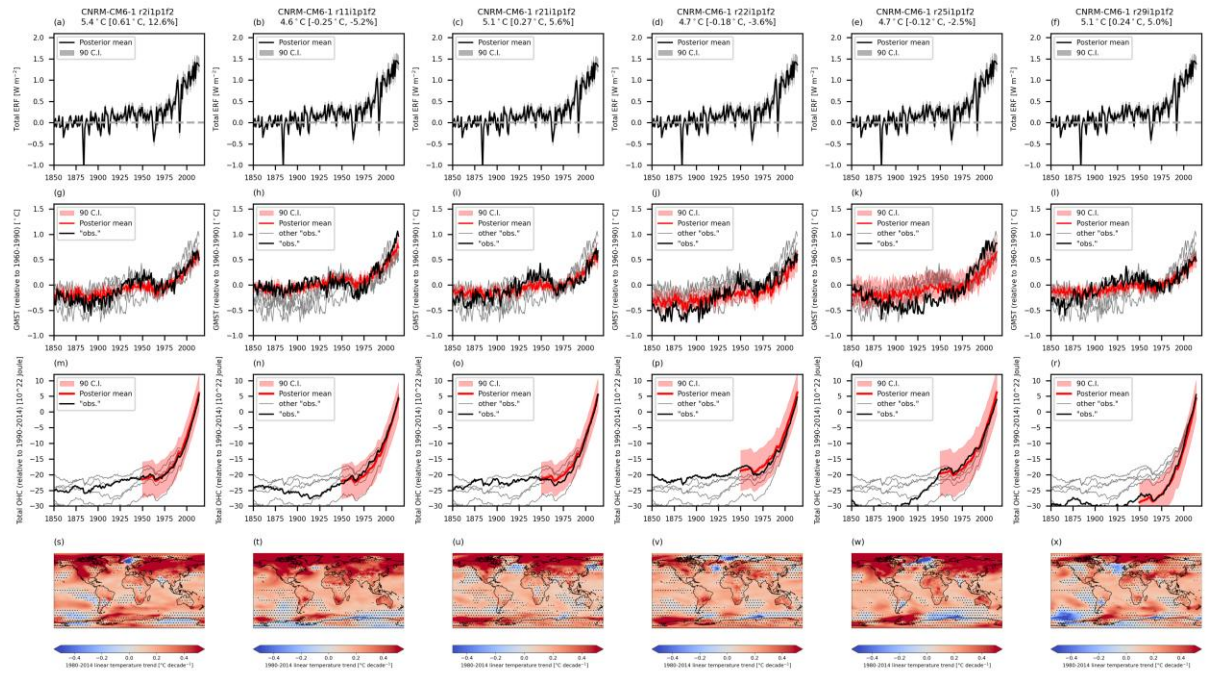


Figure S5: Same as Fig. 3, but for the ensemble members of CNRM-CM6-1 where the posterior mean ECS_{inf} is larger than ECS_{eff} (r2) and the absolute difference between the posterior mean ECS_{inf} and ECS_{eff} is less than 0.3 K (r11, r21, r22, r25, r29).

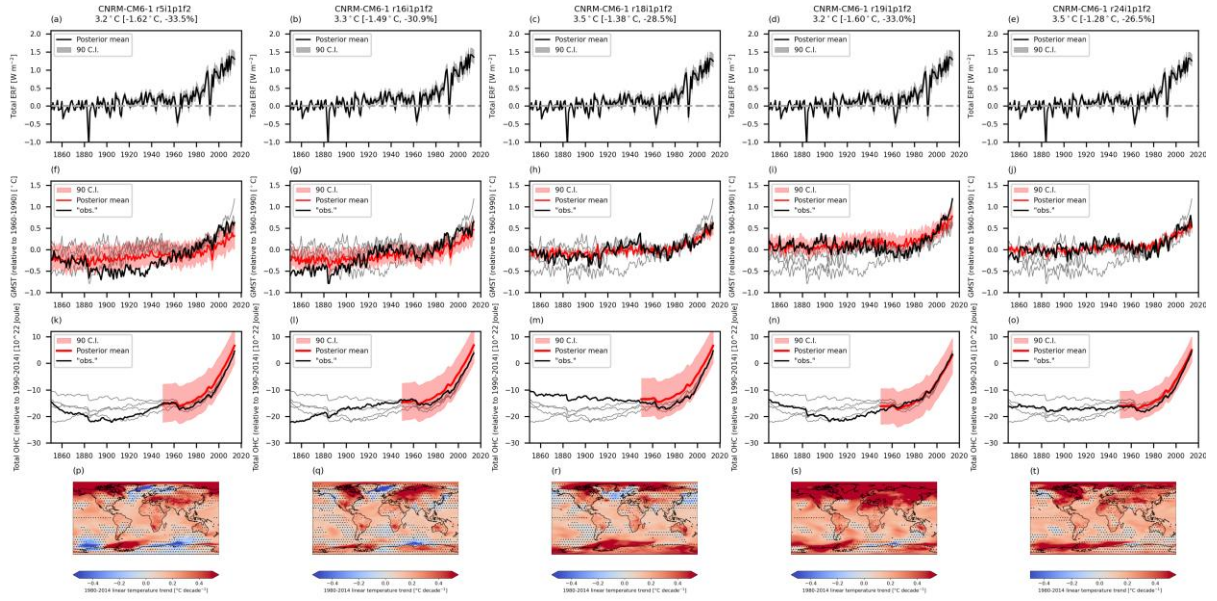


Figure S6: Same as Fig. 3, but for the ensemble members of CNRM-CM6-1 where posterior mean ECS_{Inf} is lower than ECS_{eff} by 1.28 K or more (r5, r16, r18, r19, r24).

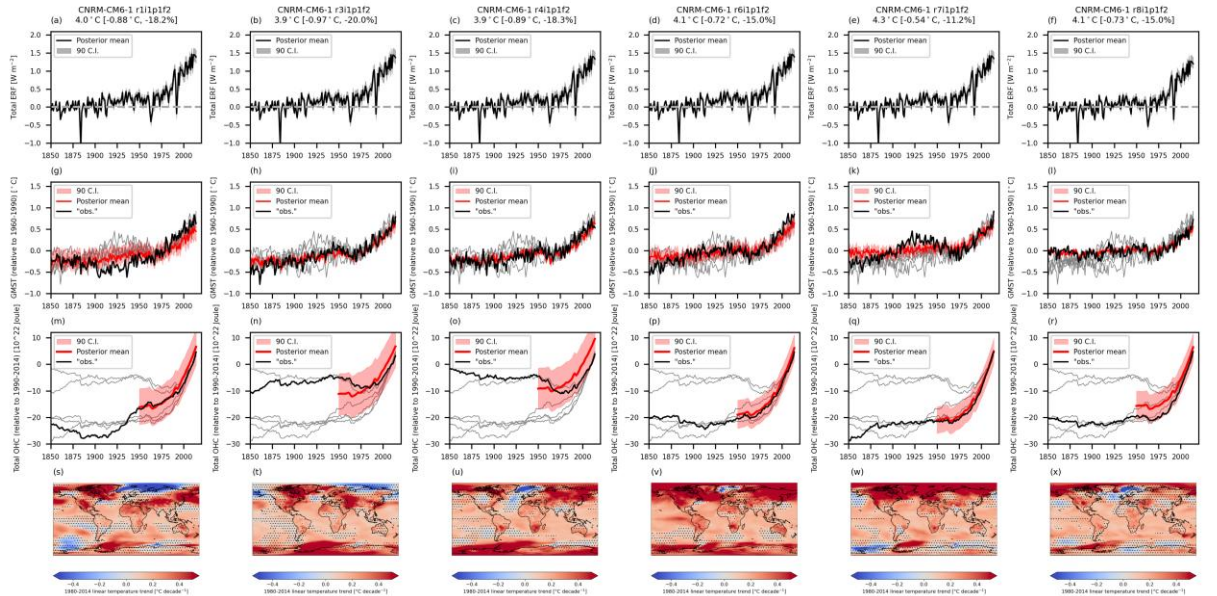


Figure S7: Same as Fig. 3, but for ensemble members of CNRM-CM6-1 not included in Fig. S5 and Fig. S6 (r1, r3, r6, r7, r8).

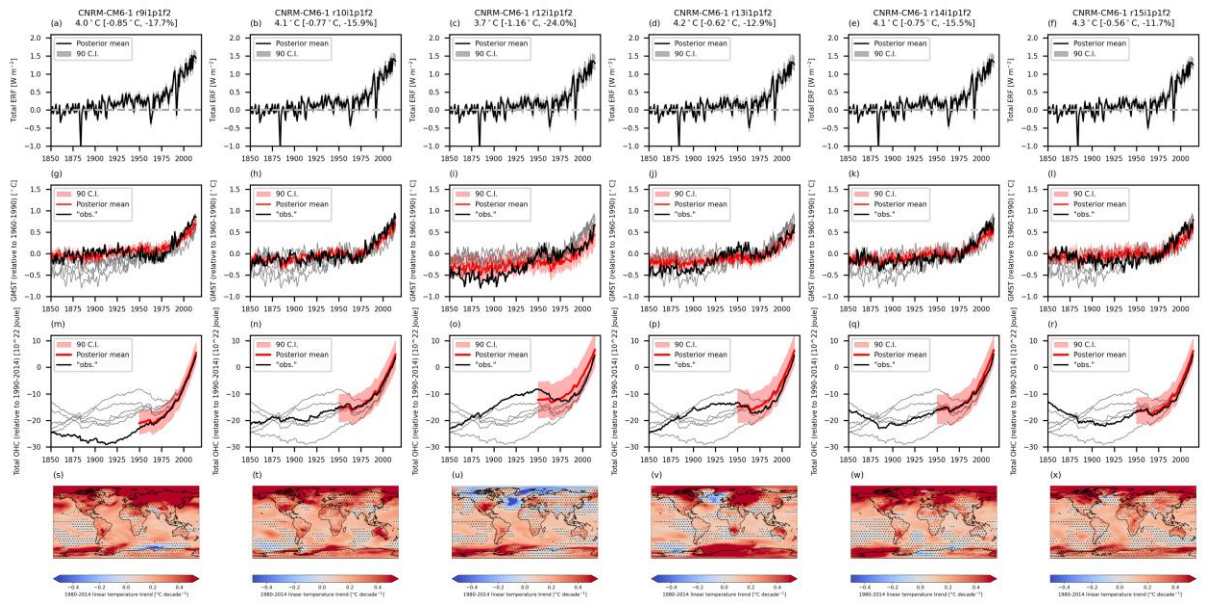


Figure S8: Same as Fig. S7 for additional six ensemble members (r9, r10, r12, r13, r14, r15) of CNRM-CM6-1.

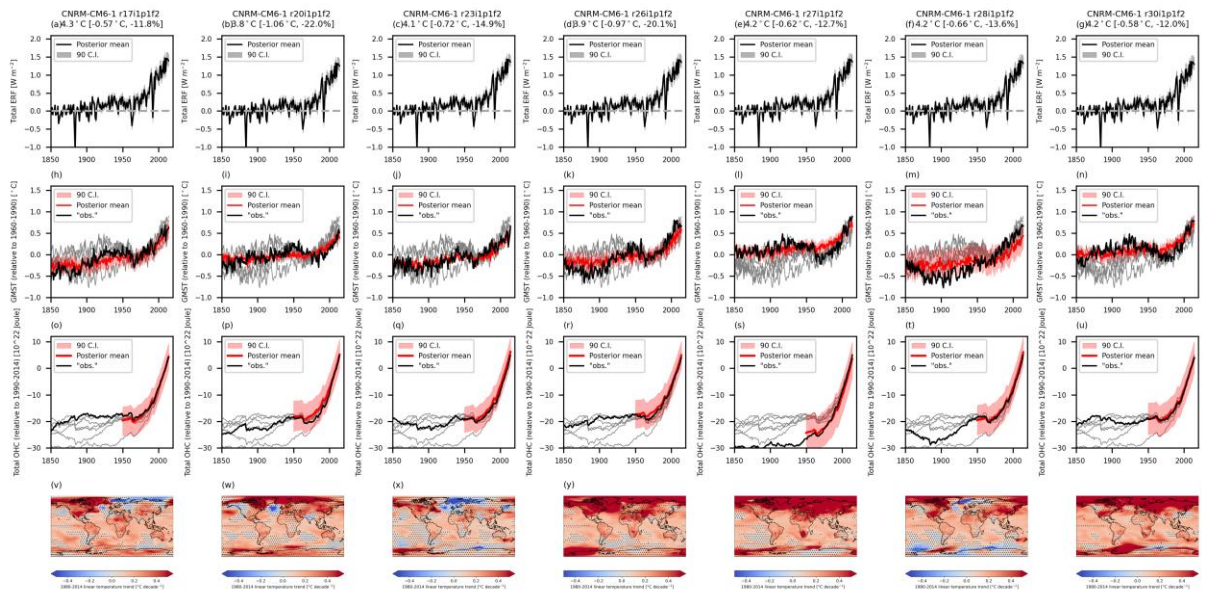


Figure S9: Same as Fig. S7 and Fig. S8 for additional seven ensemble members (r17, r20, r23, r26, r27, r28, r30) of CNRM-CM6-1.

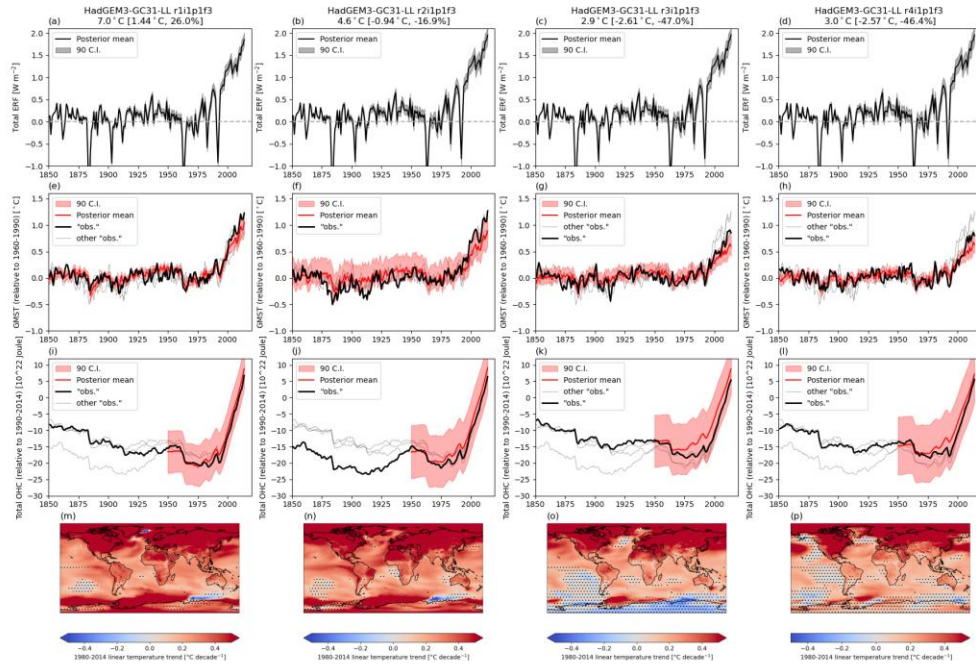


Figure S10: Same as Fig. 3, but for all the ensemble members of HadGEM3 GC3.1-LL.

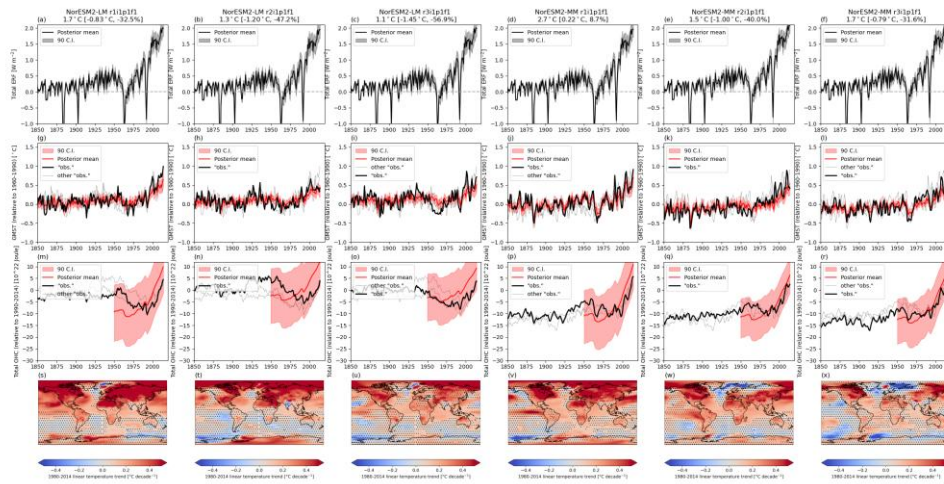


Figure S11: Same as Fig. 3, but for all the ensemble members of NorESM2-LM and NorESM2-MM.

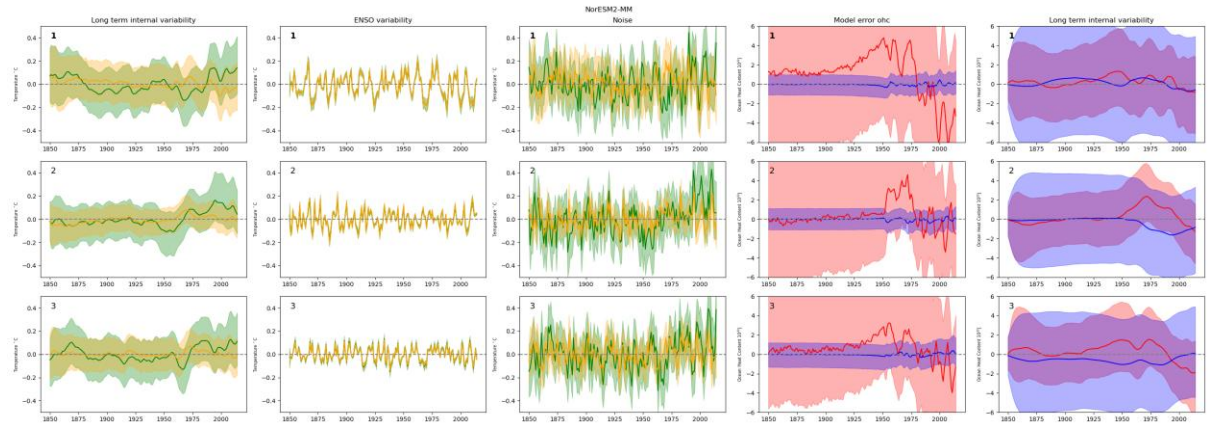


Figure S12: For all ensemble members of NorESM2-MM (indicated by number in upper left corner) posterior estimates of the long-term internal variability term (1st column), the ENSO term (2nd column) and the model errors (3rd column) for the northern hemispheric temperature in green and southern hemispheric temperature in orange. For OHC, the posterior estimates of the model error (4th column) and long-term internal variability (5th column) for the upper 700 meters in red and below 700 meter in blue. The ensemble number for the ensembles with posterior mean ECS_{inf} closest to ECS_{eff} is indicated in bold.

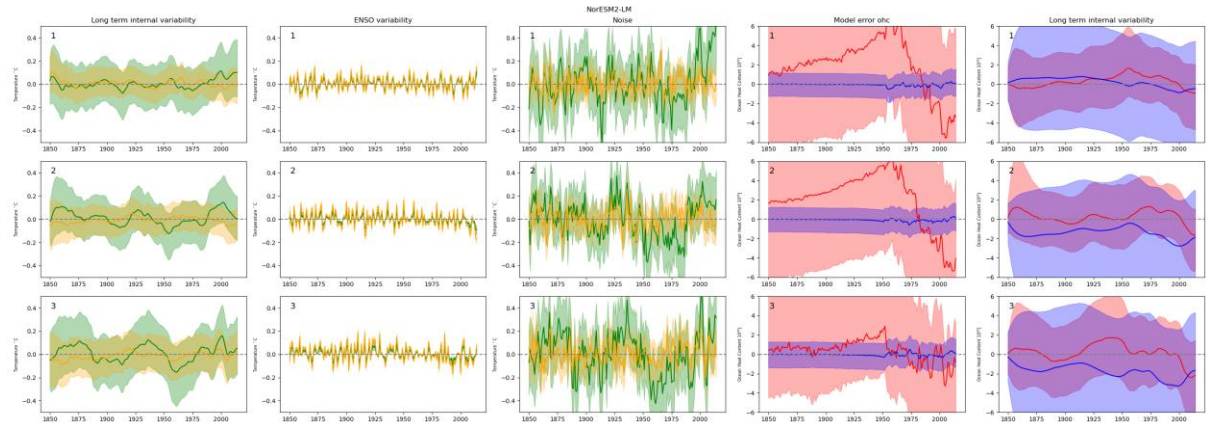


Figure S13: Same as Fig. S12 but for NorESM2-LM.

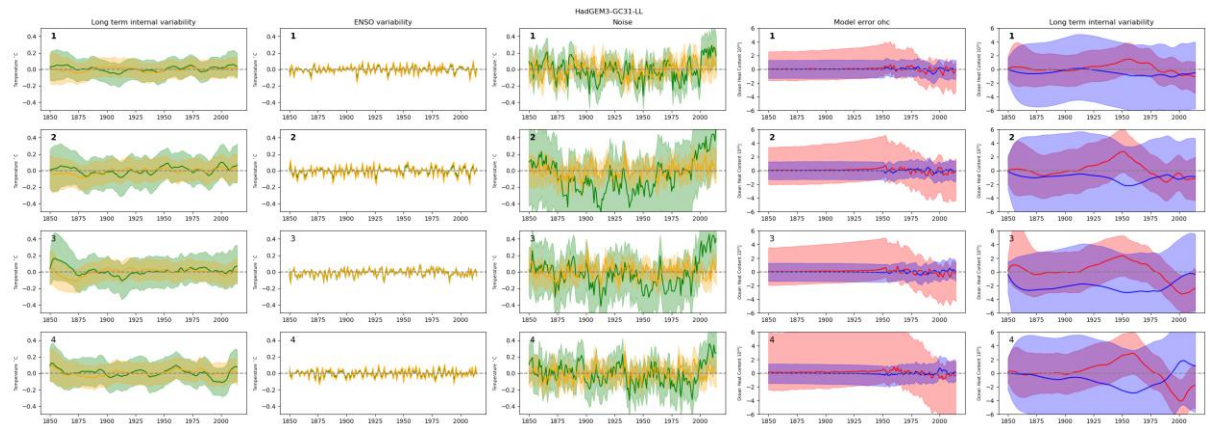


Figure S14: Same as Fig. S12 but for HadGEM3-GC31-LL.



