



Supplement of

Improving the representation of anthropogenic CO₂ emissions in climate models: impact of a new parameterization for the Community Earth System Model (CESM)

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*Comparison of the historical global CO₂ emission estimates
(1950-2012)*

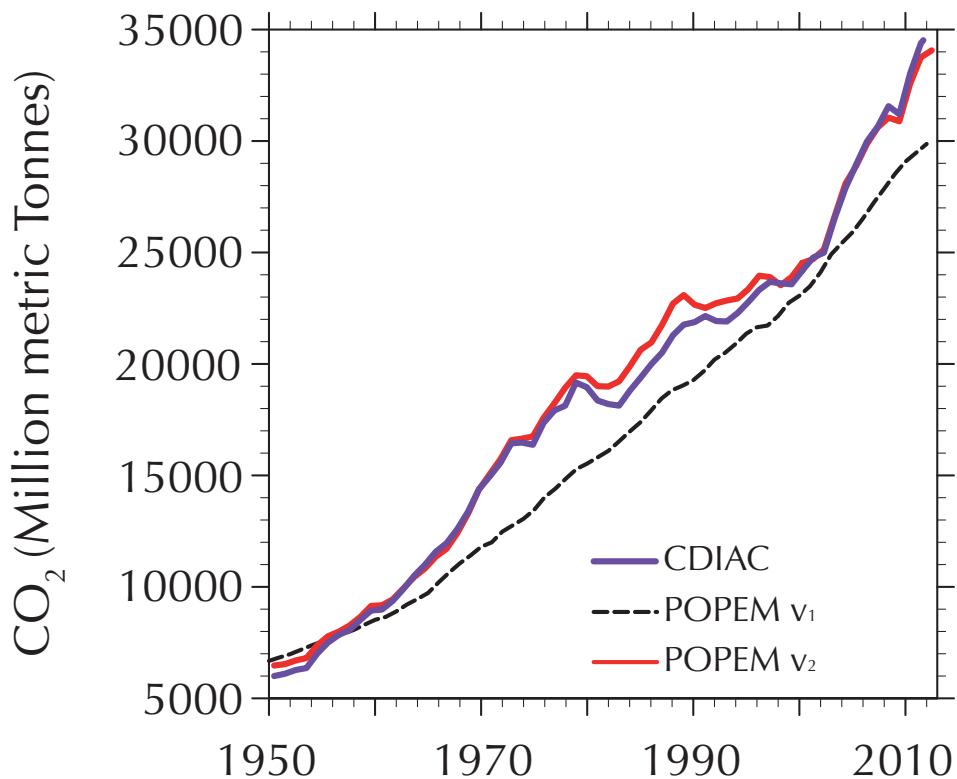


Figure S1: Comparison of the historical global CO₂ emission estimates for the years 1950–2012. The black line shows the estimates given using POPEM v1, red indicates POPEM v2, and purple indicates CDIAC estimates. Values are given in million of metric tonnes.

Monthly mean temperature anomaly (1950-1999)

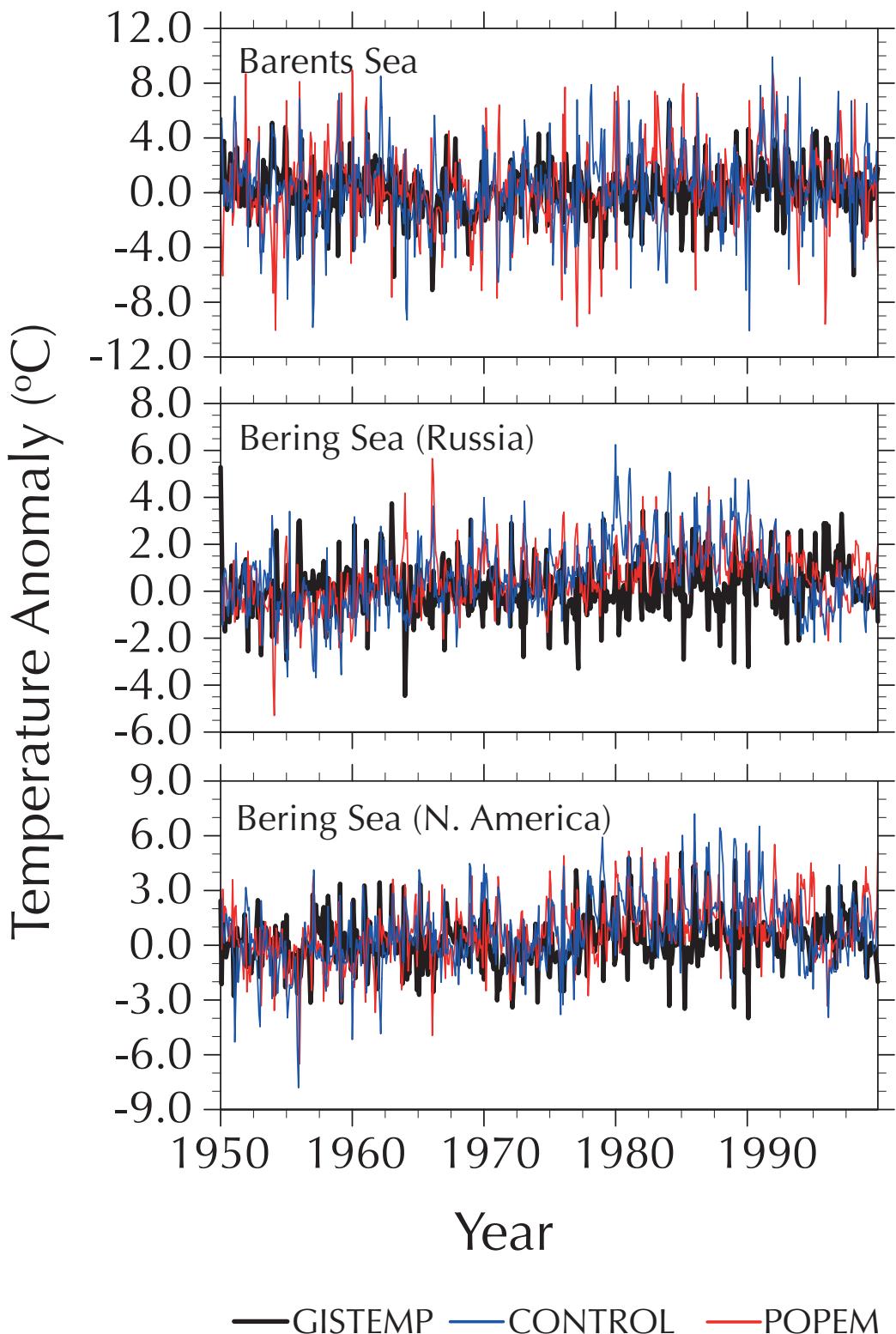


Figure S2: A comparison of the monthly mean surface temperature anomaly between GISTEMP, CONTROL and POPEM from 1950 to 1999. (Top) represents the Barents Sea ($68^{\circ}\text{N}-80^{\circ}\text{N}$, $19^{\circ}\text{E}-68^{\circ}\text{E}$); (middle) Russian part of the Bering Sea ($50^{\circ}\text{N}-65^{\circ}\text{N}$, $150^{\circ}\text{E}-180^{\circ}\text{E}$); and (bottom) American part of the Bering Sea ($50^{\circ}\text{N}-75^{\circ}\text{N}$, $140^{\circ}\text{W}-180^{\circ}\text{W}$). The black line represents observational data (GISTEMP), the blue line is the CONTROL case, and the red is the POPEM case. Anomaly was referenced to 1951-1980 period.

Global monthly mean temperature anomaly (1950-1999)

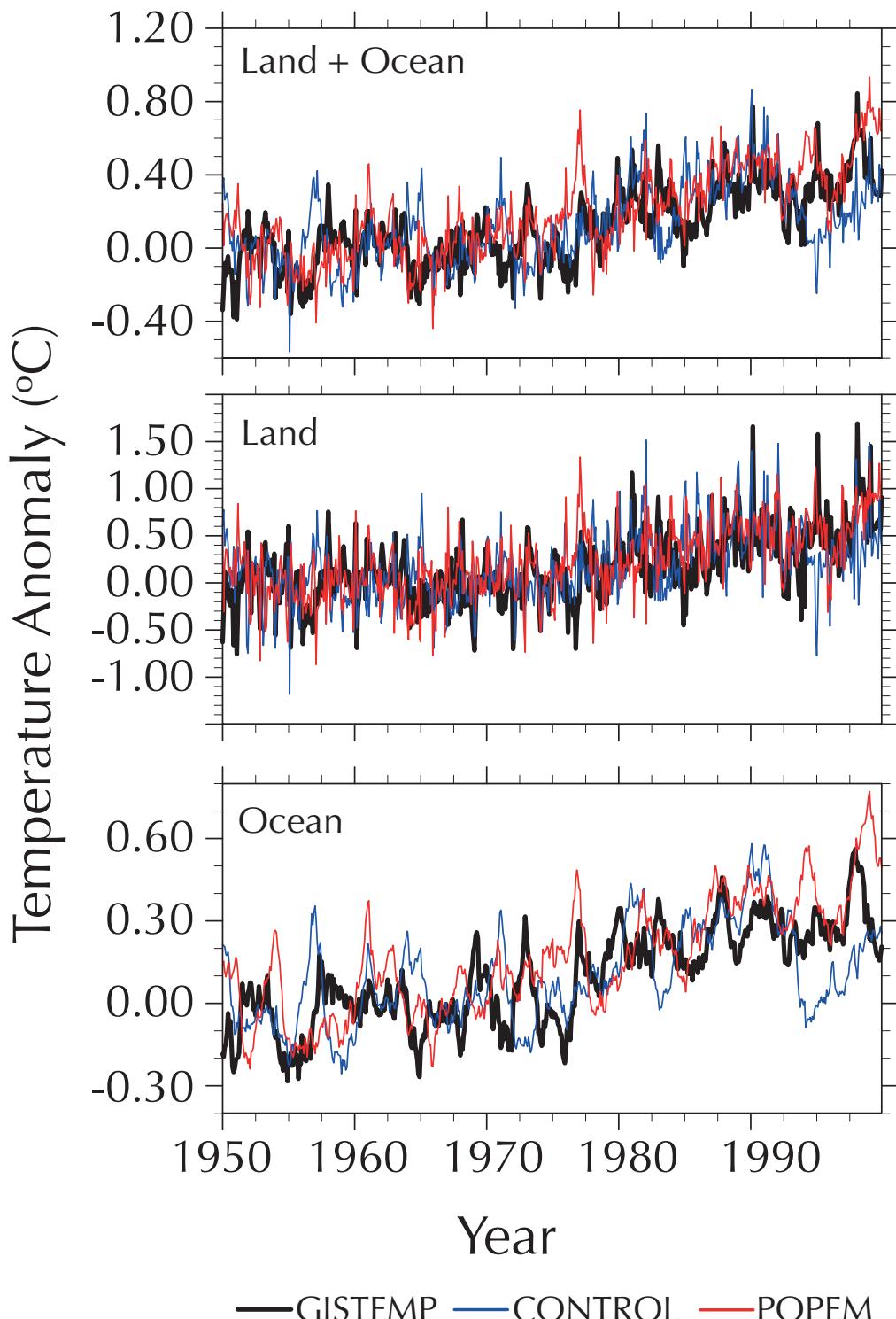


Figure S3: A comparison of the global monthly mean surface temperature anomaly between GISTEMP, CONTROL, and POPEM from 1950 to 1999. (Top) global; (middle) land; and (bottom) ocean. The black line represents observational data (GISTEMP), the blue line is the CONTROL case, and the red is the POPEM case. Anomaly was referenced to 1951-1980 period. *The main tendency is consistent albeit differences exists. Thus for instance the POPEM model clearly improves over CONTROL from 1992 onwards.*