

The climate response to five trillion tonnes of carbon

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Model name	Year at 5EgC	CO ₂ -attributable warming at 5EgC [°C]
HadGEM2-ES	2224	8.77
IPSL-CM5A-LR	2221	9.51
MPI-ESM-LR	2223	7.98
BCC-CSM 1.1	2180	6.37
Inter-model mean	N/A	8.16

Table S1. CO₂-attributable warming at 5EgC (± 10 years). Anomalies are relative to the pre-industrial control run.

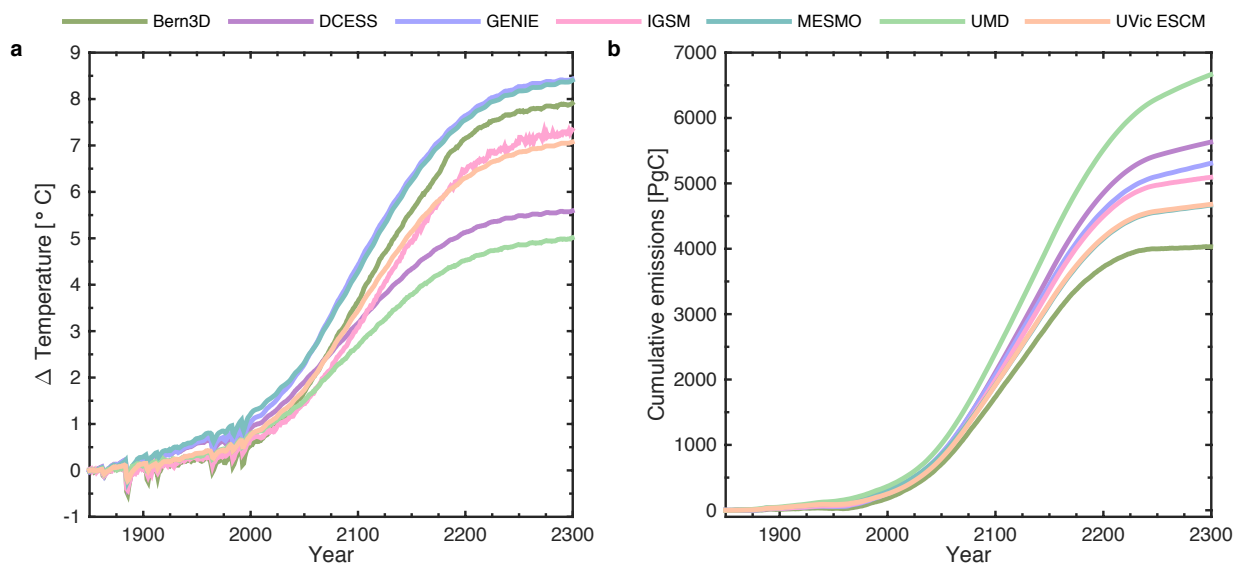


Figure S1. Earth system models of intermediate complexity: Global mean temperature (a) and cumulative emission budgets (b). Anomalies are relative to 1850-1860 mean.

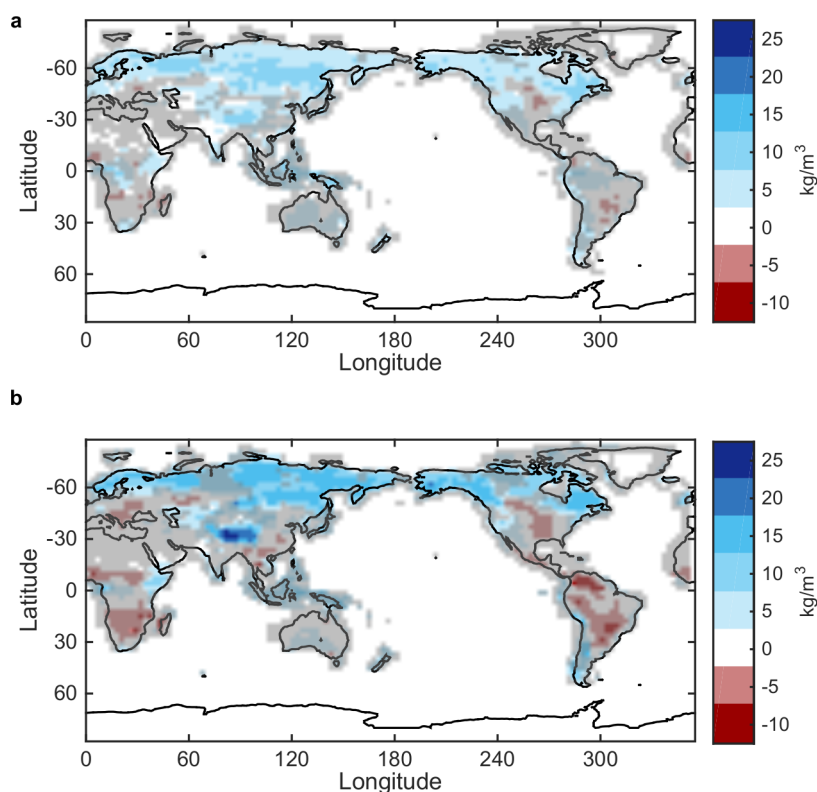


Figure S2. Simulated multi-model mean changes in the land carbon pool (a) for the period 2090-2110 and (b) at the time of 5EgC emissions. Anomalies are shown relative to the preindustrial control simulation. The grey shaded areas indicate regions of inconsistent model responses, where at least one model shows change in the opposite direction to the multi-model mean.

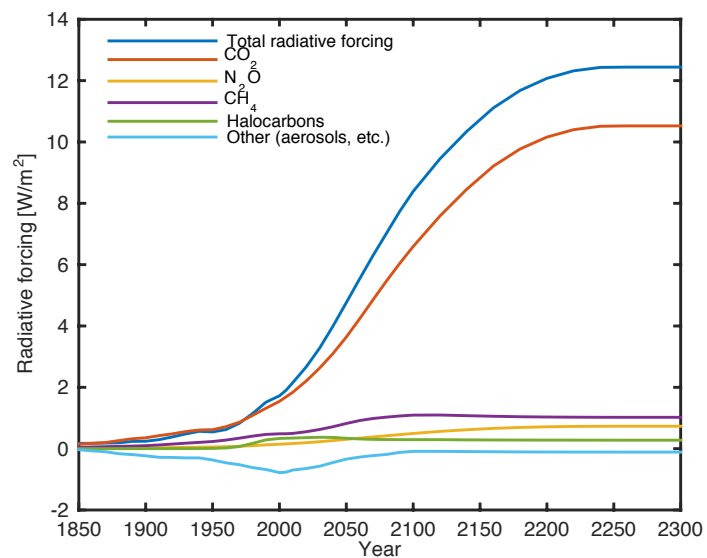


Figure S3. Radiative forcing prescribed for the RCP 8.5 Extension pathway^{7,12}.

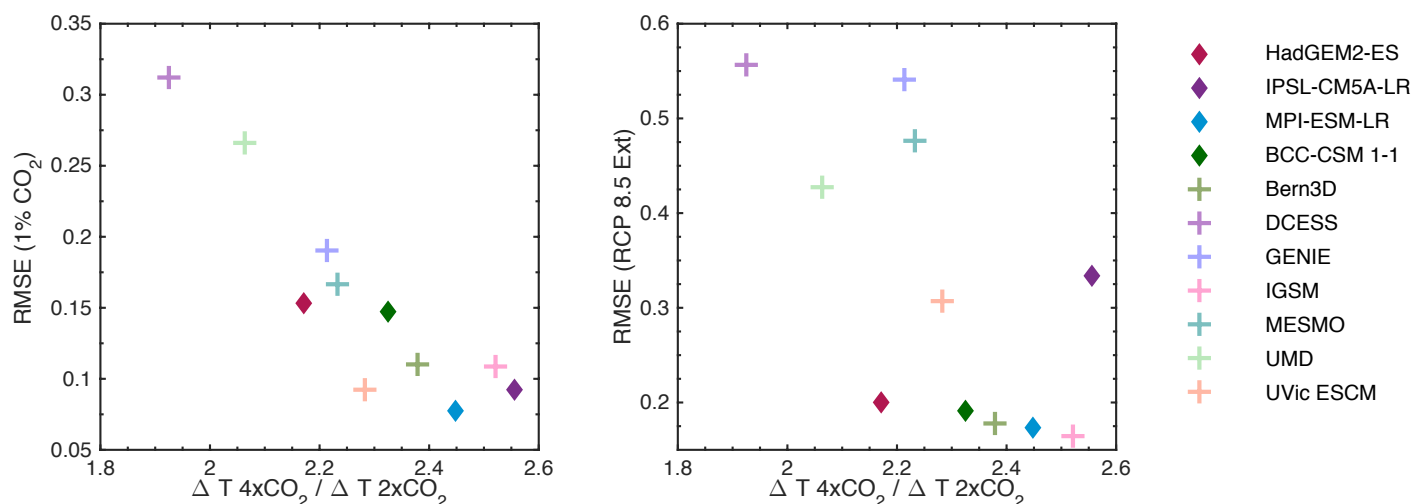


Figure S4. Root mean squared error (RMSE) and warming ratio at high cumulative emissions for 1PCTCO₂ simulation (panel **a**) and RCP 8.5 Ext (panel **b**). The horizontal axis shows the ratio of warming in response to an increase in CO₂ concentration in a 1PCTCO₂ simulation, where 1xCO₂ is preindustrial CO₂ concentration. The ratio represents the warming in response to CO₂ concentration increase from 1xCO₂ to 4xCO₂, to the warming in response to CO₂ concentration increase from 1xCO₂ to 2xCO₂. Vertical axis shows root mean squared error for the least square linear regression fits to warming against cumulative emissions for the 1PCTCO₂ simulation (panel **a**) and for the RCP 8.5 Extension pathway (after scaling by ratio of CO₂ to total radiative forcing) (panel **b**).

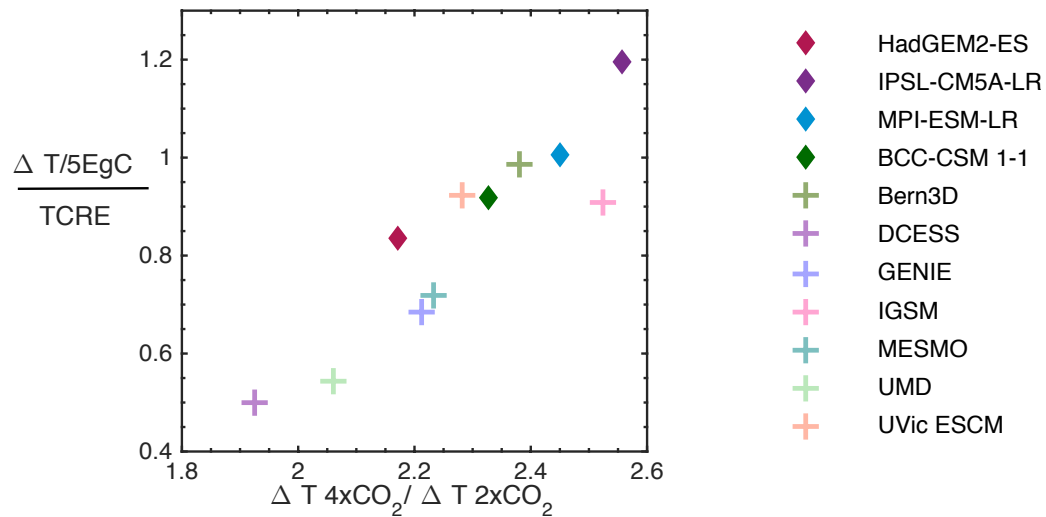


Figure S5. Ratio of warming at 5 EgC (from RCP 8.5 Ext simulation) to TCRE as a function of the warming ratio of temperature at CO₂ quadrupling to temperature at CO₂ doubling (from 1PCTCO₂ increase simulations). ESMs are represented by diamonds, while EMICs are represented by crosses.

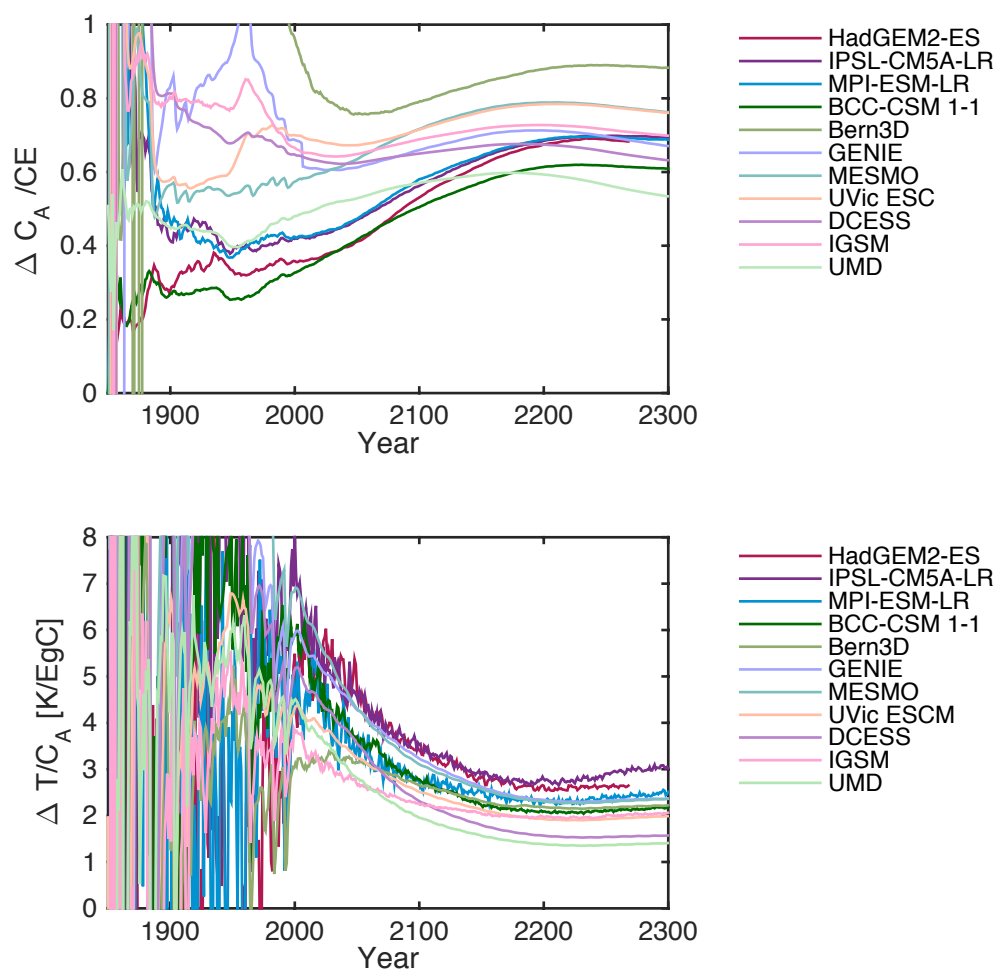


Figure S6. Atmospheric carbon burden in the RCP 8.5-Ext simulations, calculated as the change in atmospheric carbon (C_A) per unit of cumulative carbon emissions (CE) (a); The ratio of temperature change (ΔT) to airborne fraction of CO_2 simulated in the RCP 8.5-Ext simulations (C_A), as a function of time. Calculated as change in temperature per unit of atmospheric carbon (b).

Note that the product of these two ratios (C_A / CE and $\Delta T / C_A$) is equal to the ratio of temperature change to cumulative emissions.

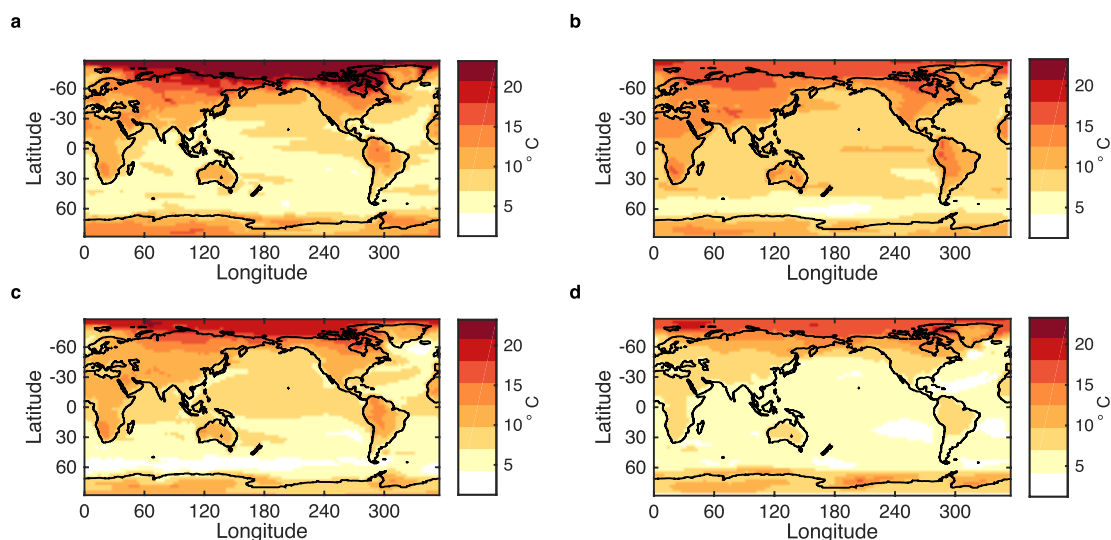


Figure S7. Regional temperature response to 5 EgC CO₂ emissions, anomaly with respect to the preindustrial control simulation, for different models: HadGEM2-ES (**a**); IPSL-CM5A-LR (**b**); MIP-ESM-LR (**c**); BCC-CSM 1.1 (**d**). The values correspond to the time when cumulative emissions reach 5 EgC, and are scaled by the ratio of CO₂ to total radiative forcing.

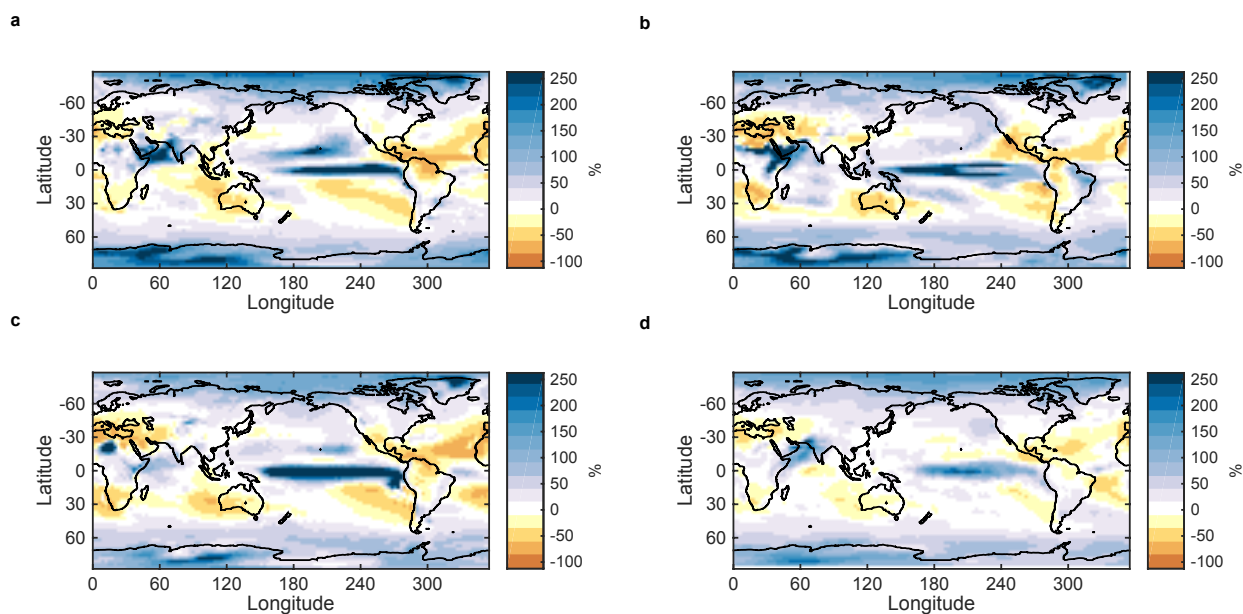


Figure S8. Regional precipitation response to 5 EgC CO₂ emissions, expressed as a percentage of simulated preindustrial precipitation for different models: HadGEM2-ES (a); IPSL-CM5A-LR (b); MIP-ESM-LR (c); BCC-CSM 1.1 (d). The values correspond to the time when cumulative emissions reach 5 EgC, and are scaled by the ratio of CO₂ to total radiative forcing.

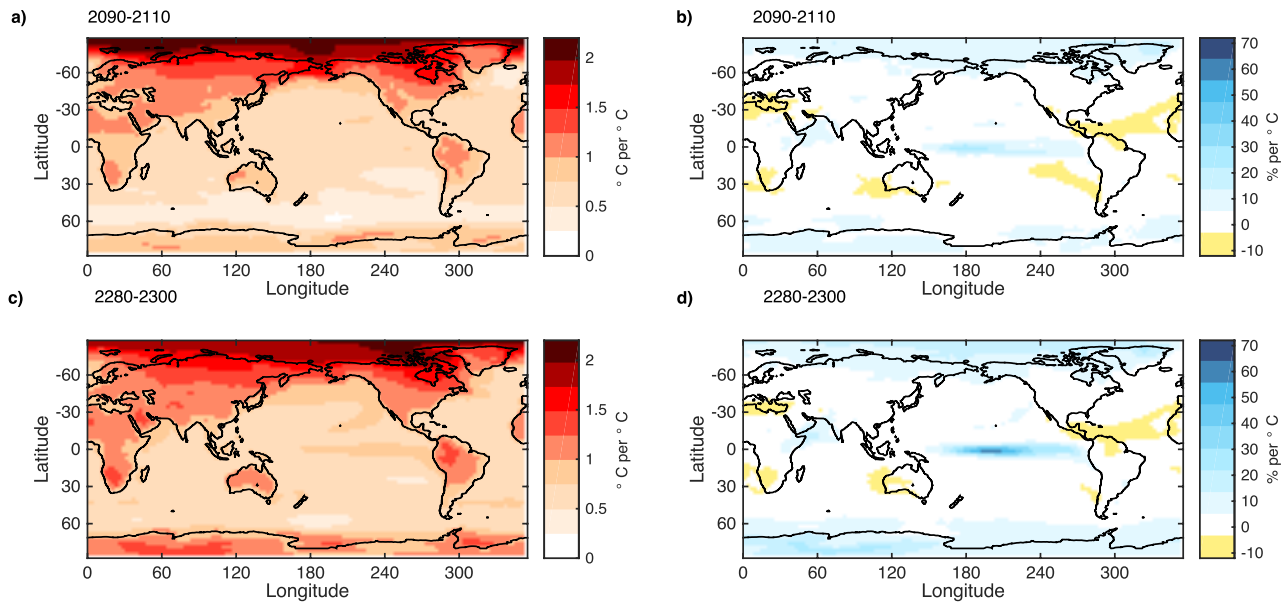


Figure S9. Simulated model-mean CO_2 -attributable temperature (left) and precipitation changes (right) for the period 2090-2110 (top) and 2280-2300 (bottom), scaled by the global mean temperature in respective year. Precipitation is expressed as a percentage of simulated preindustrial precipitation. Anomalies are relative to preindustrial control run.