Climate response to zeroed emissions of greenhouse gases and aerosols

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Figure S1: Simulated global climate response following the elimination of emissions of CO₂, other greenhouse gases and aerosols. Solid lines show the response for the standard aerosol forcing (−1.2 Wm⁻² at 2010), as in Figure 1 of the main manuscript. Dashed lines show the response for low (−1.1 Wm⁻² at 2010) and high (−1.4 Wm⁻² at 2010) aerosol forcing, representing a subset of the full range of aerosol forcings shown in Figure 3 of the main manuscript. As expected, the uncertainty in the magnitude of the historical aerosol forcing affected the response primarily in simulations where aerosol forcing was not eliminated after 2010 (red and green curves). The year-2200 range of global mean temperature was 14.2-14.5 °C for the CO₂-only experiment and 13.1-13.4 °C for the CO₂+GHG experiment. In the CO₂+aerosol experiment (blue lines), increased aerosol forcing led to increased warming between 2010 and 2020 due to smaller historical temperature change, though the year-2200 global mean temperature was unaffected by aerosol uncertainty. Uncertainty in historical aerosol forcing also affected atmospheric CO₂ due to climate-carbon cycle feedbacks.
Figure S2: Spatial pattern of temperature change following the elimination of aerosol (a, b), non-CO\textsubscript{2} greenhouse gas (c, d) and CO\textsubscript{2} (e, f) emissions at the year 2010. Left panels show temperature changes between 2010 and 2020, and right panels show temperature changes between 2010 and 2200. The spatial patterns associated with the elimination of each individual forcing are similar in 2020 and 2200. The warming associated with the rapid removal of aerosol forcing dominates the net response pattern in the year 2020, whereas the cooling associated with the gradual decline of non-CO\textsubscript{2} greenhouse gas forcing has a much stronger effect on the year-2200 temperature change pattern. Regional-scale changes associated with the elimination of CO\textsubscript{2} emissions alone are relatively small.
**Figure S3**: Simulated temperature response to zero emissions of CO$_2$, non-CO$_2$ gases and aerosols, with the strength of the year-2010 aerosol forcing varying between −0.8 and −1.9 W/m$^2$. The black solid and dashed lines overlaid on the historical portion of the plot show the best guess and likely range of the historical temperature change due to uncertainty in transient climate response (TCR) and climate-carbon cycle feedback. This range was computed using the cumulative emissions from the simulation with standard aerosol forcing and the likely range of the climate carbon response$^1$ (1.0-2.5 °C per trillion tonnes of cumulative carbon emitted)$^2$. The range in the temperature response due uncertainty in the TCR and carbon cycle feedback is comparable in magnitude to the range of responses due to uncertainty in the aerosol forcing, implying that any of the simulations with varying aerosol forcing could reproduce the observed temperature change, given appropriate (if not necessarily realistic) values of TCR and carbon cycle feedback.

**References**