

Supporting Information for “Interpreting the Dependence of Cloud-Radiative Adjustment on Forcing Agent”

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Table S1. Experiment names and details for the experiments using common forcing agents in this paper. All experiments use the same control SSTs and sea ice.

Experiment name	Description
control	Pre-industrial climate (year 1850)
$10\times\text{CH}_4$	10 times concentrations of methane compared to pre-industrial levels
$2\times\text{CO}_2$	Doubling of CO_2 from pre-industrial level (284.7 ppm) to 569.4 ppm
$10\times\text{BC}$	10 times concentrations of black carbon compared to pre-industrial levels
$3\%\text{Sol}$	3% increase in the solar constant

Table S2. Experiment names and details for the simplified experiments used in this paper. All experiments use the same control SSTs and sea ice. The heating rates were prescribed as extra terms in the heating rate equations within CAM4's radiation scheme.

Experiment name	Description
atm_4	Homogeneous heating throughout the atmosphere for a horizontally homogeneous vertically-integrated forcing of 4 W m^{-2}
sfc_4	Homogeneous 4 W m^{-2} downwards flux at the surface
vloc_φhPa	Atmospheric heating defined through Eq. 1

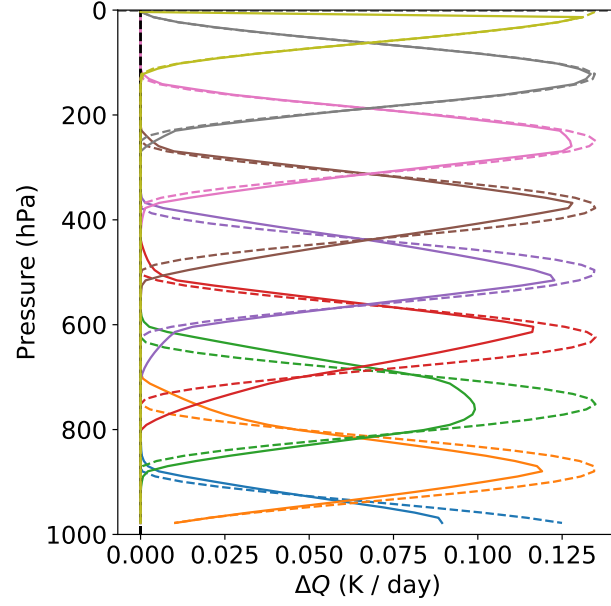


Figure S1. Heating profiles of all of the pulse heating experiments in this work. Dashed lines show the heating rates defined in Eq. 1 of the main text, whilst the solid lines show the profiles interpolated from the model grid.

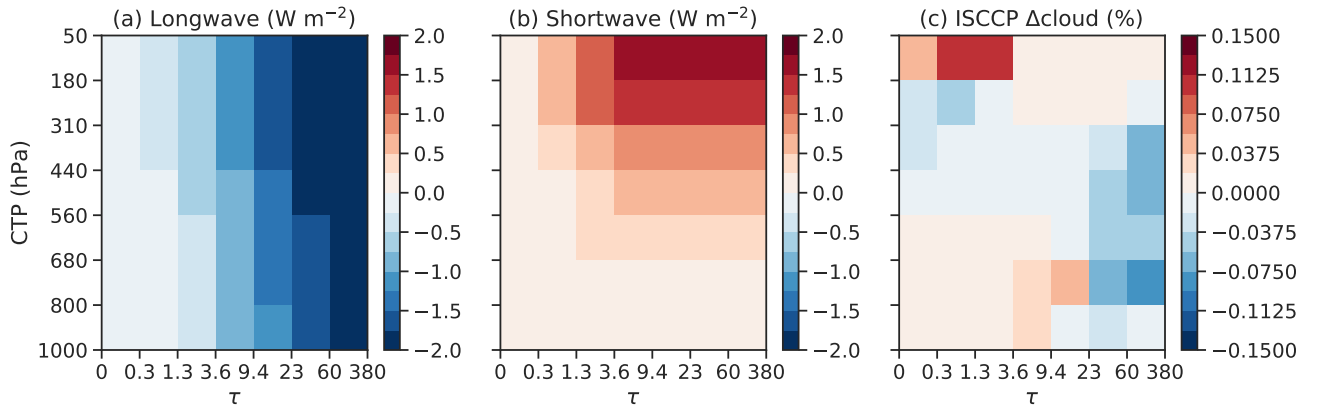


Figure S2. (a–b) Globally- (weighted by clear-sky surface albedo) and time-averaged histograms of the cloud kernels obtained from Zelinka et al. (2012). (c) Globally- and time-averaged histogram of the changes in satellite-observed cloud fraction between the $2\times\text{CO}_2$ and control cases.

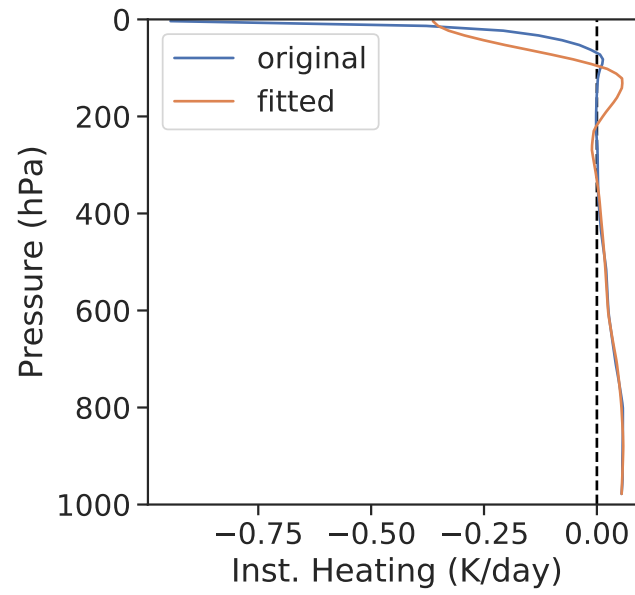


Figure S3. Heating profile for the $2\times\text{CO}_2$ experiment, with a linear fit of localised pulse heating experiments. The limited number of localised pulses results in issues with fitting to the stratospheric heating rates.

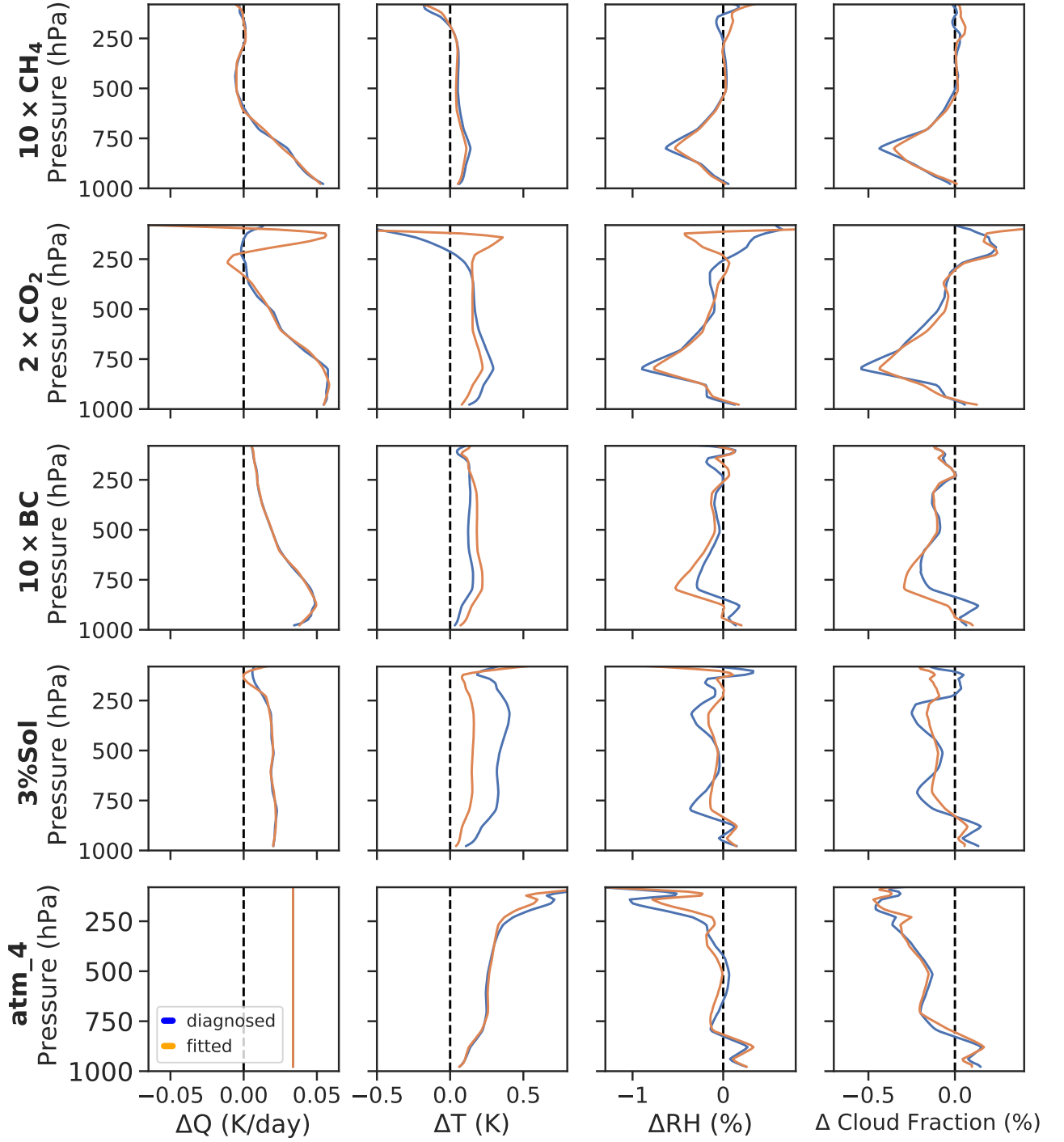


Figure S4. Global-mean vertical profiles of IRF (ΔQ) and rapid adjustments of temperature (ΔT), relative humidity (ΔRH) and cloud fraction. The same as Fig. 3 in the main text, except without contributions from surface forcings. Note that only the 3%Sol case changes significantly.