

Supplement of Atmos. Chem. Phys., 20, 4047–4058, 2020
<https://doi.org/10.5194/acp-20-4047-2020-supplement>
© Author(s) 2020. This work is distributed under
the Creative Commons Attribution 4.0 License.



Supplement of

Global sensitivity analysis of chemistry–climate model budgets of tropospheric ozone and OH: exploring model diversity

Oliver Wild et al.

Correspondence to: Oliver Wild (o.wild@lancaster.ac.uk)

The copyright of individual parts of the supplement might differ from the CC BY 4.0 License.

Table S1. Uncertainty ranges used for the model simulations and for construction of the emulators. The sensitivity analysis described in the paper uses a reduced subset of this parameter space that better reflects comparable uncertainty estimates across the eight variables.

Variables	Full Range
Surface NOx emissions	30–50 TgN yr ⁻¹
Lightning NO emissions	2–8 TgN yr ⁻¹
Biogenic isoprene emissions	200–800 TgC yr ⁻¹
Dry deposition rates	± 80%
Wet deposition rates	± 80%
Atmospheric humidity	± 50%
Cloud optical depth	× 0.1–10
Boundary layer mixing	× 0.01–100

Table S2. Comparison of the conditions from the control run of each model.

Variables	FRSGC/UCI	GISS GCM	CAM-Chem
Surface NOx emissions, TgN yr ⁻¹	40	40	40
Lightning NO emissions, TgN yr ⁻¹	5	5	5
Isoprene emissions, TgCyr ⁻¹	500	500	500
Methane mixing ratio, ppb	1760	1760	1760
Tropospheric ozone burden, Tg	314	342	333
Methane chemical lifetime, yr	8.86	11.65	9.44
Annual mean total column ozone (global), DU	321	294	295
Annual mean total column ozone (tropical), DU	265	263	258
Annual mean mass of water vapour, 10 ¹⁶ kg	1.26	1.21	–

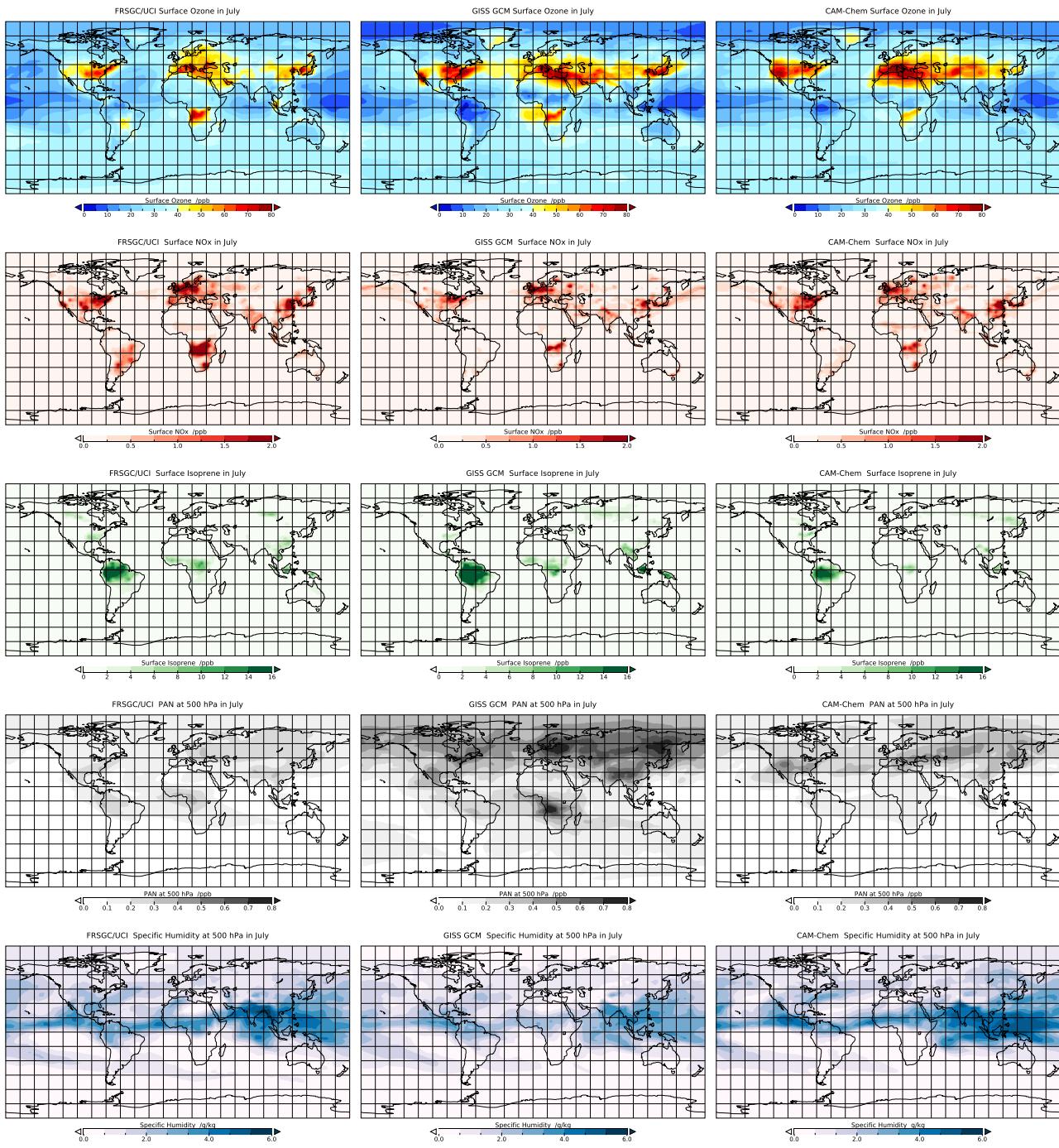


Figure S1. Monthly mean results for July from the control run of each model showing mean surface ozone (top), surface NO_x (row 2), surface isoprene (row 3), peroxyacetyl nitrate (PAN) at 500 hPa (row 4) and specific humidity at 500 hPa (bottom).

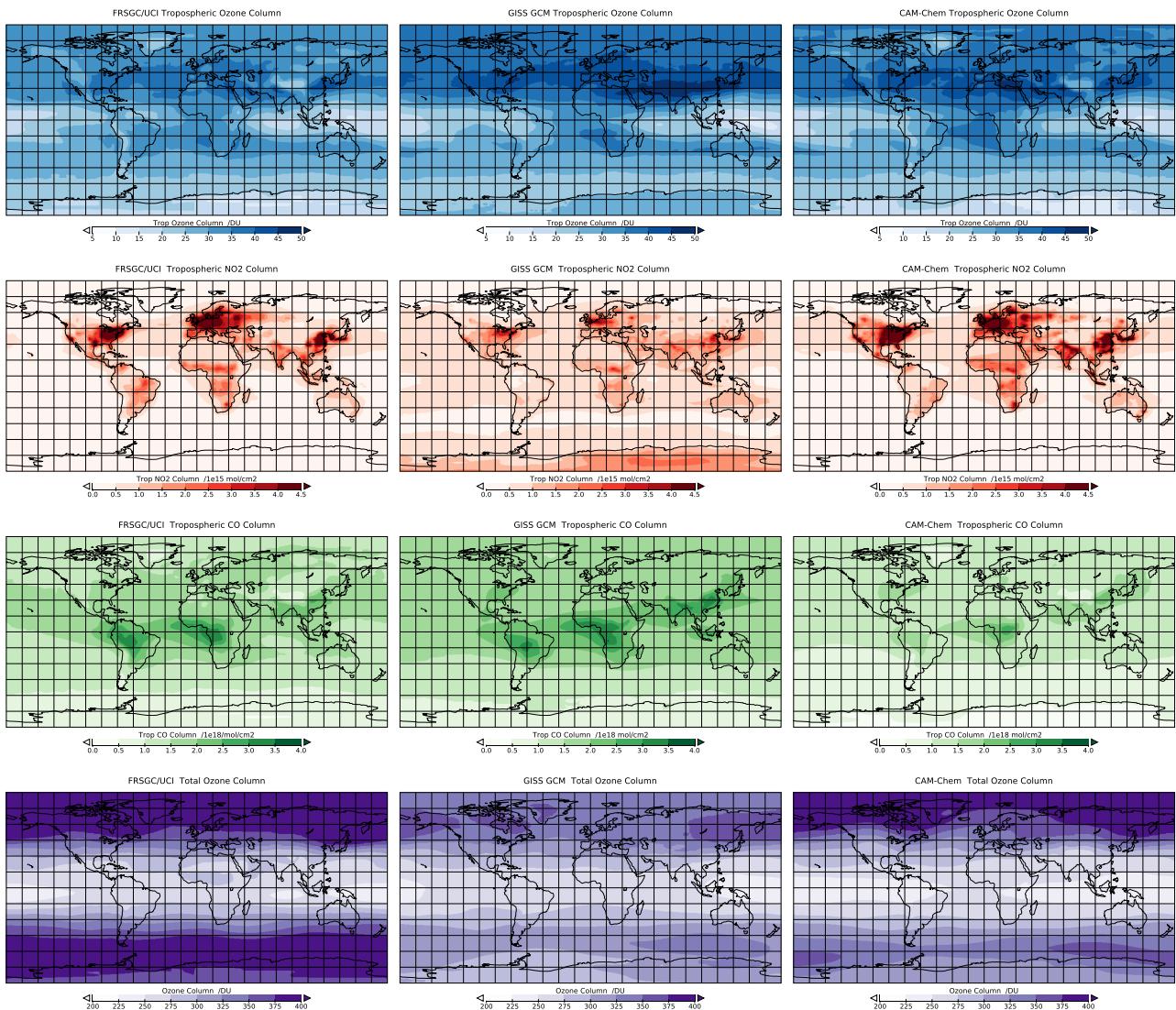


Figure S2. Annual mean results from the control run of each model showing tropospheric ozone column (top), tropospheric NO₂ column (row 2), tropospheric CO column (row 3) and total column ozone (bottom).

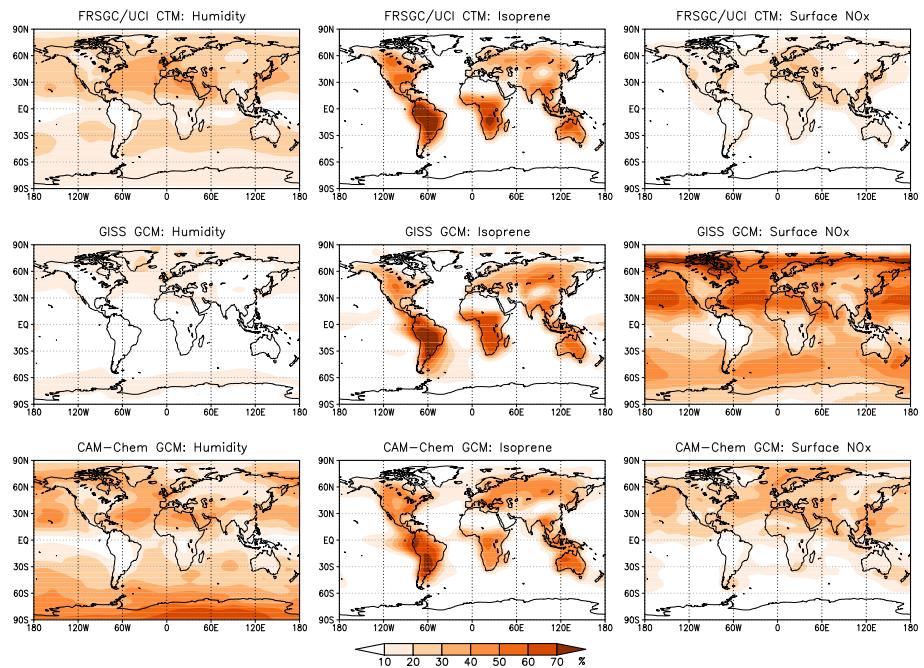


Figure S3. Contributions (in %) to the total variance in the annual tropospheric column CH_4 chemical loss rate in each model from humidity, isoprene emissions and surface NO_x emissions.

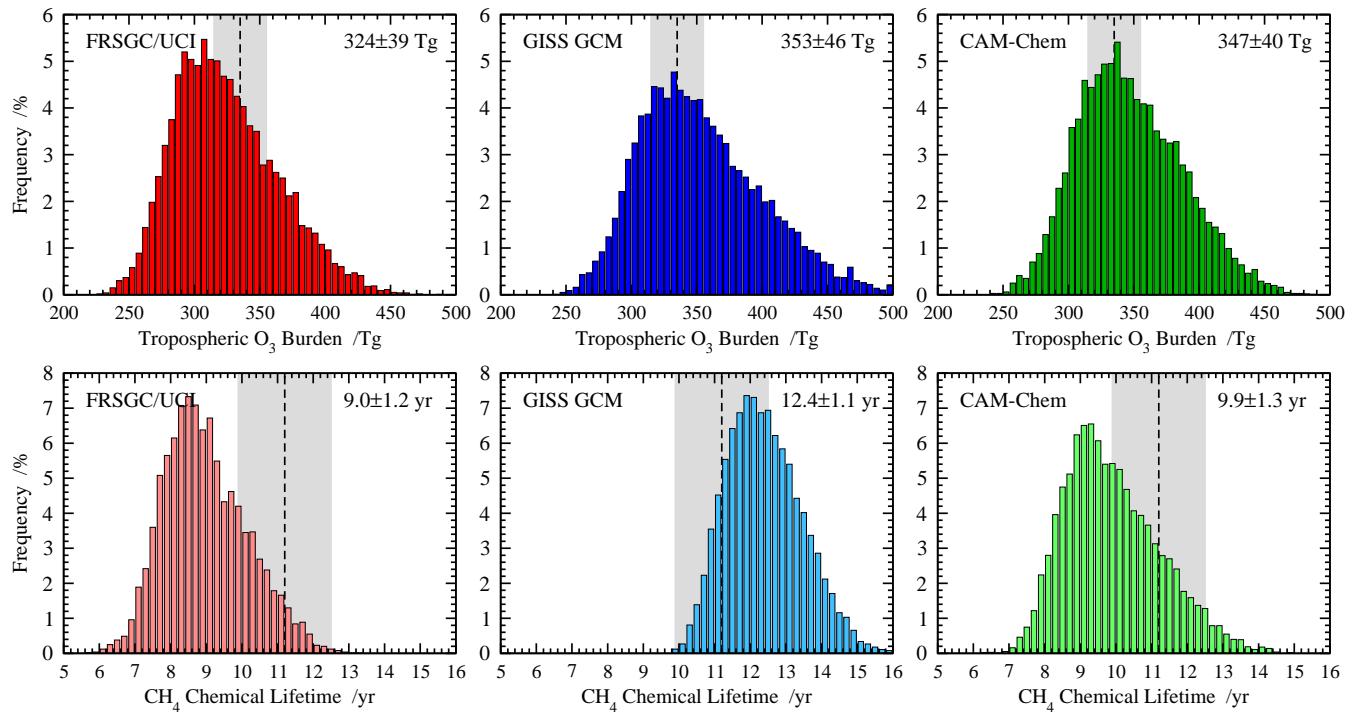


Figure S4. Probability distributions for the global annual mean tropospheric O₃ burden (top row) and tropospheric chemical lifetime of CH₄ (bottom row) for each model over the full sensitivity range shown in Table S1. The mean and standard deviation over 10,000 realizations are shown on the upper right of each panel, and observation-based estimates of O₃ burden and CH₄ lifetime are shown shaded.

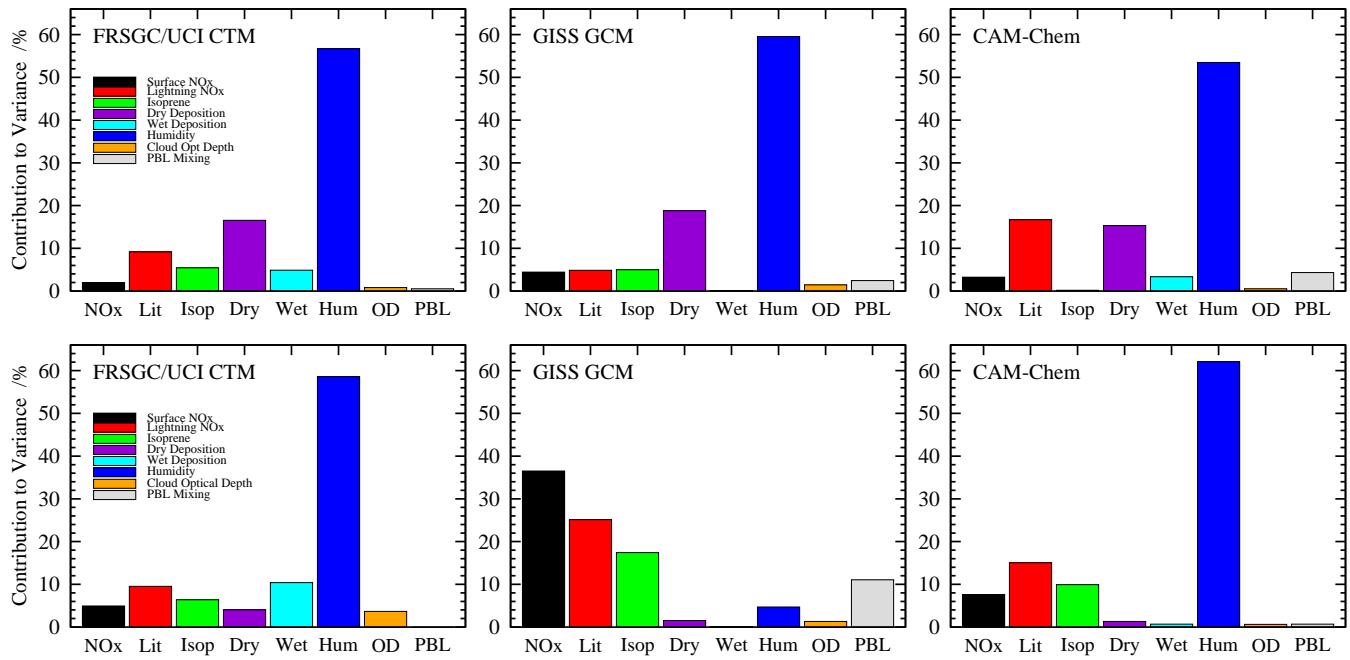


Figure S5. Contributions of each variable to the total variance in the simulated tropospheric O₃ burden (top row) and annual mean CH₄ chemical lifetime (bottom row) in each model over the full sensitivity range shown in Table S1.