

Supplementary Information

Volcanic forcing of high-latitude Northern Hemisphere eruptions

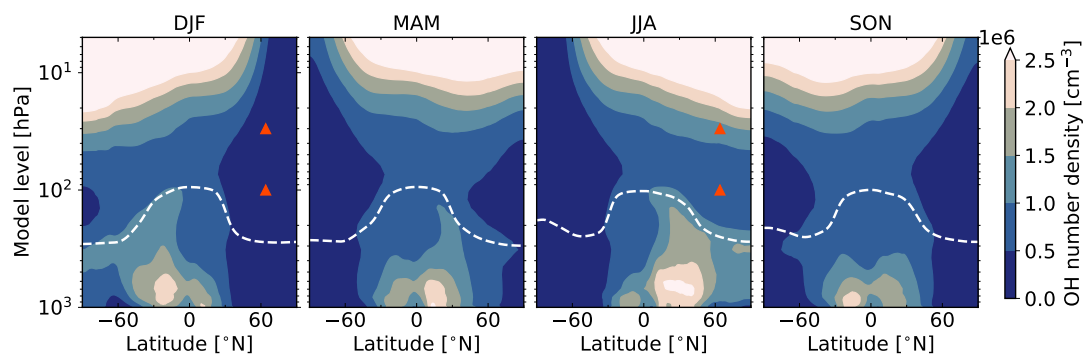
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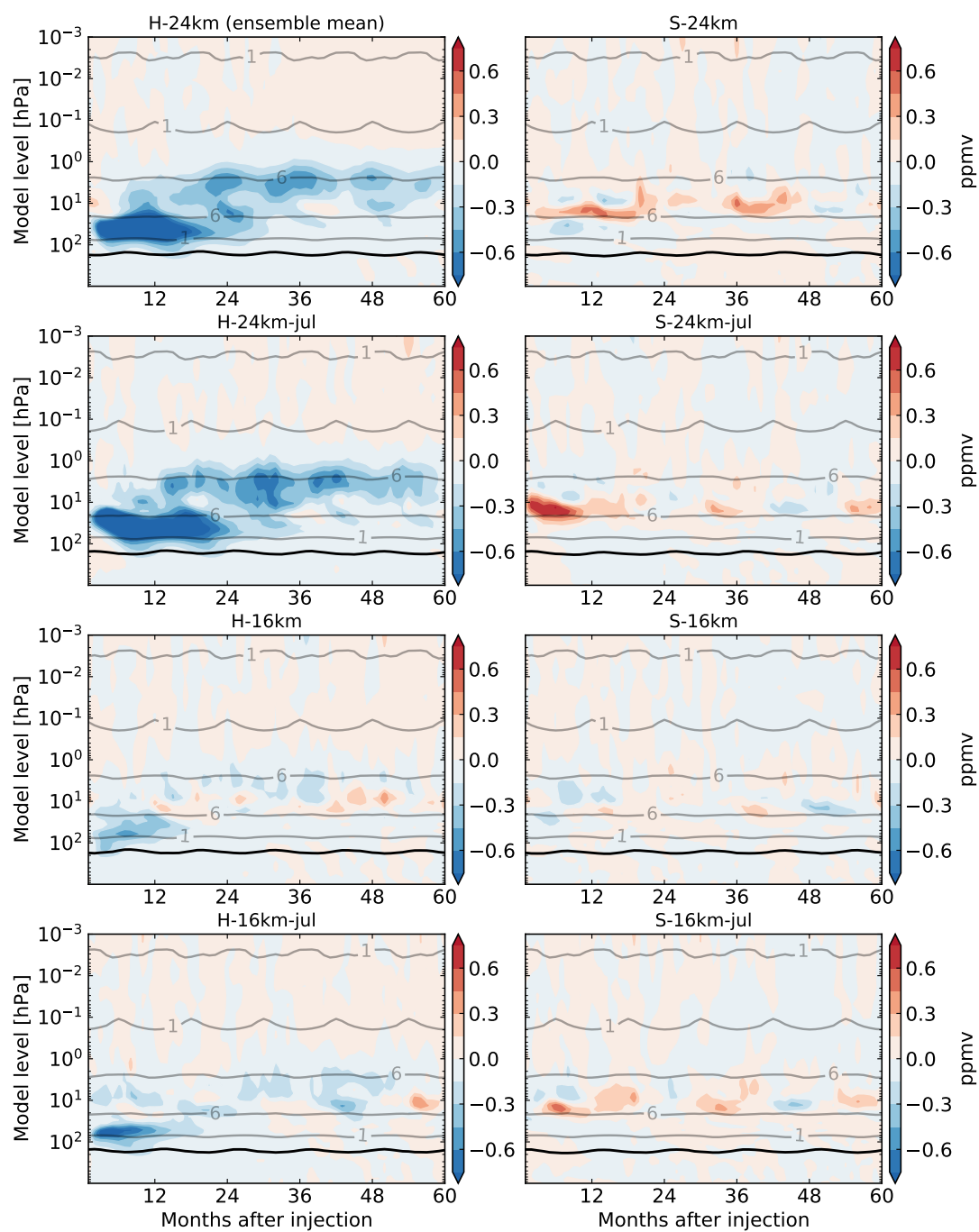
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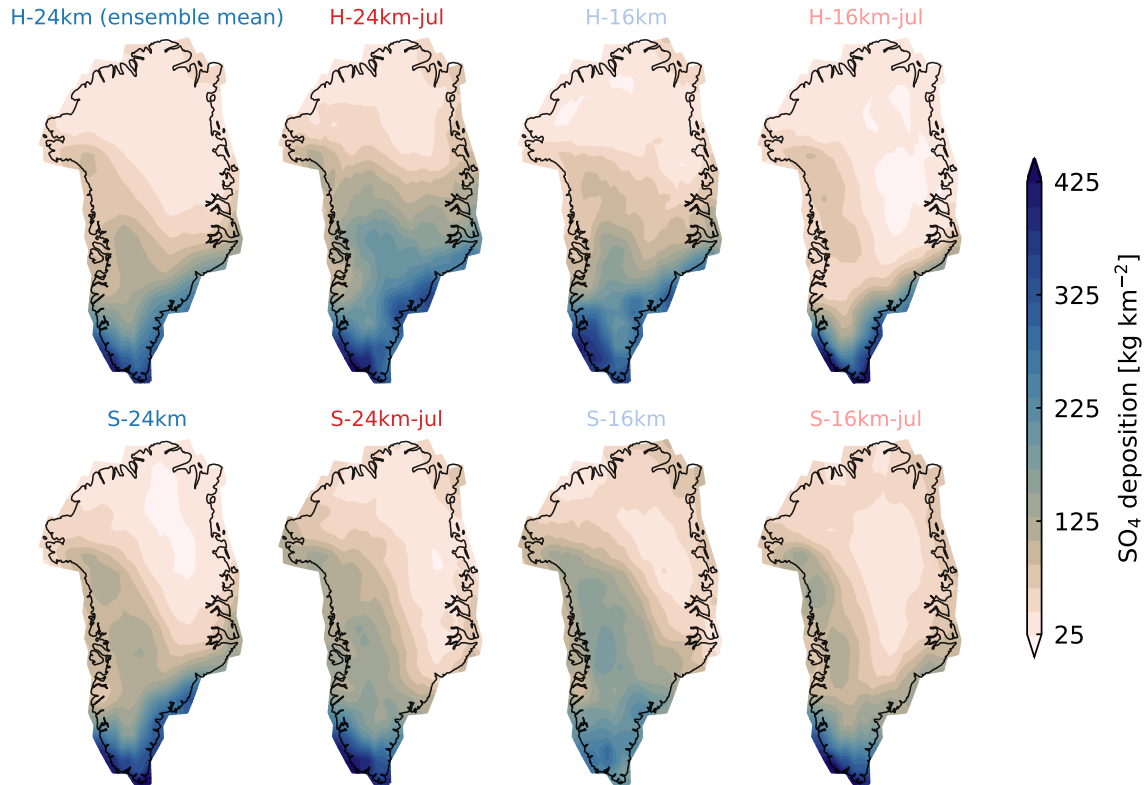
Supplementary Figures



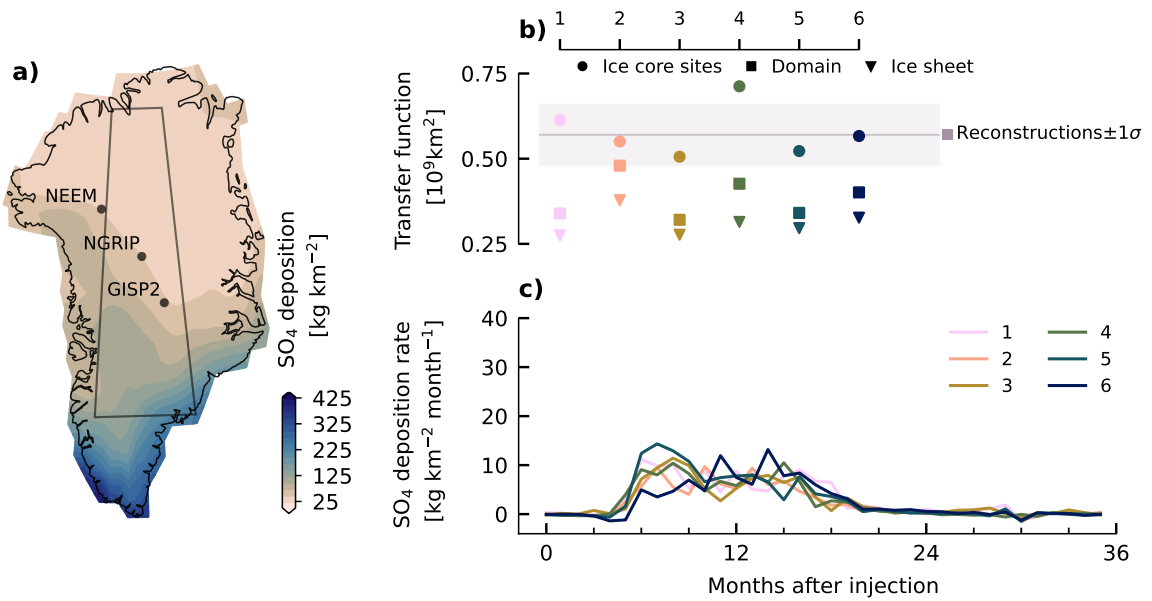
Supplementary Figure 1: Seasonal OH climatology in CESM2-WACCM6. The triangles indicate the level and latitude of the volcanic injections specified in Table 1. The white dashed line indicates the modelled climatological lapse rate tropopause.



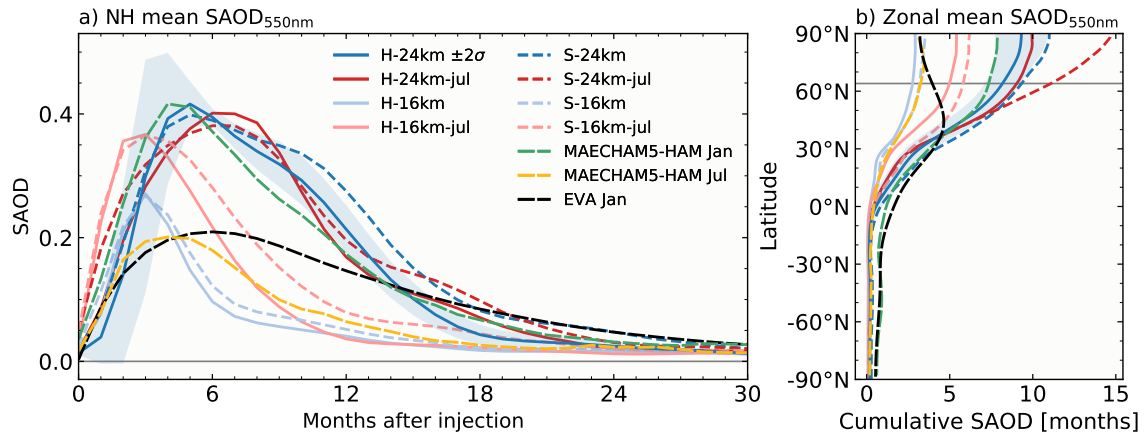
Supplementary Figure 2: Northern Hemisphere mean O₃ change in the model experiments. The grey lines show the model's Northern Hemisphere mean O₃ climatology in units of parts per million by volume (ppmv) and the black line indicates the model's Northern Hemisphere mean climatological lapse rate tropopause.



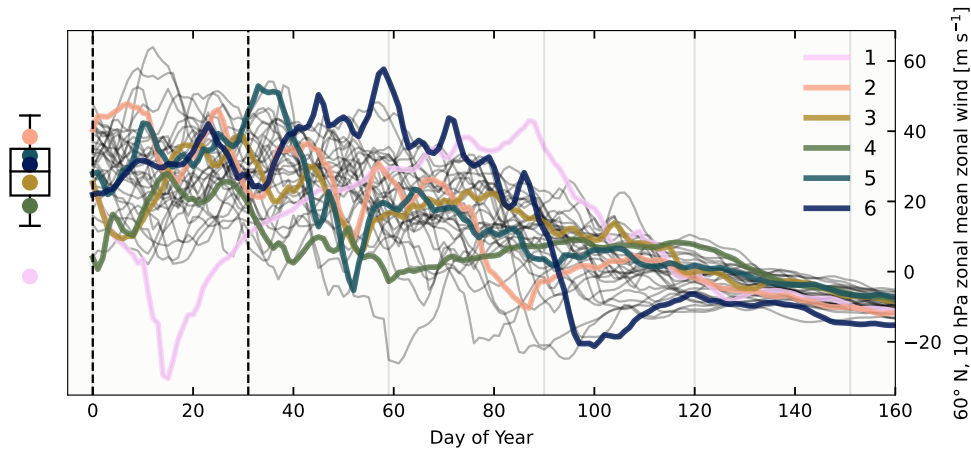
Supplementary Figure 3: Modelled GrIS deposition as in Figure 4a but for all model experiments.



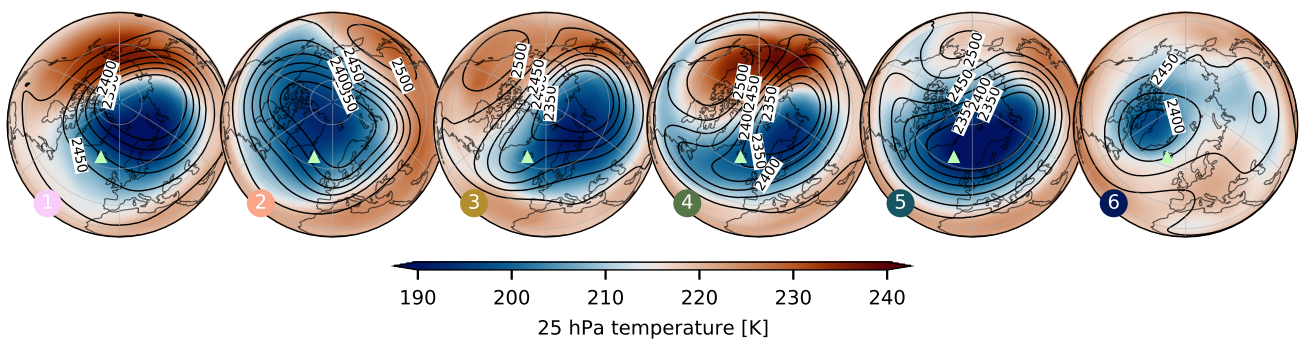
Supplementary Figure 4: Modelled Greenland ice sheet (GrIS) SO₄ deposition and associated transfer functions as in Figure 4 but for the ensemble members of the baseline experiment.



Supplementary Figure 5: Comparison of modelled SAOD response. a) Northern Hemisphere (0° to 90° N) mean SAOD at 550 nm as modelled by CESM2-WACCM6, along with the SAOD modelled by MAECHAM5-HAM and the Easy Volcanic Forcing generator (EVA) for comparable volcanic injections. b) Meridional forcing profiles expressed by the cumulative anomaly of zonal mean SAOD at 550 nm. Shading represents two standard deviations of the H-24km ensemble.



Supplementary Figure 6: Polar vortex initial condition. The 10 hPa, 60° N zonal mean zonal wind is depicted for all years in the control run (shown in grey), with the selected years highlighted. The left-hand side boxplot illustrates the distribution of the January mean wind across all years (center line, median; box limits, lower and upper quartiles; whiskers, 1.5 times the interquartile range, outliers not shown), the points indicating the positions of the selected years within the distribution. The dashed lines delineate January in the time series.



Supplementary Figure 7: Polar vortex initial condition at the approximate injection level (25 hPa) in the six baseline experiment ensemble members. The figure displays the January 1 daily mean 25 hPa temperature (colour) and geopotential height (contours) in geopotential decametres (gpdm) at 25 gpdm contour intervals.