

Supplementary Material

Multi-model assessment of impacts of the 2022 Hunga eruption on stratospheric ozone and its chemical and dynamical drivers

Ewa M. Bednarz^{1,2}, Valentina Aquila³, Amy H. Butler², Peter Colarco^{4,5}, Eric Fleming^{4,6}, Freja F. Østerstrøm^{7,8}, David Plummer⁹, Ilaria Quaglia¹⁰, William Randel¹⁰, Michelle L. Santee¹¹, Takashi Sekiya¹², Simone Tilmes¹⁰, Xinyue Wang¹³, Shingo Watanabe^{12,14}, Wandu Yu¹⁵, Jun Zhang¹⁰, Yunqian Zhu^{1,2}, Zhihong Zhuo¹⁶

Contents:

Figures S1-S10.

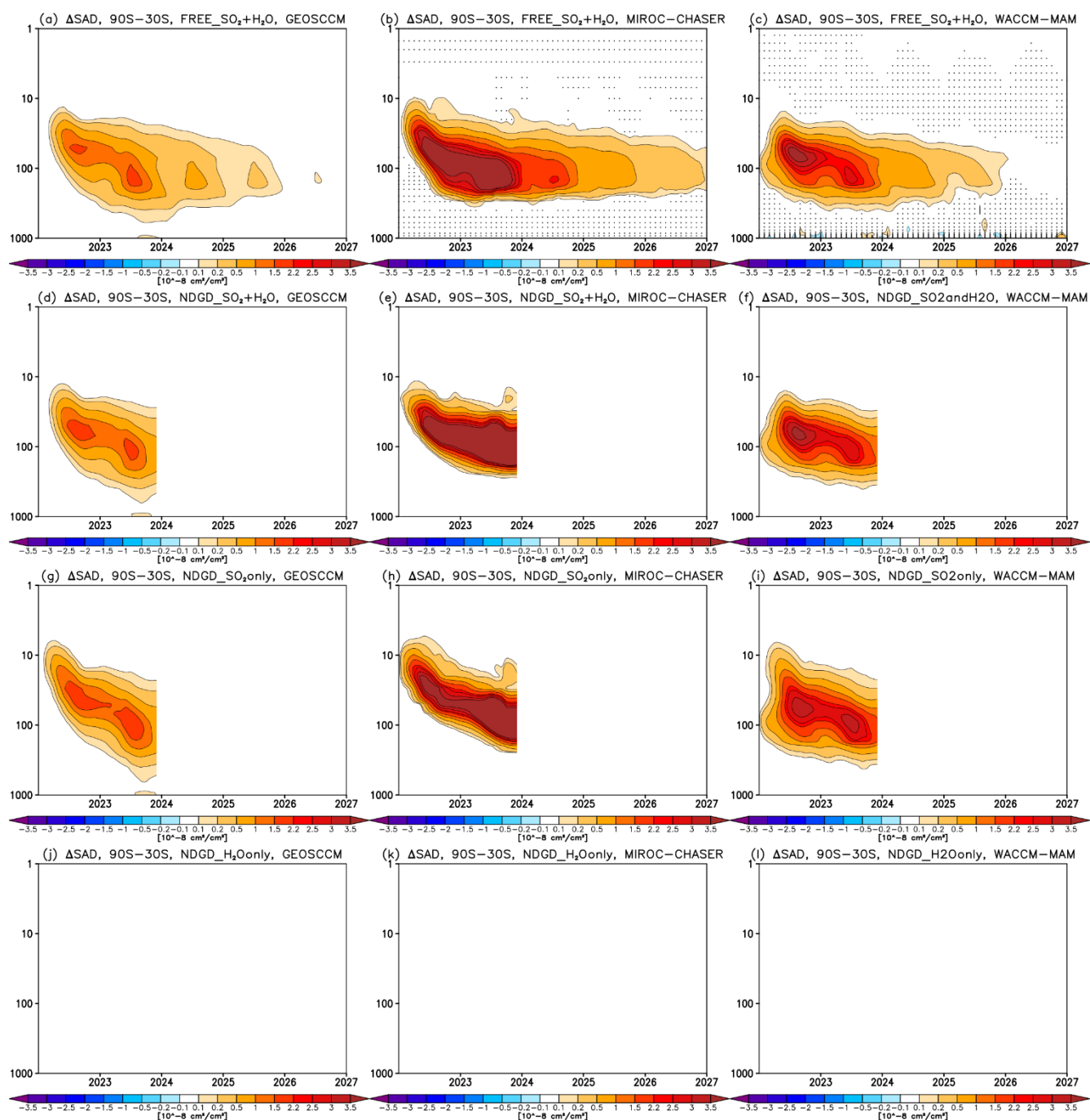


Figure S1. Pressure vs time changes (perturbed minus control) in the SH extratropical (90°S-30°S) aerosol SAD simulated in GEOSCCM (left), MIROC-CHASER (middle) and WACCM-MAM (right). Row 1 is for the free running experiment with simultaneous injection of SO₂ and H₂O. Rows 2-4 are for the nudged simulations, either with SO₂+H₂O injection (row 2), SO₂-only injection (row 3) or H₂O-only injection (row 4). Stippling in row 1 marks regions where the response is not statistically significant (with the response taken as a significant if it exceeds ± 2 standard errors in the difference in means).

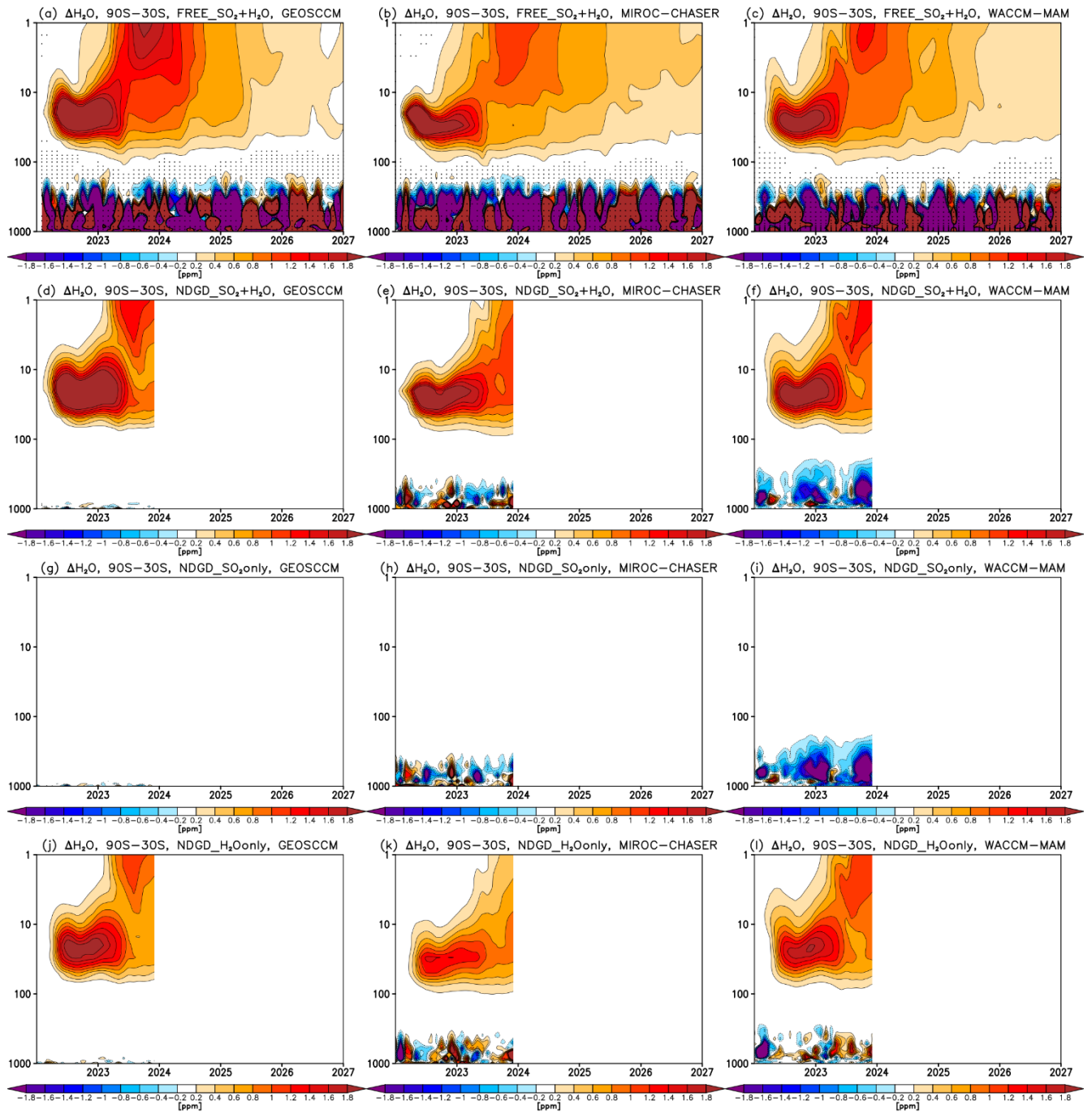


Figure S2. As in Fig. S1 but for the changes in water vapor.

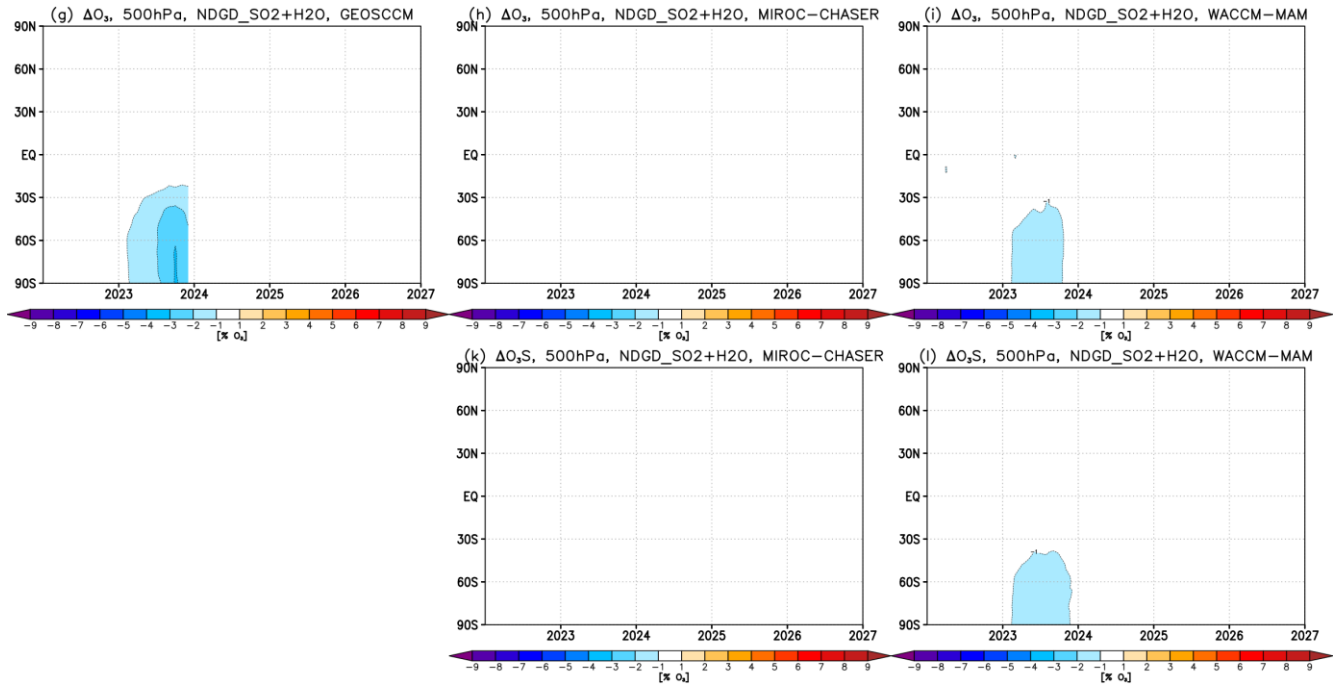


Figure S3. As in Fig. 4 of the main manuscript, but for the changes simulated in the corresponding nudged simulations with the simultaneous injection of SO_2 and H_2O .

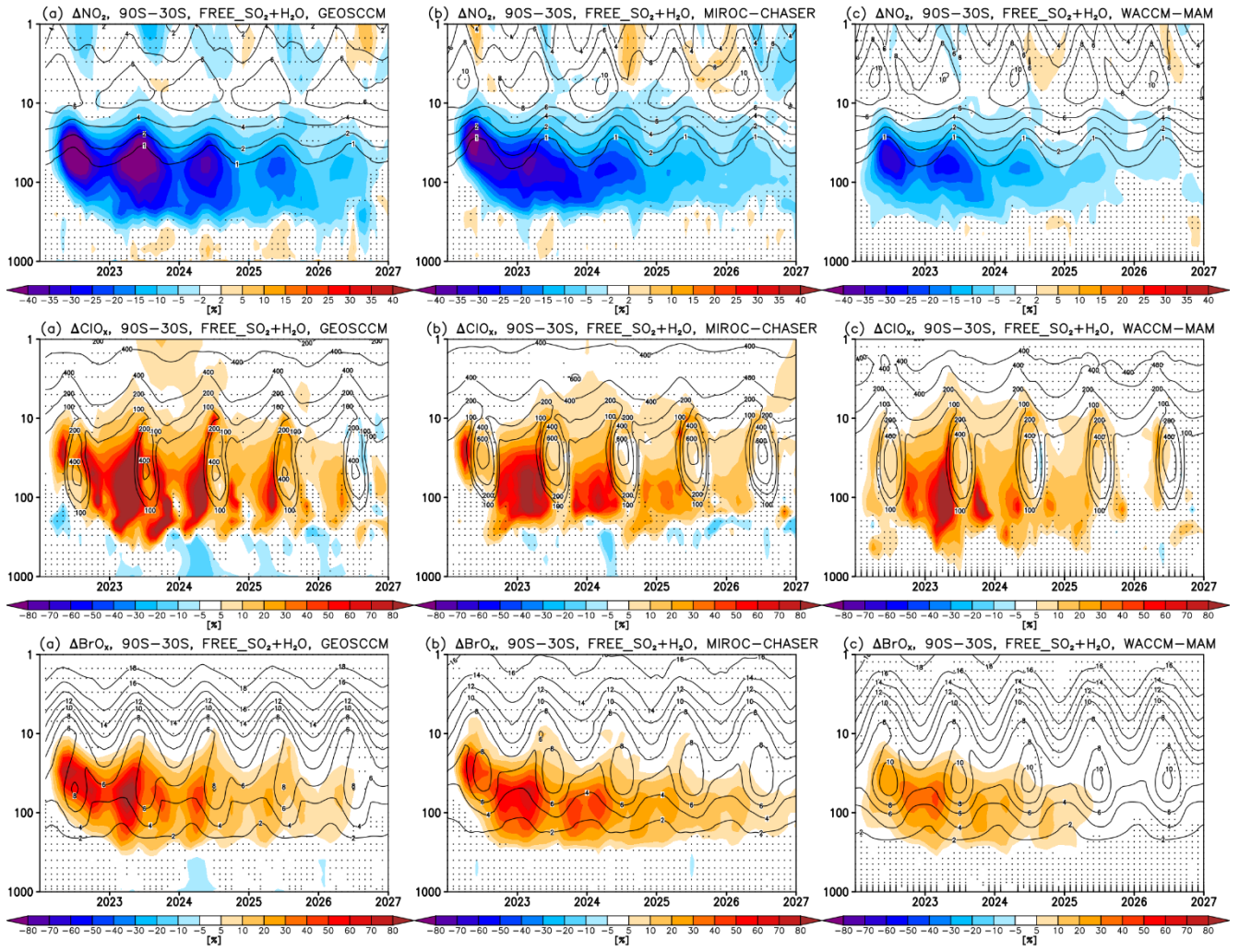


Figure S4. As in Fig. 6 of the main manuscript but for the changes (shading) expressed as percentage difference relative to the values in the control simulations (contours).

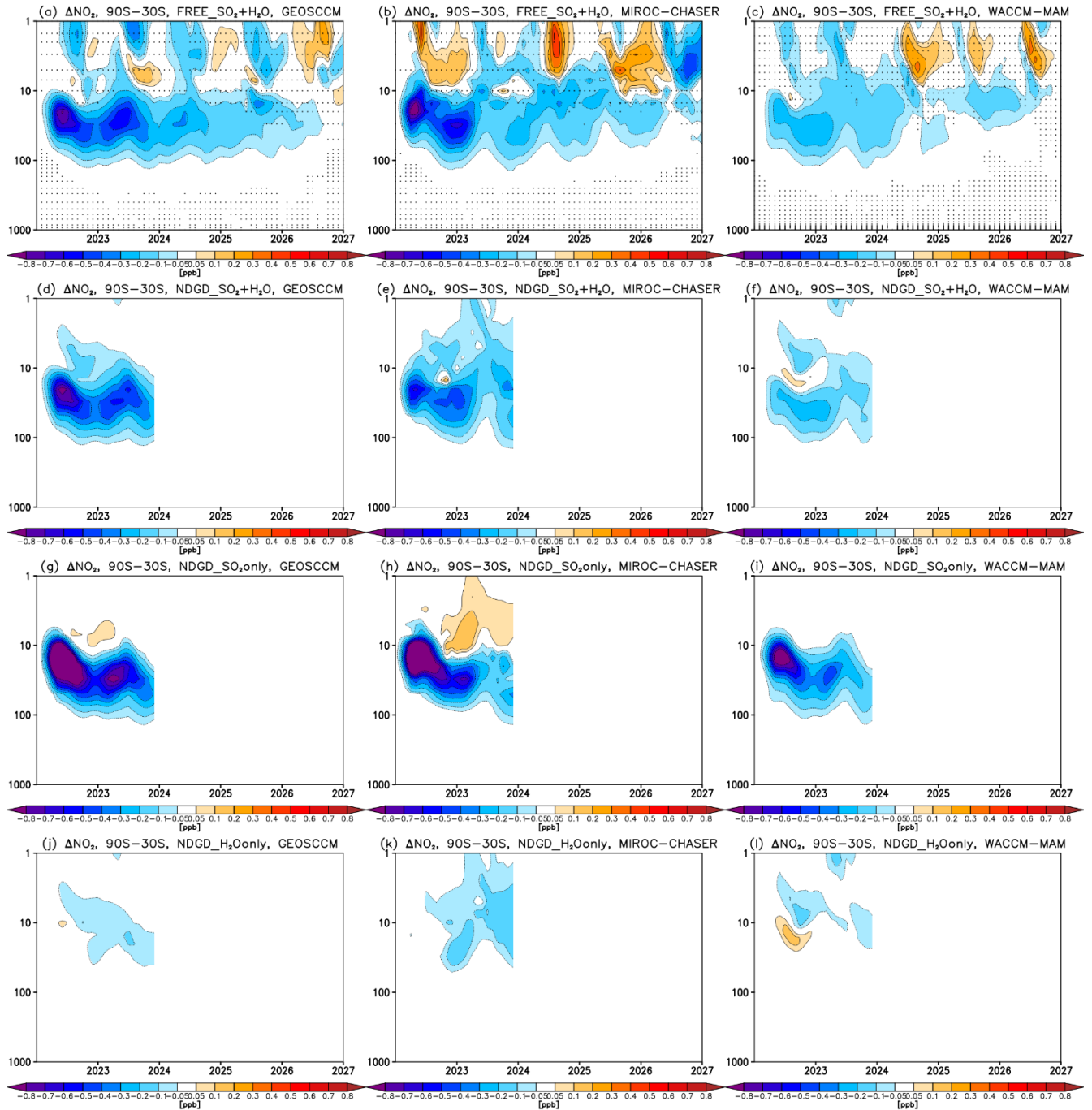


Figure S5. Pressure vs time changes (perturbed minus control) in the 90°S–30°S averaged NO₂ mixing ratios simulated in GEOSCCM (left), MIROC-CHASER (middle) and WACCM-MAM (right). Row 1 is for the free running experiment with simultaneous injection of SO₂ and H₂O. Rows 2–4 are for the nudged simulations, either with SO₂+H₂O injection (row 2), SO₂-only injection (row 3) or H₂O-only injection (row 4). Stippling in row 1 marks regions where the response is not statistically significant (defined as in Fig. S1).

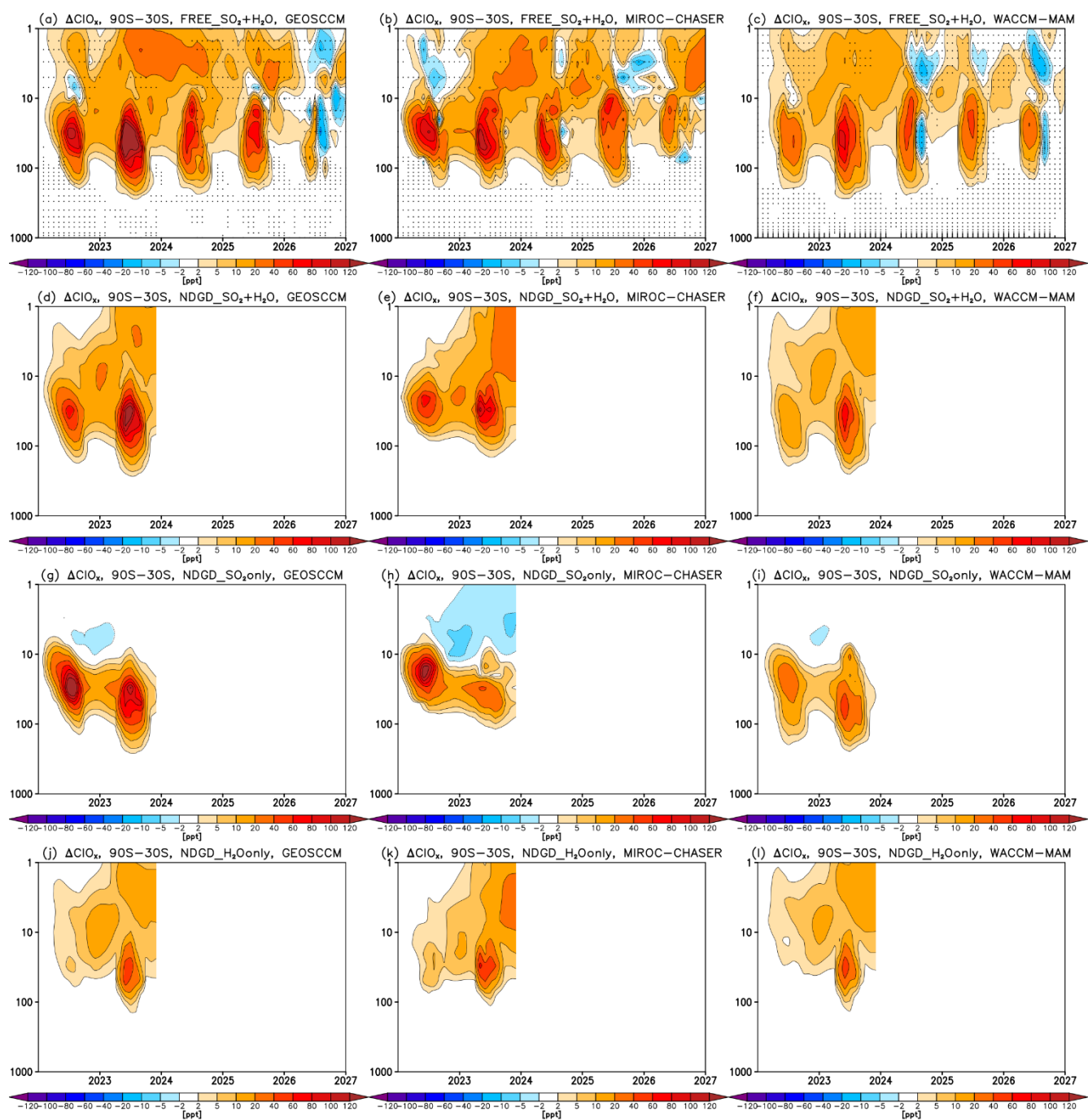


Figure S6. As in Fig. S5 but for changes in ClOx mixing ratios.

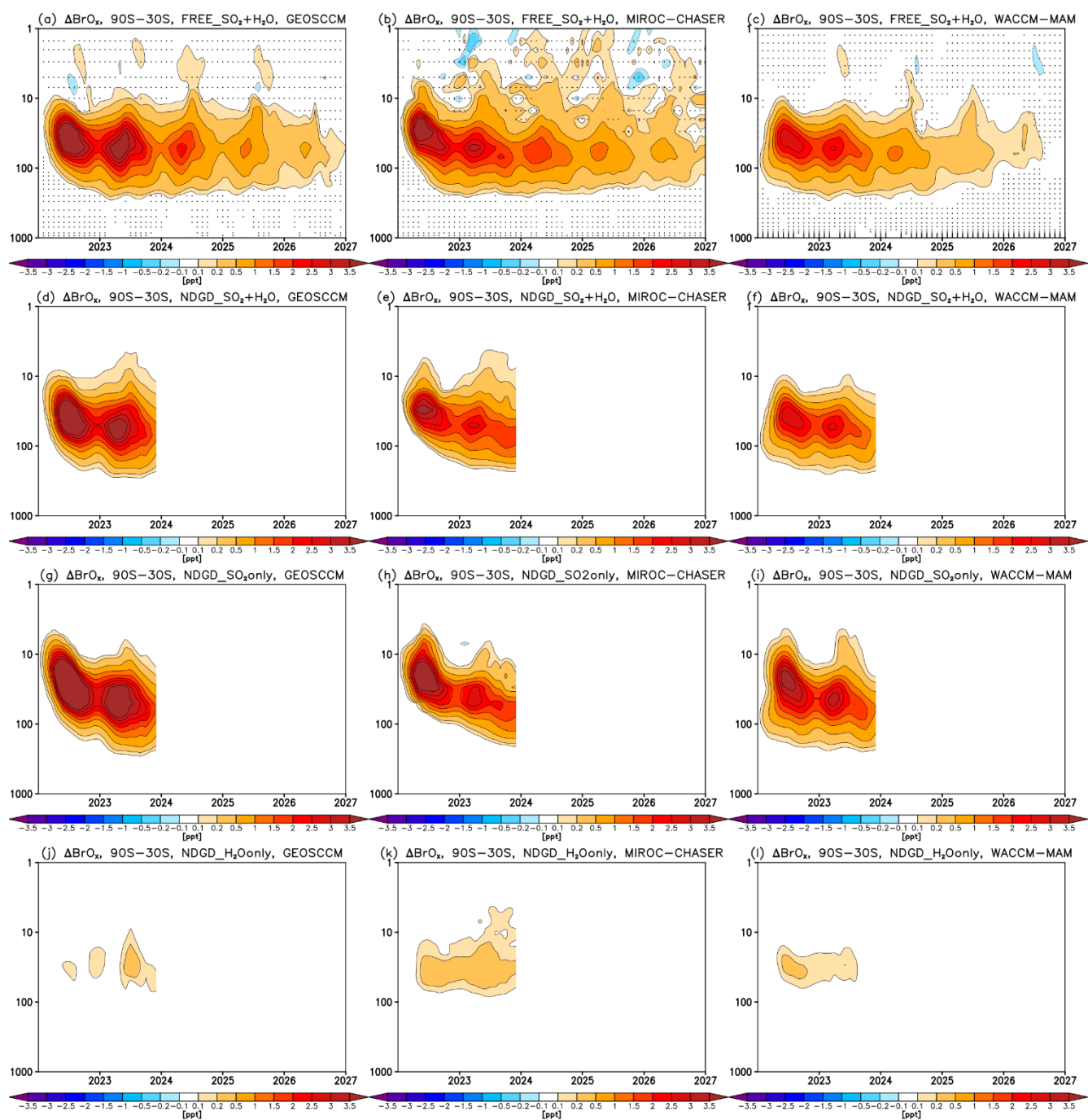


Figure S7. As in Fig. S5 but for changes in BrOx mixing ratios.

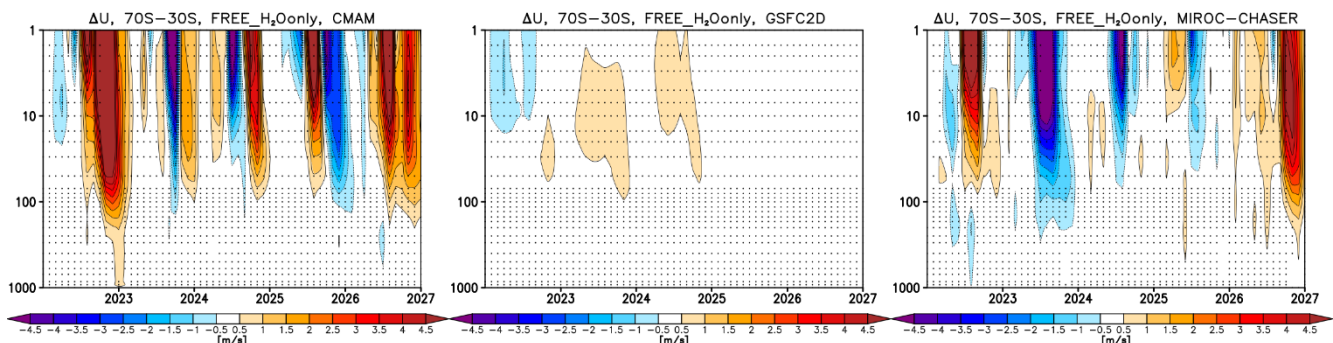


Figure S8. Pressure vs time changes (perturbed minus control) in 70°S-30°S average zonal wind simulated in the free running experiment with H₂O-only injection (FREE_H₂Oonly) in CMAM (left), GSFC2D (middle) and MIROC-CHASER (right). Stippling marks regions where the response is not statistically significant (as in Fig. 1).

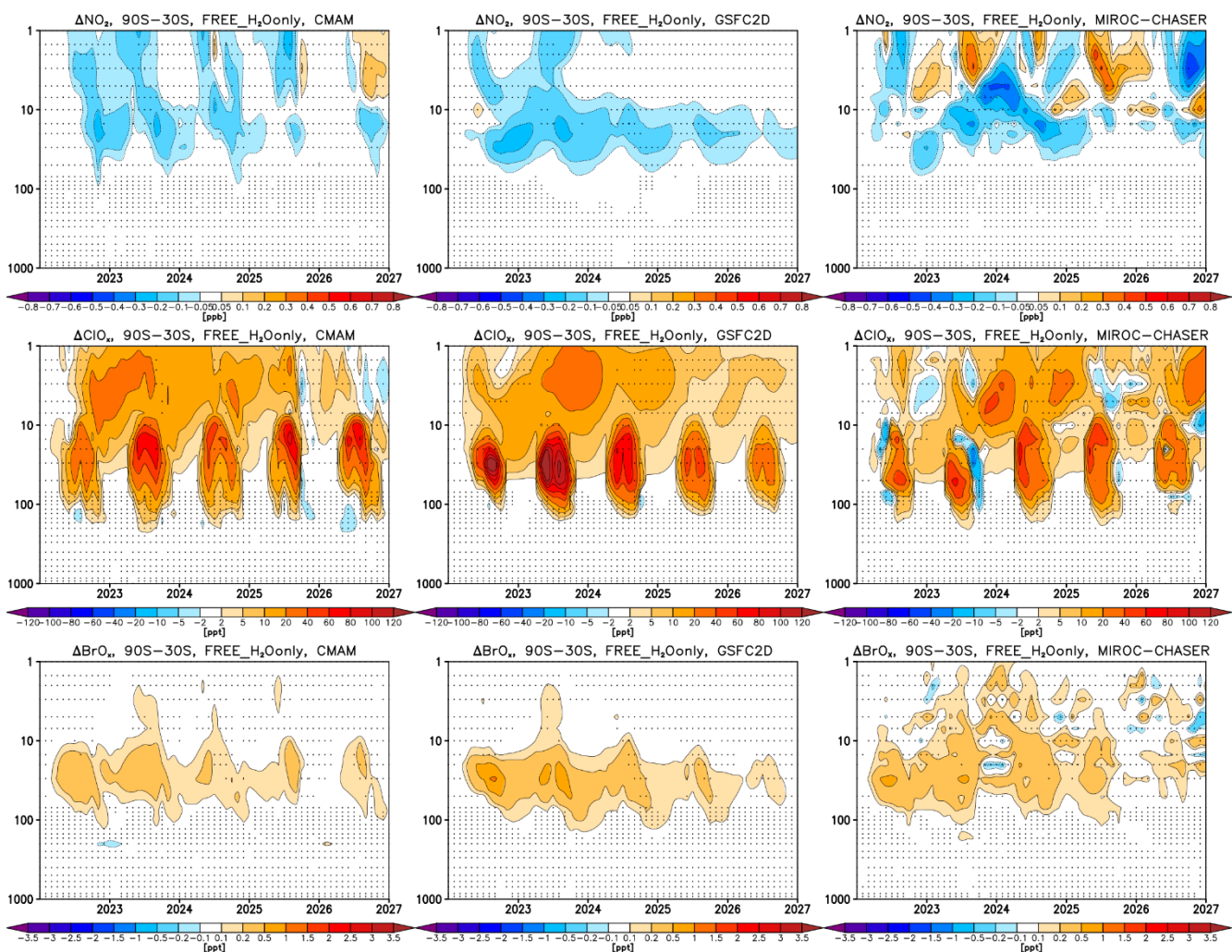


Figure S9. Pressure vs time changes (perturbed minus control) in 90°S-30°S average NO₂ (row 1), ClO_x (row 2) and BrO_x (row 3) mixing ratios simulated in the free running experiment with H₂O-only injection (FREE_H₂Oonly) in CMAM (left), GSFC2D (middle; note that the model includes Br₂ tracer which is included in BrO_x) and MIROC-CHASER (right). Stippling marks regions where the response is not statistically significant (defined as in Fig. 1).

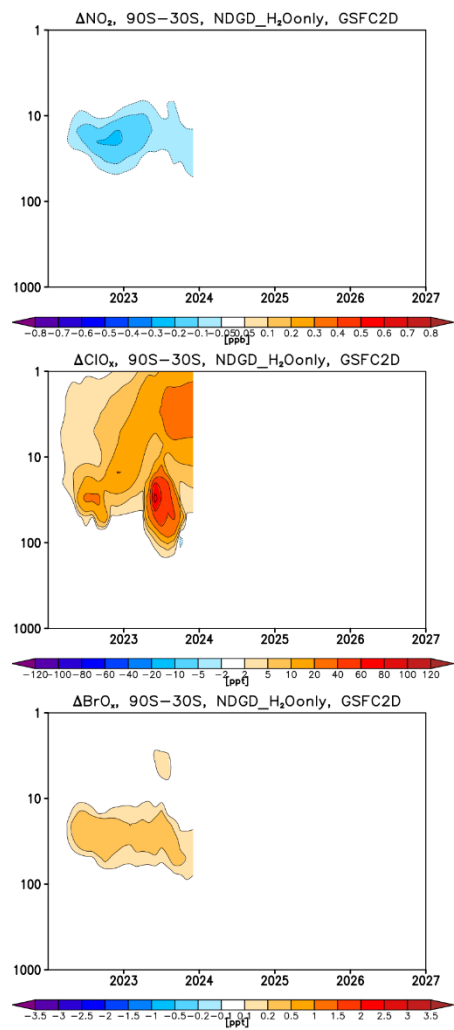


Figure S10. As in Fig. S9 but for the responses in the nudged GSFC2D simulations with H_2O -only injection.