

Supporting Information for “The role of snow in controlling halogen chemistry and boundary layer oxidation during Arctic spring: A 1D modelling case study”

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1. Figures S1 to S6

Introduction This supporting information includes 6 figures displaying the measurement data from OASIS and results from the sensitivity runs. We include model results from sensitivity tests performed based on the chlorine and bromine emission parameterizations (S1, S2 and S3). We also include the OASIS observations used to select our model time period (S4), a comparison of the calculated surface inversion height derived from two different expressions (S5) and the vertical distribution of Cl_2 and Br_2 in the PBLH sensitivity run (S6).

References

- Boylan, P., Helmig, D., Staebler, R., Turnipseed, A., Fairall, C., & Neff, W. (2014). Boundary layer dynamics during the Ocean-Atmosphere-Sea-Ice-Snow (OASIS) 2009 experiment at Barrow, AK. *Journal of Geophysical Research: Atmospheres*, *119*(5), 2261–2278. doi: 10.1002/2013JD020299
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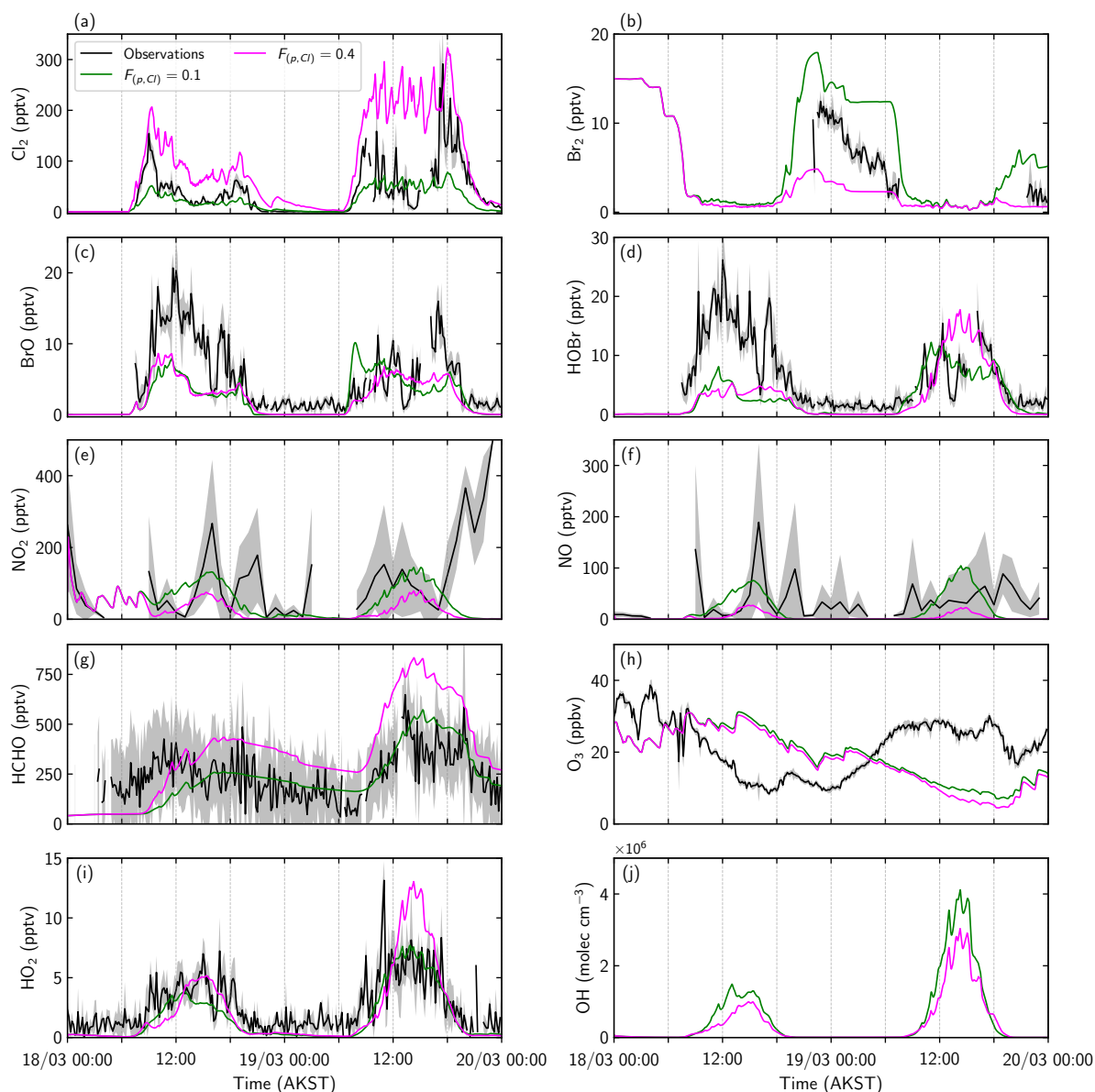


Figure S1. Model comparison of the primary chlorine emission sensitivity runs with observations at 1.5 m above ground level during 18 and 19 March 2009. Values of $F_{(p,Cl)} = 0.1$ (green) and $F_{(p,Cl)} = 0.4$ (magenta) were tested and are compared with the 10-minute averaged measurements (black). NO_x measurements are plotted as an hourly average. Grey shaded areas represent the standard deviation of the average from the instantaneous measurements.

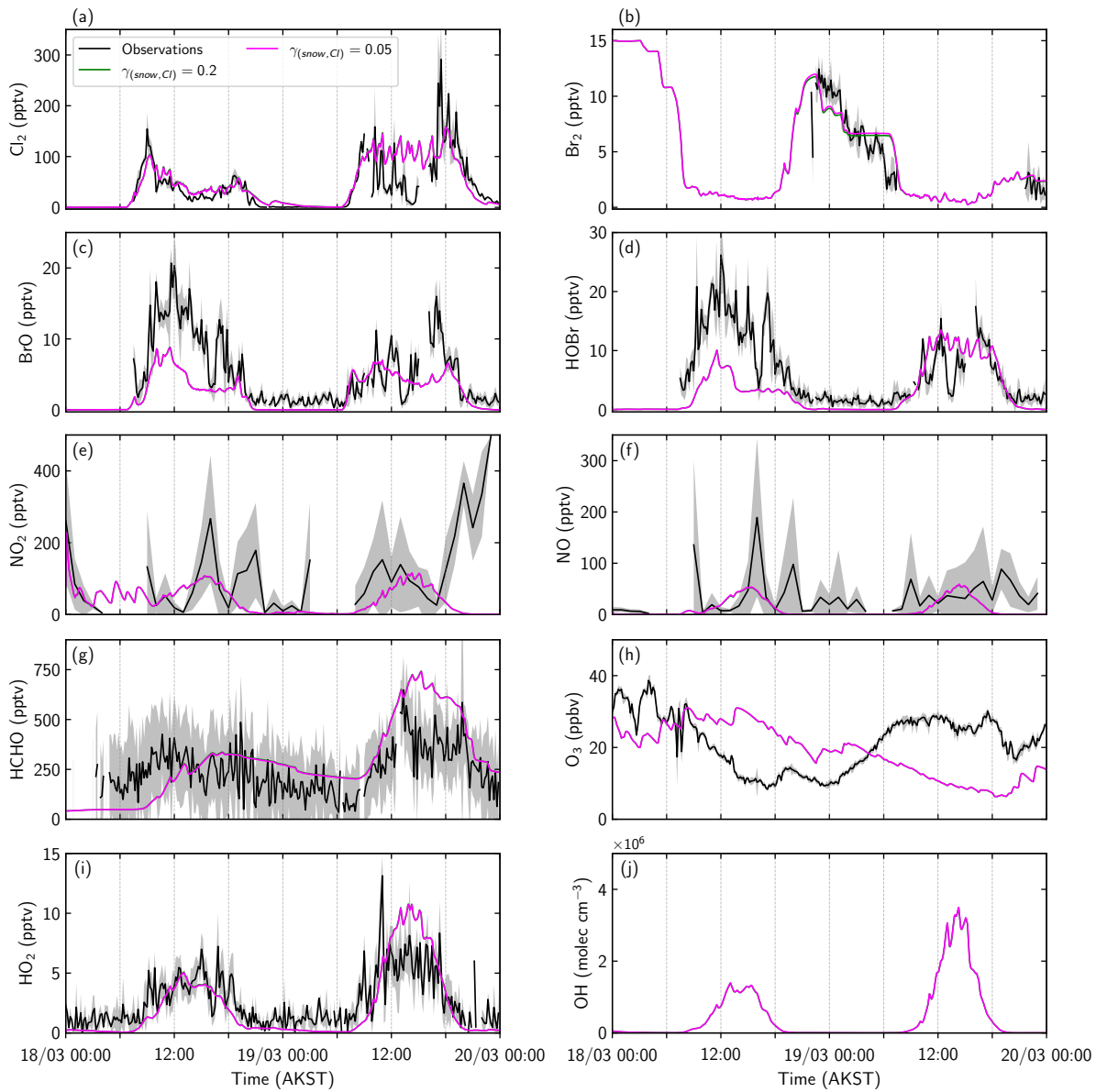


Figure S2. Model comparison of the snow-surface chlorine recycling sensitivity runs with observations at 1.5 m above ground level during 18 and 19 March 2009. Values of $\gamma_{(snow, Cl)} = 0.05$ (magenta) and $\gamma_{(snow, Cl)} = 0.2$ (green) were tested and are compared with the 10-minute averaged measurements (black). NO_x measurements are plotted as an hourly average. Grey shaded areas represent the standard deviation of the average from the instantaneous measurements.

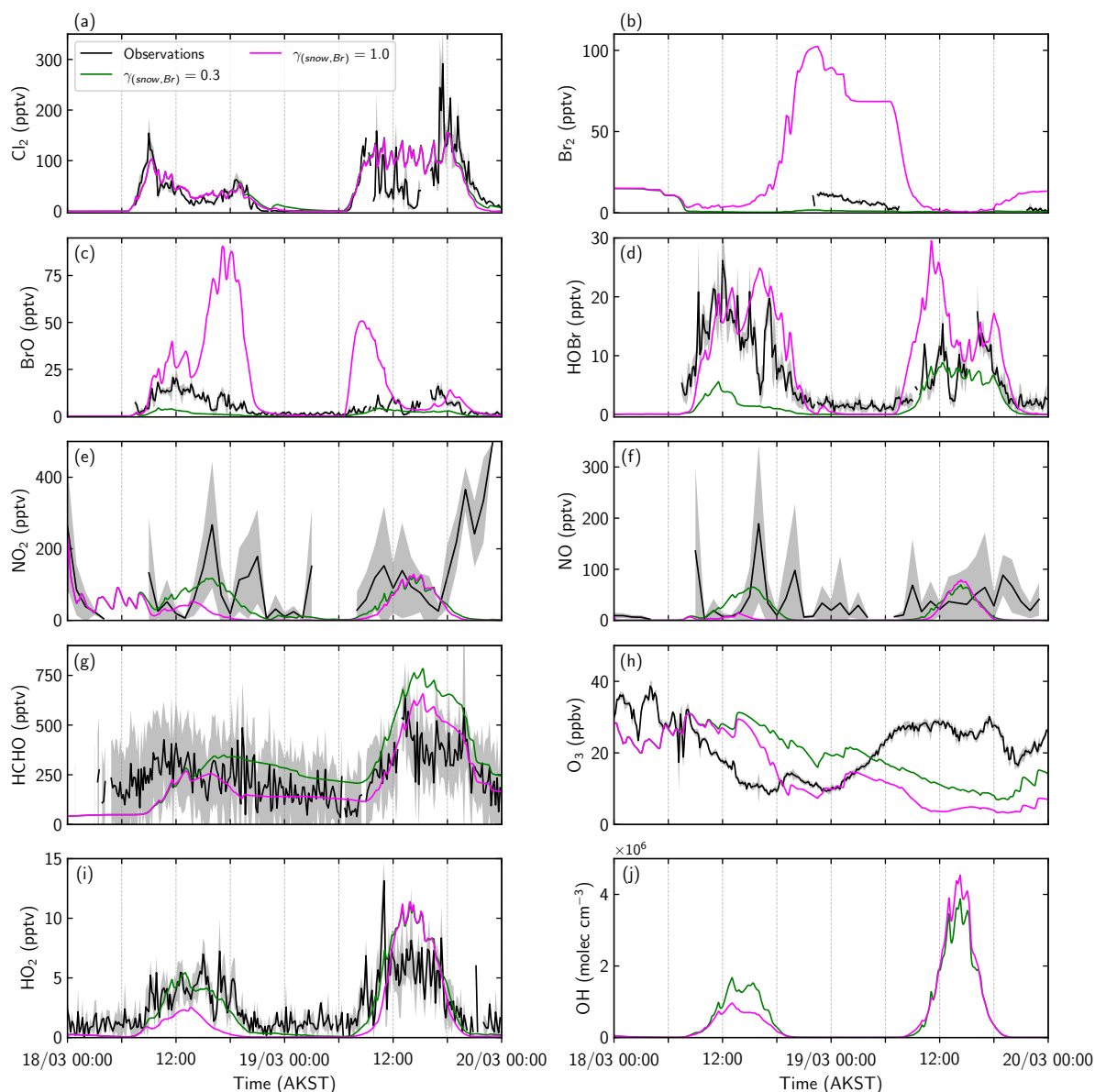
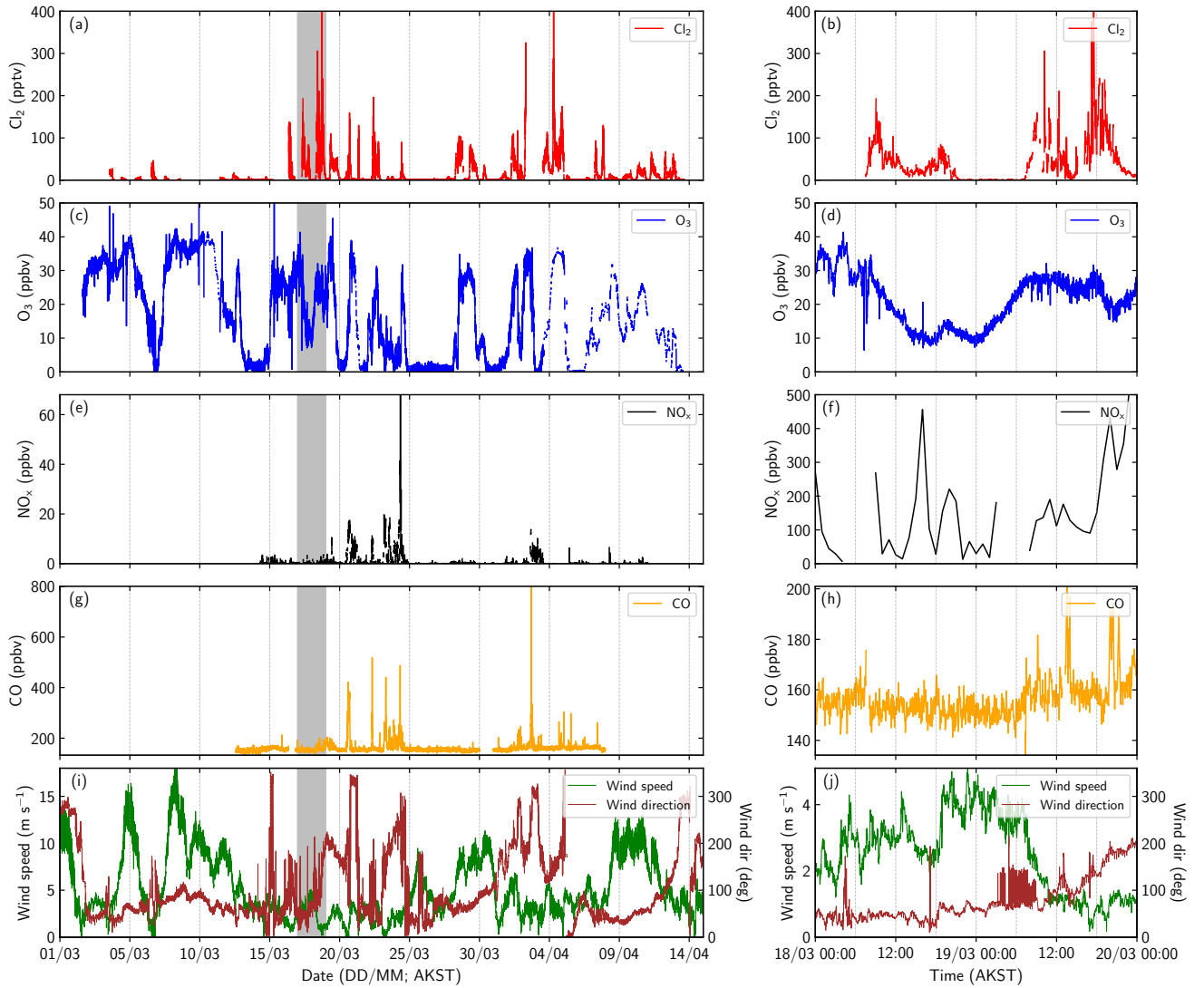


Figure S3. Model comparison of the snow-surface bromine recycling sensitivity runs with observations at 1.5 m above ground level during 18 and 19 March 2009. Values of $\gamma_{(snow, Br)} = 0.3$ (magenta) and $\gamma_{(snow, Br)} = 1.0$ (green) were tested and are compared with the 10-minute averaged measurements (black). NO_x measurements are plotted as an hourly average. Grey shaded areas represent the standard deviation of the average from the instantaneous measurements.



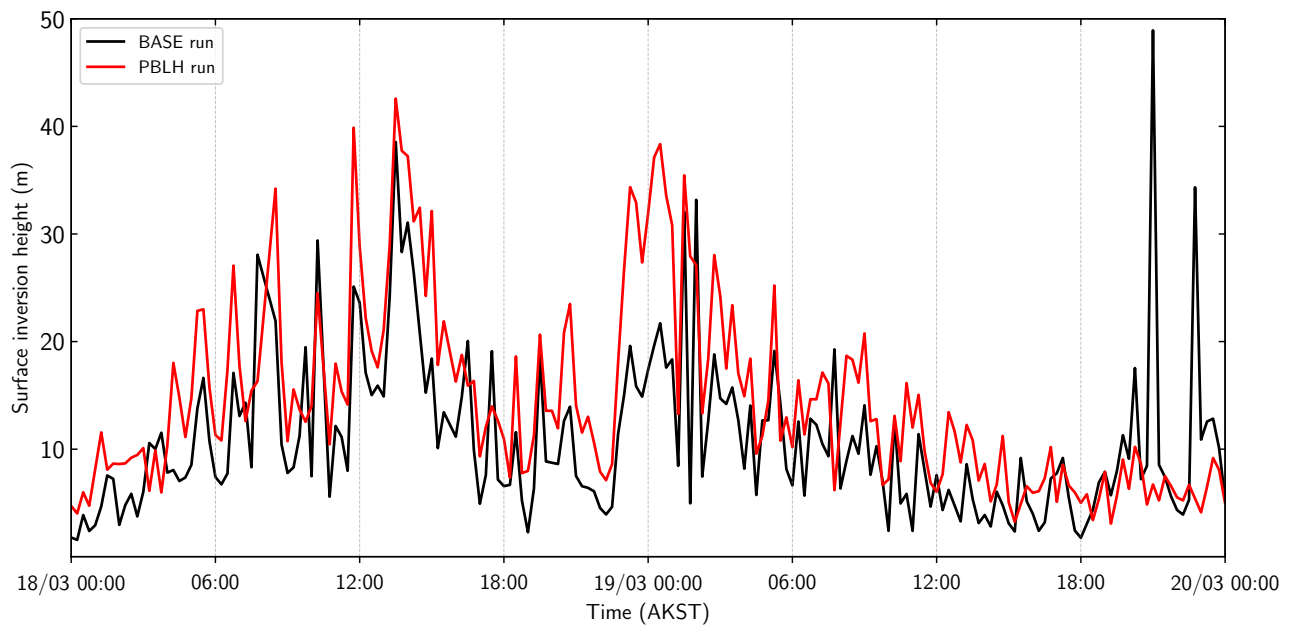


Figure S5. Surface inversion height estimates calculated from turbulent flux measurements during OASIS (Boylan et al., 2014) used in the BASE (black) and PBLH (red) runs. The expression used to calculate the surface inversion height in the BASE run is from Zilitinkevich et al. (2002) and Zilitinkevich and Baklanov (2002), and in the PBLH run (red), Pollard et al. (1973).

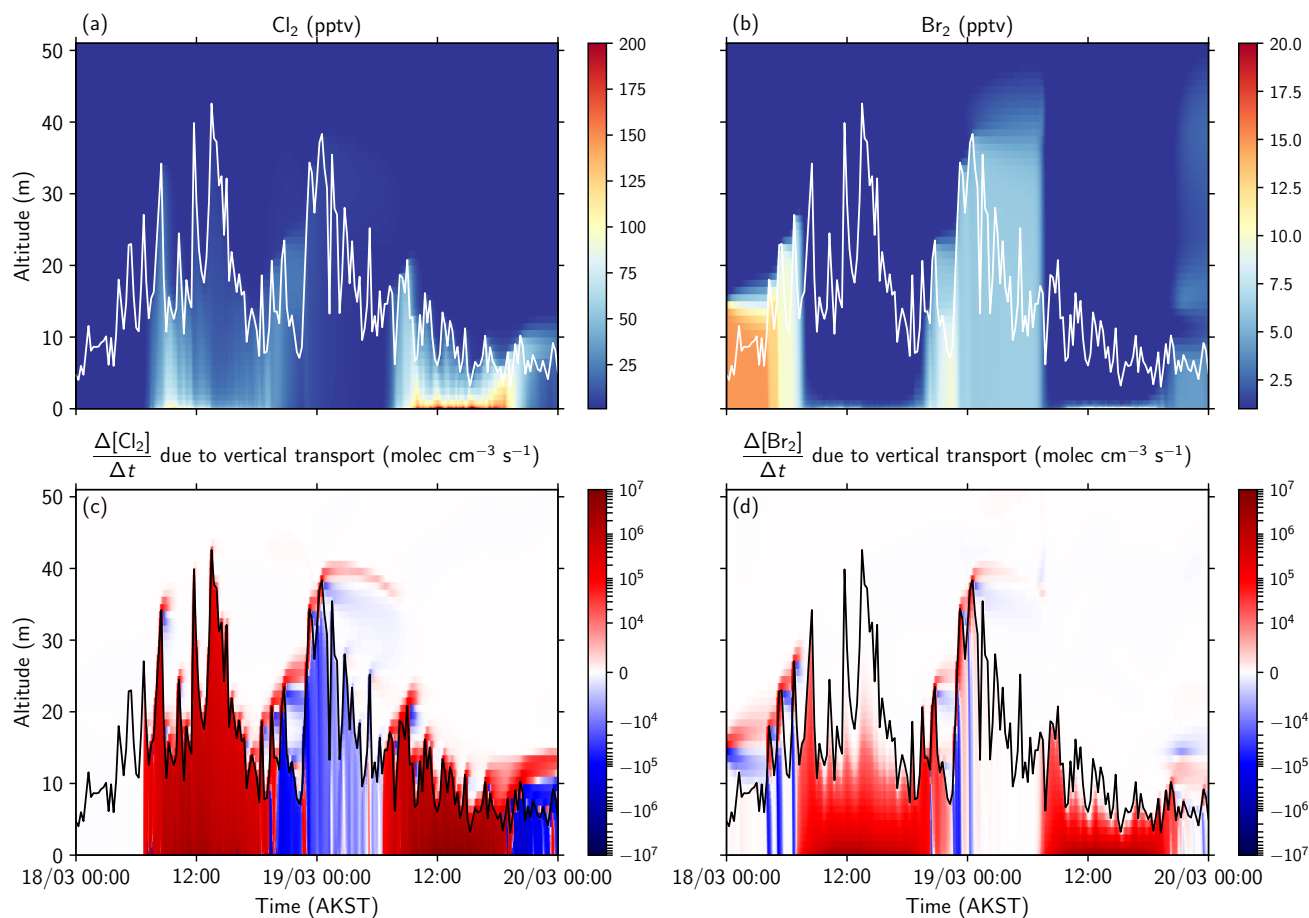


Figure S6. Modelled vertical distributions of (a) Cl_2 and (b) Br_2 during 18 and 19 March 2009 in the PBLH run. White trace indicates the model prescribed surface inversion height. Modelled concentration change of (c) Cl_2 and (d) Br_2 due to vertical transport and deposition with respect to time. Black trace indicates the prescribed surface inversion height. Positive values represent upward transport and negative values indicate downward transport.