



Supplement of

A regional modelling study of halogen chemistry within a volcanic plume of Mt Etna's Christmas 2018 eruption

Herizo Narivelo et al.

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1 Figures

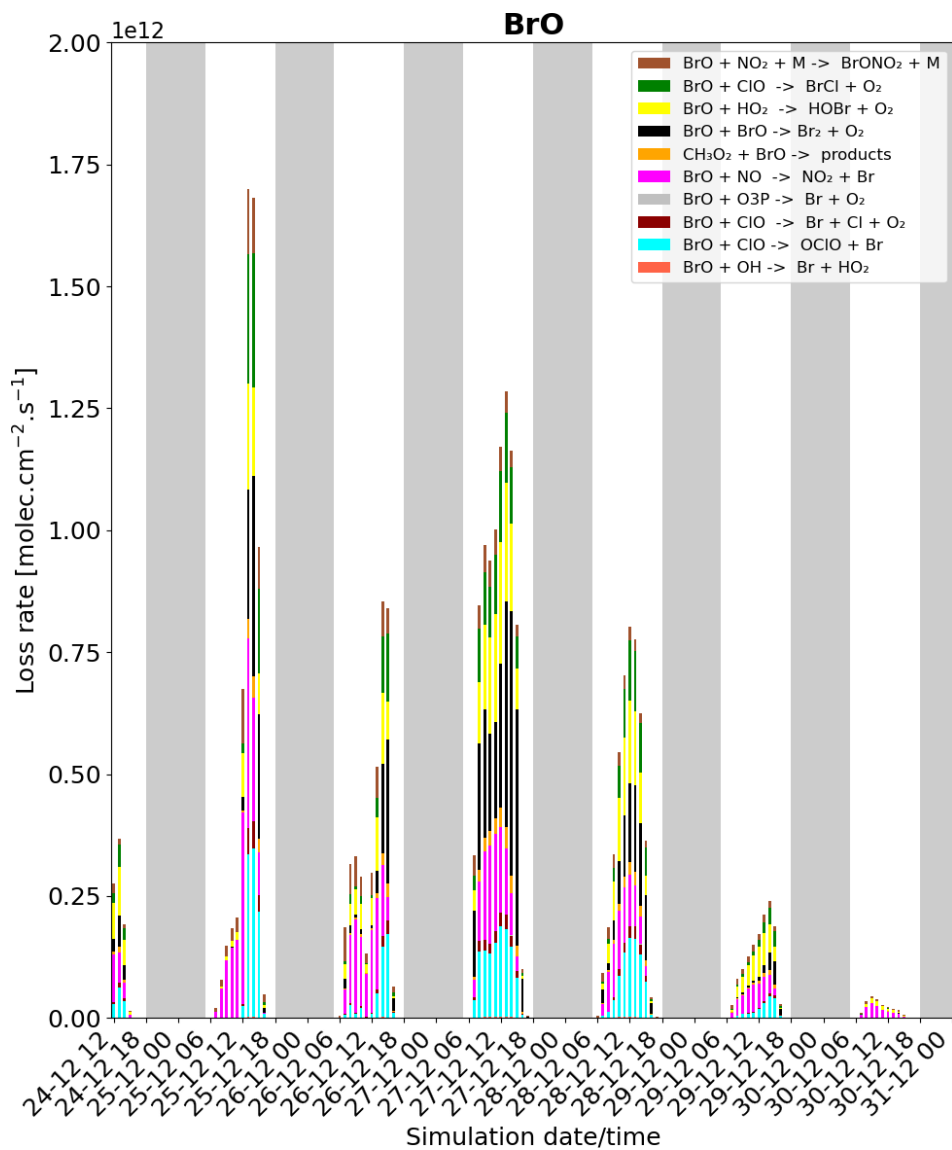


Figure S1. Time evolution of BrO loss rates in [molec.cm⁻².s⁻¹] without the photolysis of BrO and the BrO + BrO → Br + Br + O₂ reaction, from 24 December at 12:00 to 31 December 2018 at 00:00 UTC in the near volcano plume.

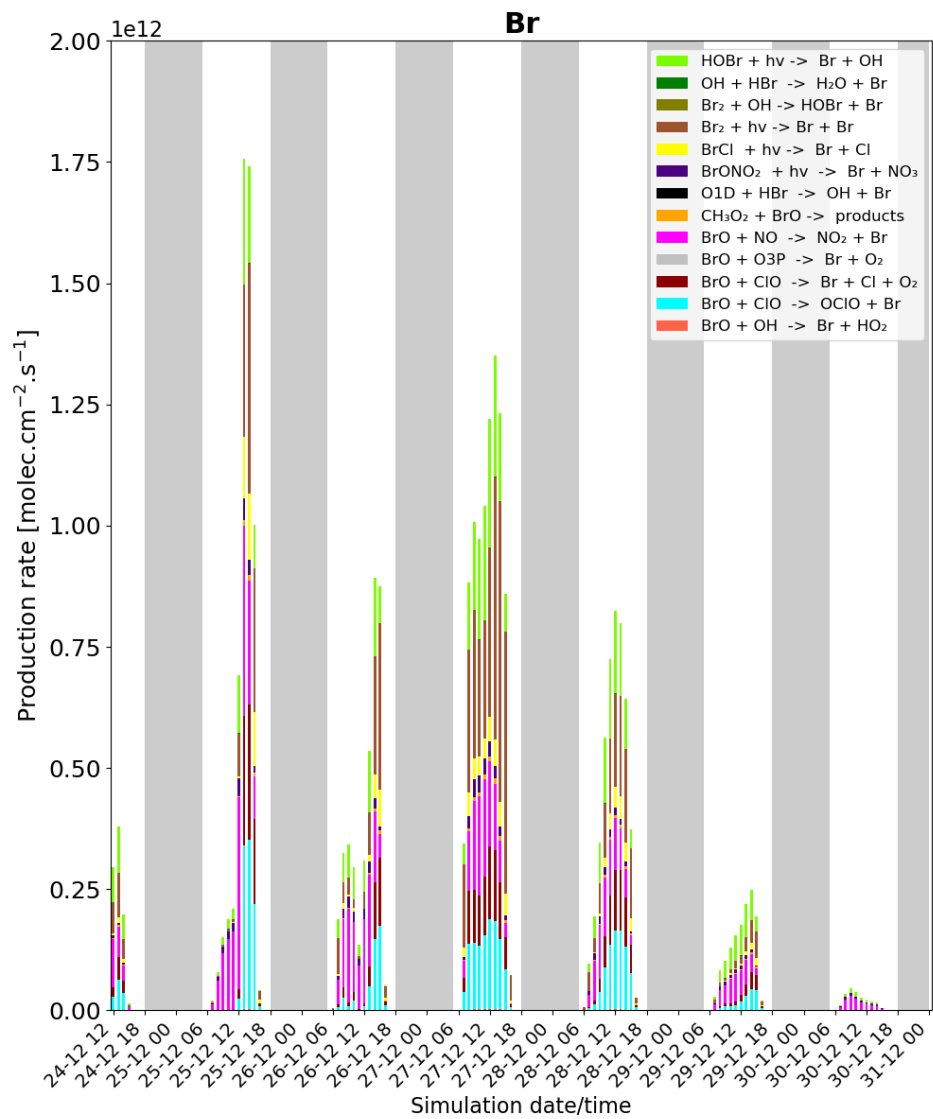


Figure S2. Time evolution of Br production rates in [molec.cm⁻².s⁻¹] without the photolysis of BrO and the BrO + BrO → Br + Br + O₂ reaction, from 24 December at 12:00 to 31 December 2018 at 00:00 UTC in the near volcano plume.

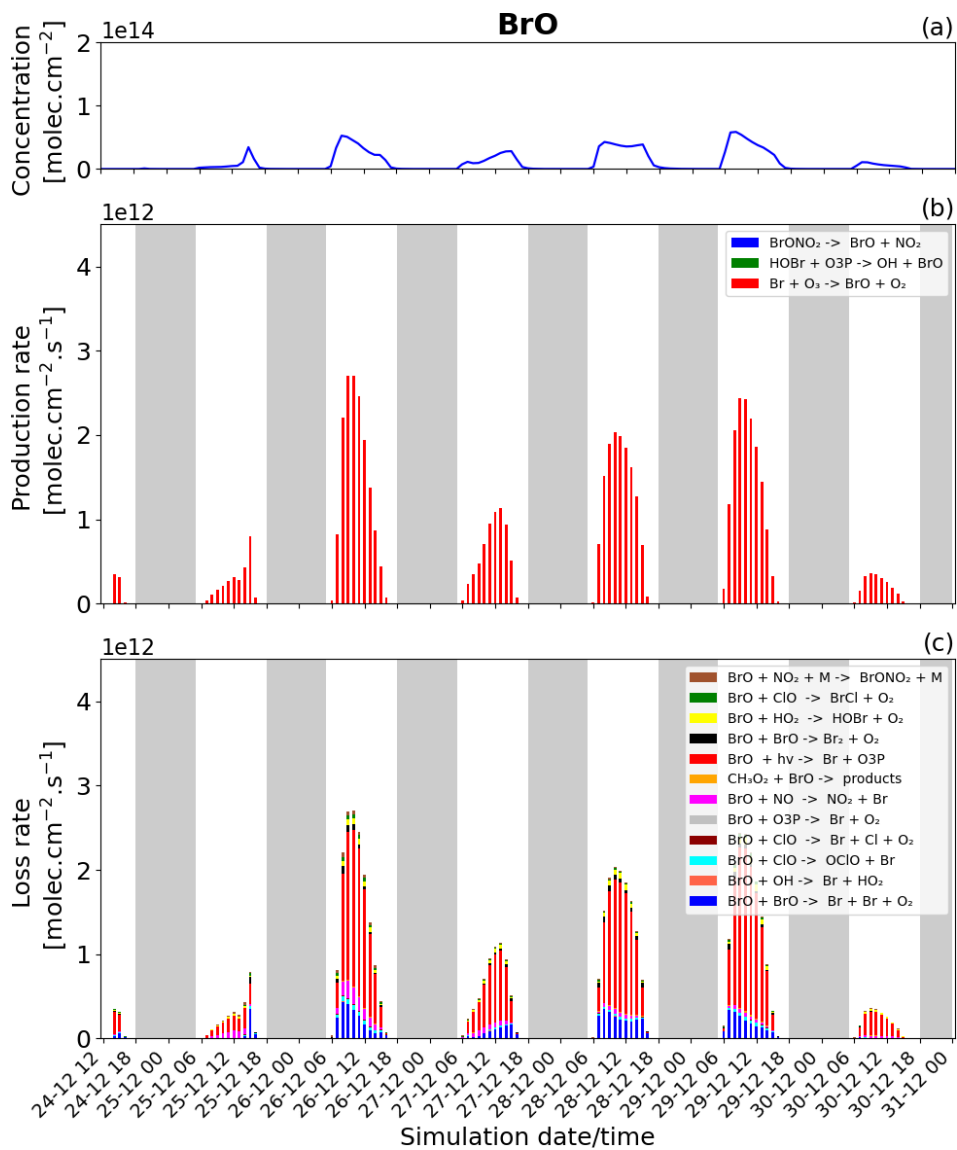


Figure S3. Time evolution of : (a) BrO column concentration in [molec.cm⁻²], (b) production rates and (c) loss rates for BrO both in [molec.cm⁻².s⁻¹] from 24 December at 14:00 to 31 December 2018 at 00:00 UTC in the young plume.

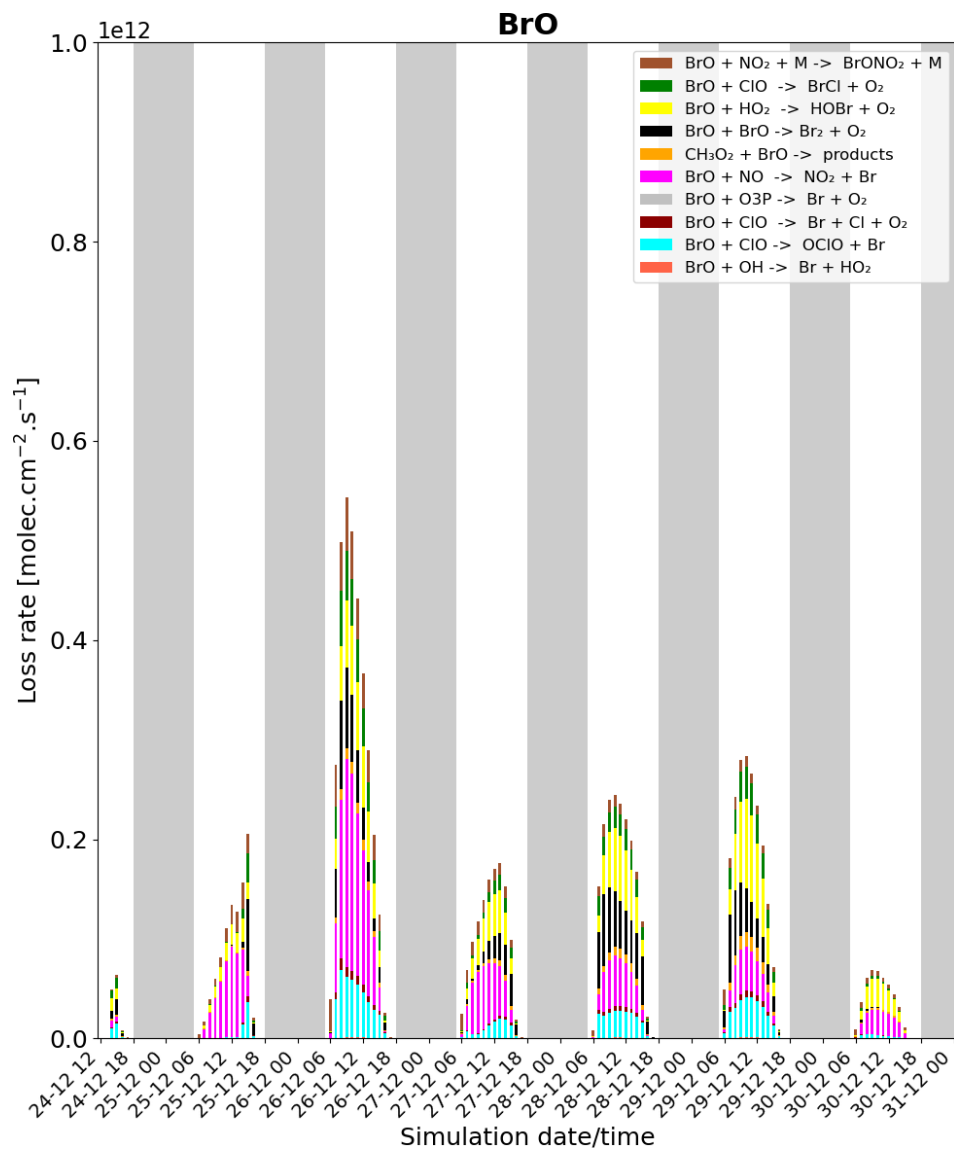


Figure S4. Time evolution of BrO loss rates in [molec.cm⁻².s⁻¹] without the photolysis of BrO and the BrO + BrO → Br + Br + O₂ reaction from 24 December at 14:00 to 31 December 2018 at 00:00 UTC in the young plume.

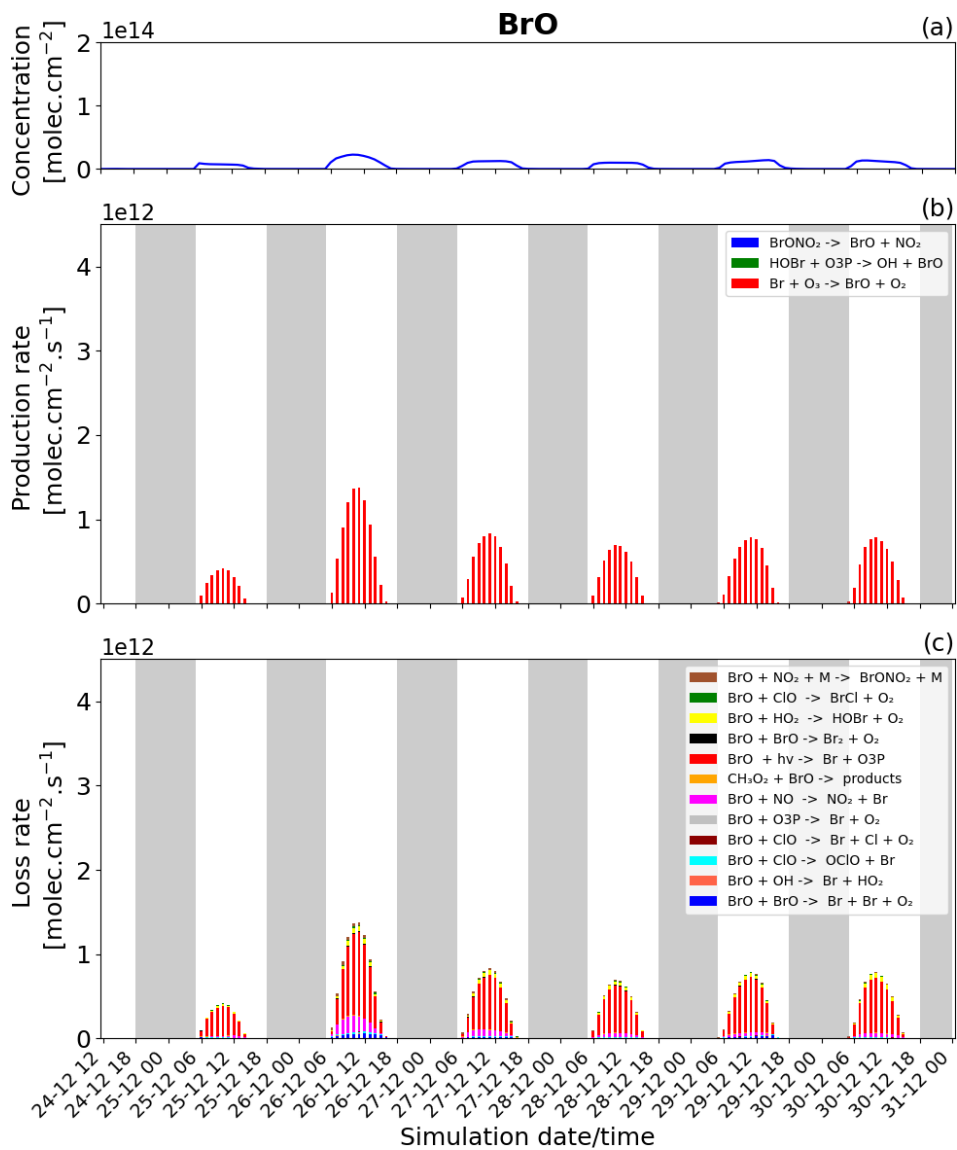


Figure S5. Time evolution of : (a) BrO column concentration in $[\text{molec.cm}^{-2}]$, (b) production rates and (c) loss rates for BrO both in $[\text{molec.cm}^{-2}.\text{s}^{-1}]$ from 24 December at 20:00 to 31 December 2018 at 00:00 UTC in the aged plume.

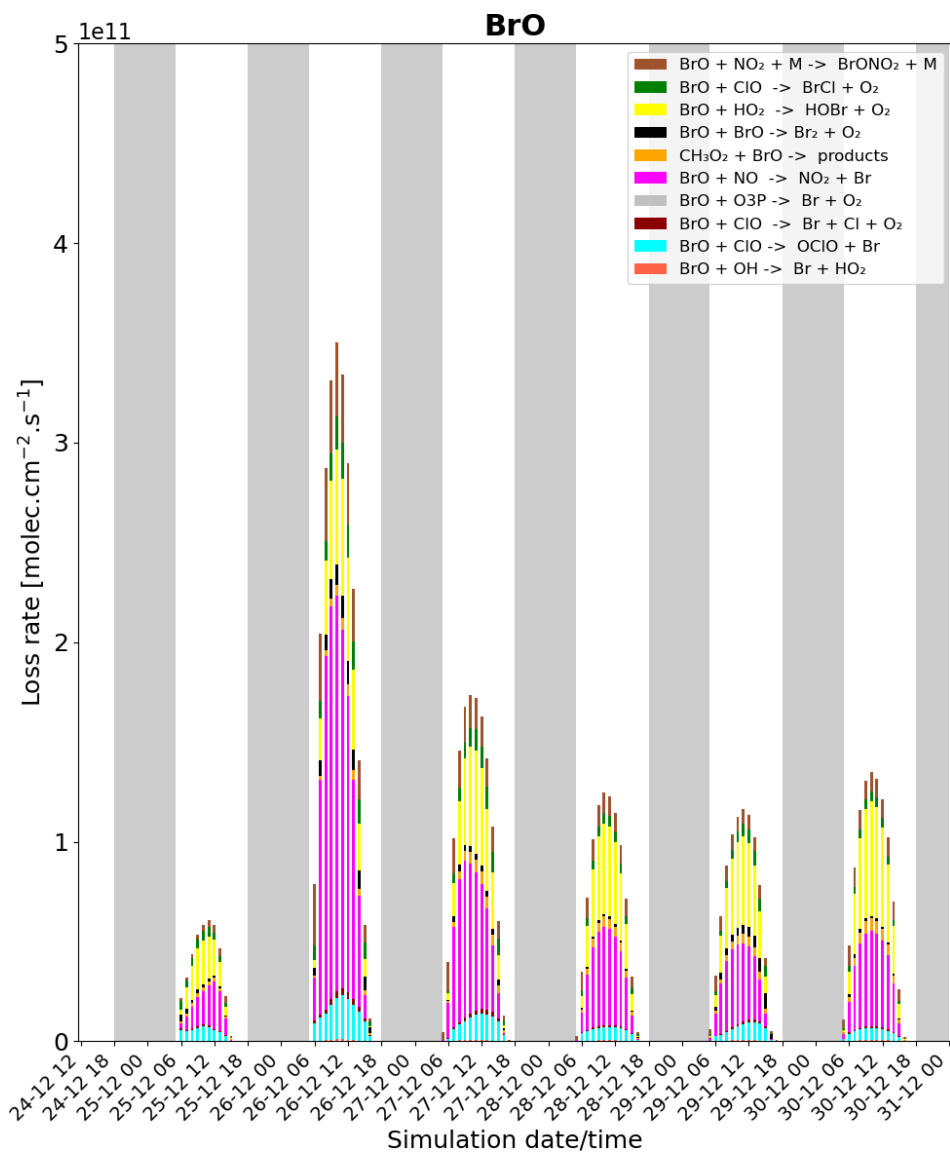


Figure S6. Time evolution of BrO loss rates in [molec.cm⁻².s⁻¹] without the photolysis of BrO and the BrO + BrO → Br + Br + O₂ reaction, from 24 December at 20:00 to 31 December 2018 at 00:00 UTC in the aged plume.

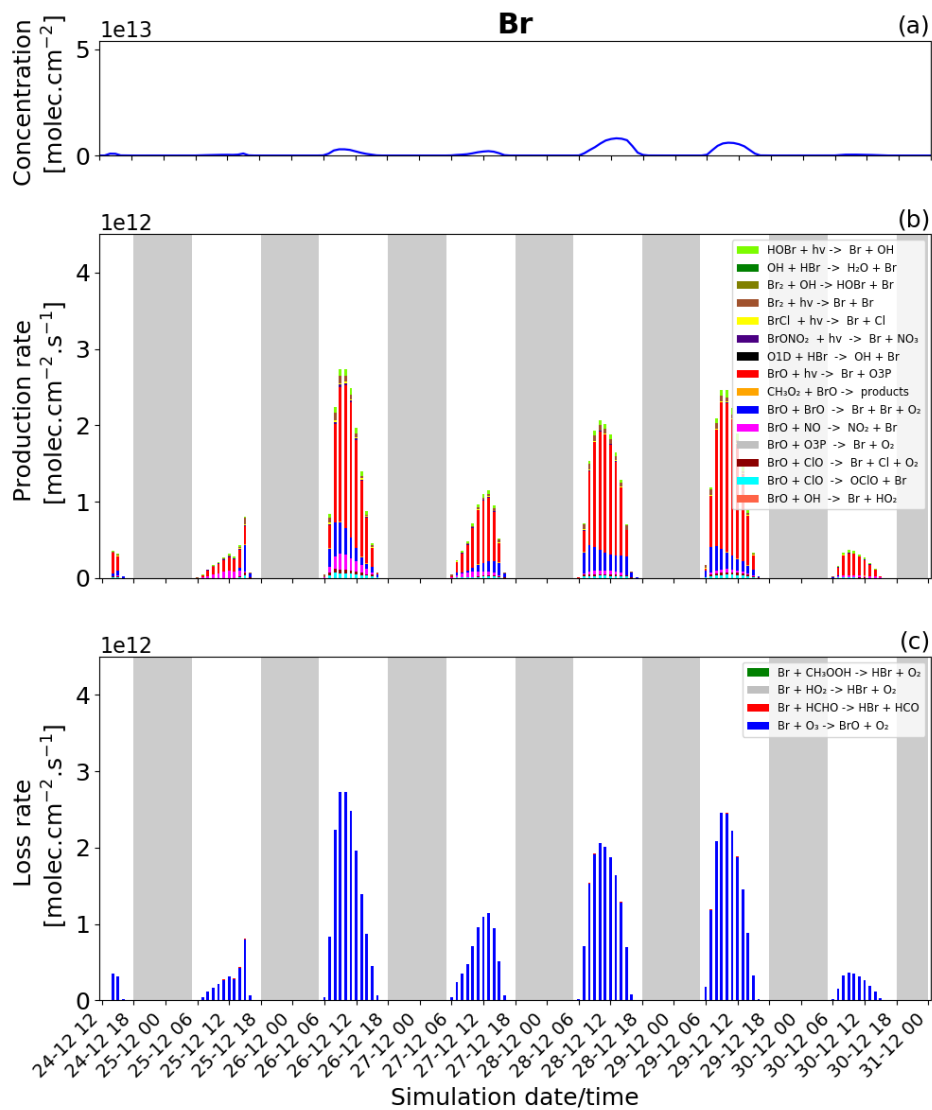


Figure S7. Time evolution of : (a) Br column concentration in $[\text{molec.cm}^{-2}]$, (b) production rates and (c) loss rates for Br both in $[\text{molec.cm}^{-2}.\text{s}^{-1}]$ from 24 December at 14:00 to 31 December 2018 at 00:00 UTC in the young plume.

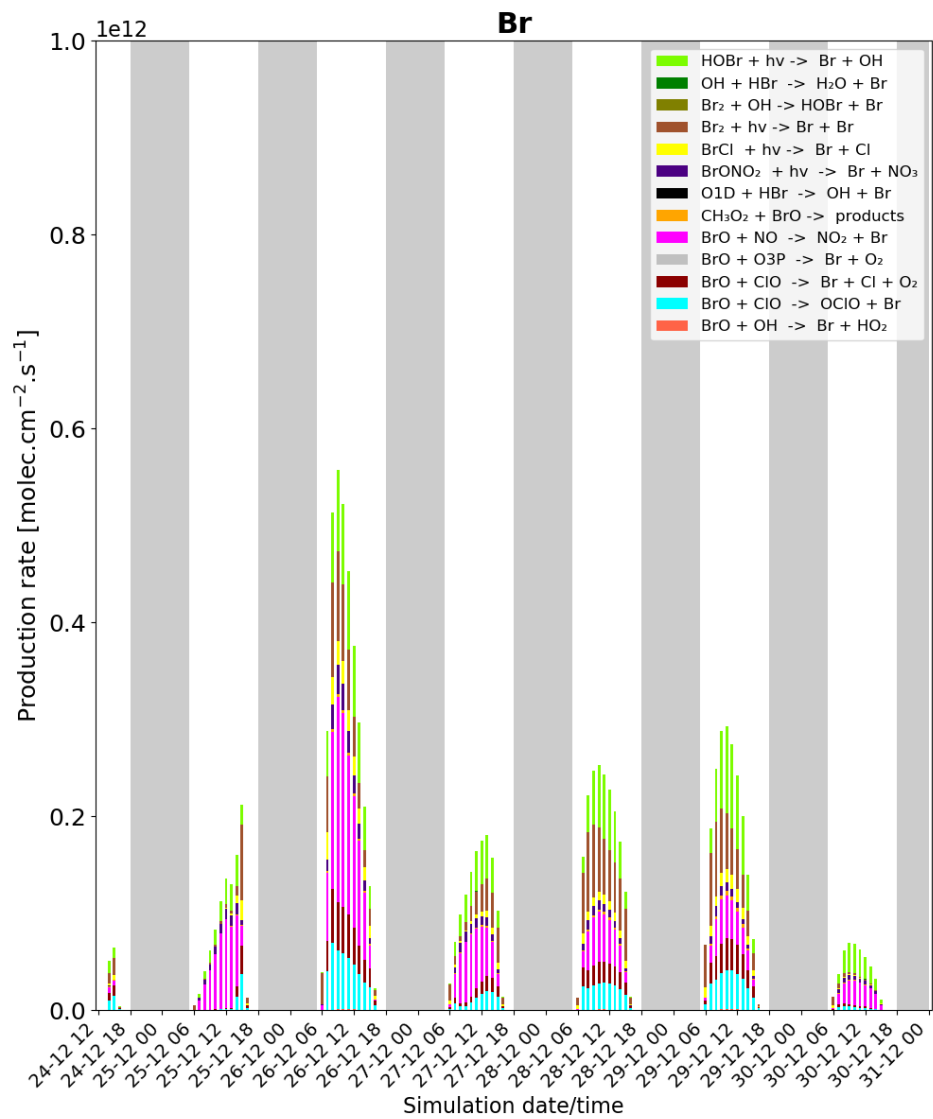


Figure S8. Time evolution of Br production rates in [molec.cm⁻².s⁻¹] without the photolysis of BrO and the BrO + BrO → Br + Br + O₂ reaction, from 24 December at 14:00 to 31 December 2018 at 00:00 UTC in the young plume.

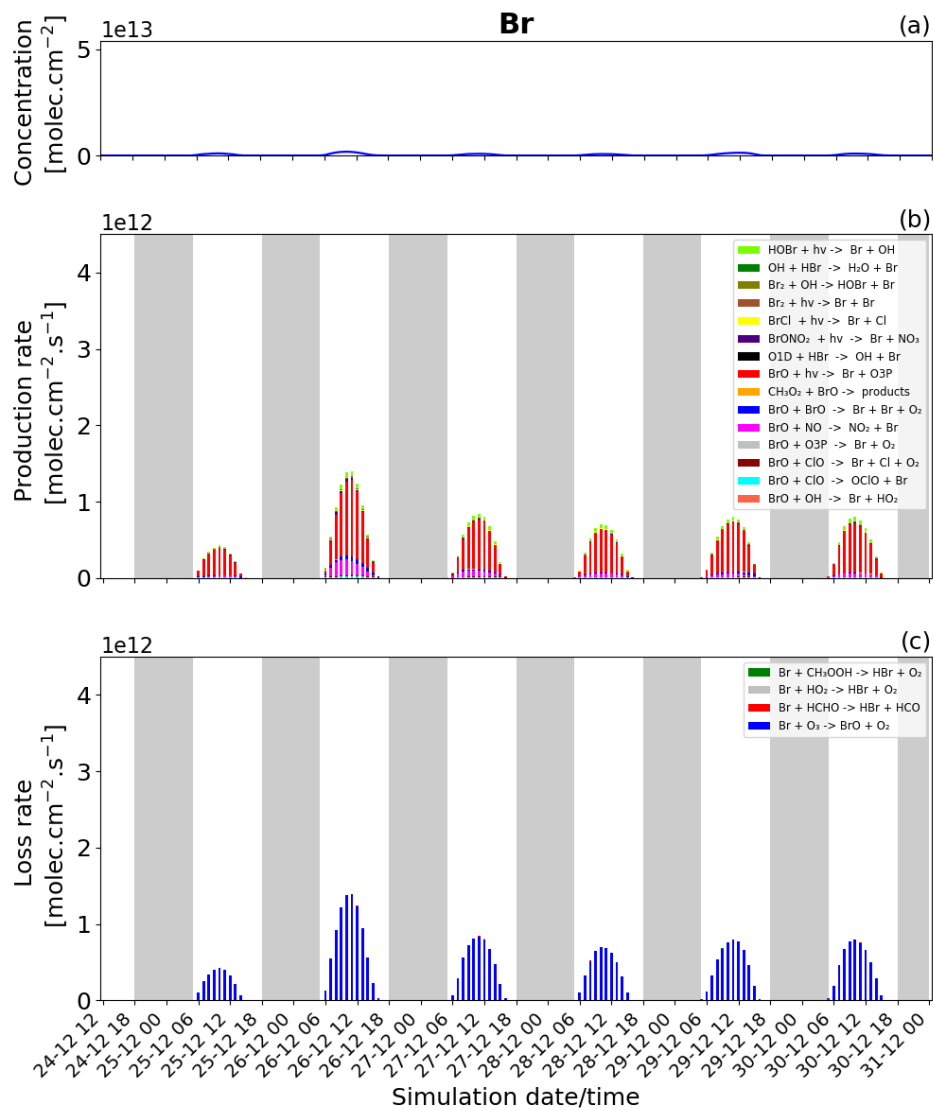


Figure S9. Time evolution of : (a) Br column concentration in $[\text{molec.cm}^{-2}]$, (b) production rates and (c) loss rates for Br both in $[\text{molec.cm}^{-2}.\text{s}^{-1}]$ from 24 December at 20:00 to 31 December 2018 at 00:00 UTC in the aged plume.

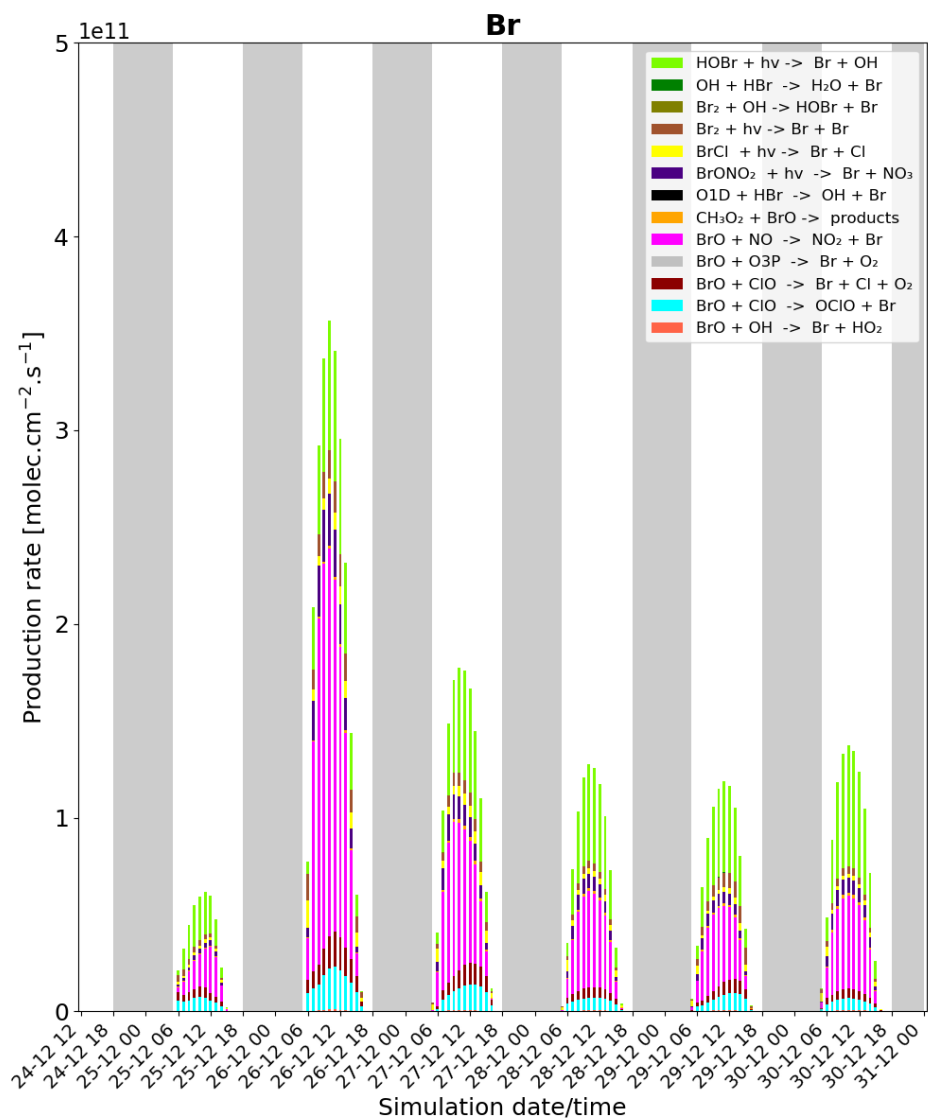


Figure S10. Time evolution of Br production rates in [molec.cm⁻².s⁻¹], without the photolysis of BrO and the BrO + BrO → Br + Br + O₂ reaction from 24 December at 20:00 to 31 December 2018 at 00:00 UTC in the aged plume.

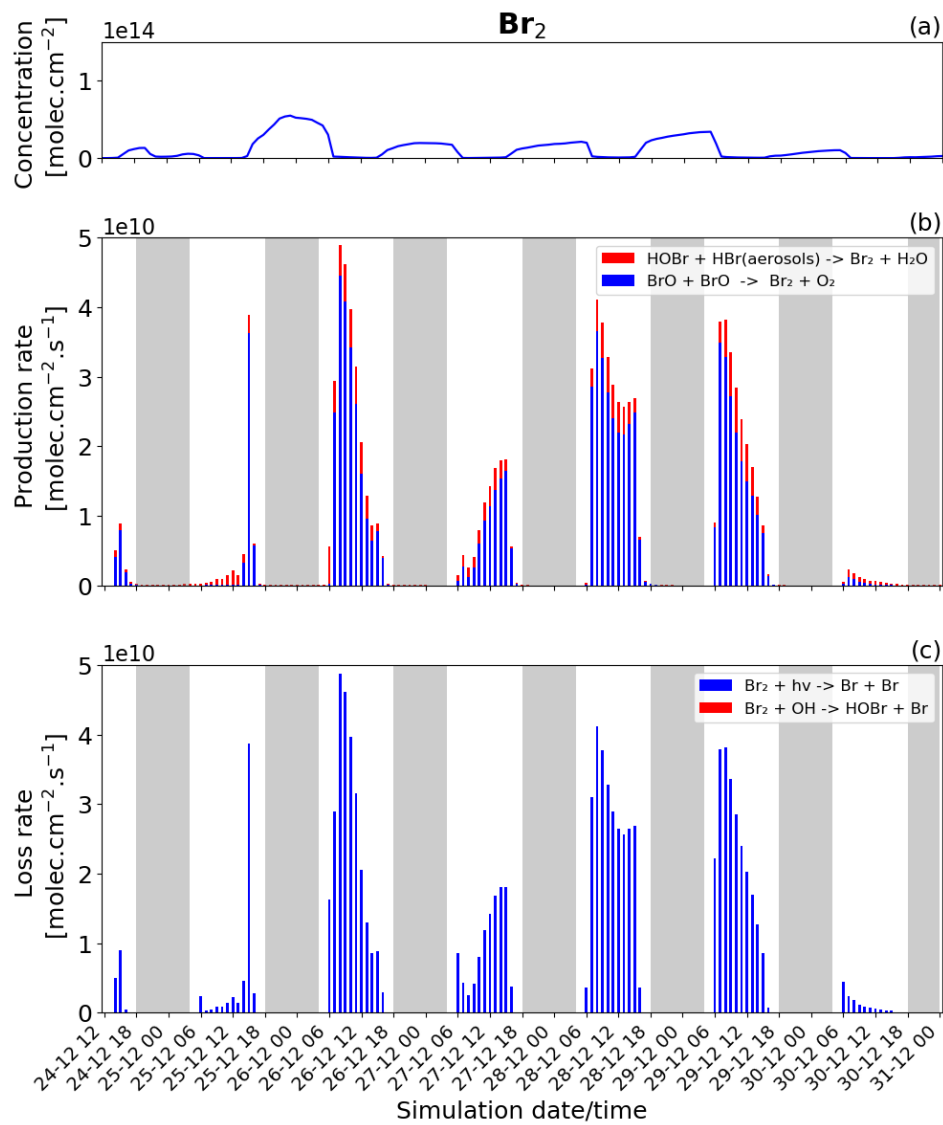


Figure S11. Time evolution of : (a) Br_2 column concentration in $[\text{molec. cm}^{-2}]$, (b) production rates and (c) loss rates for Br_2 both in $[\text{molec. cm}^{-2} \cdot \text{s}^{-1}]$ from 24 December at 14:00 to 31 December 2018 at 00:00 UTC in the young plume.

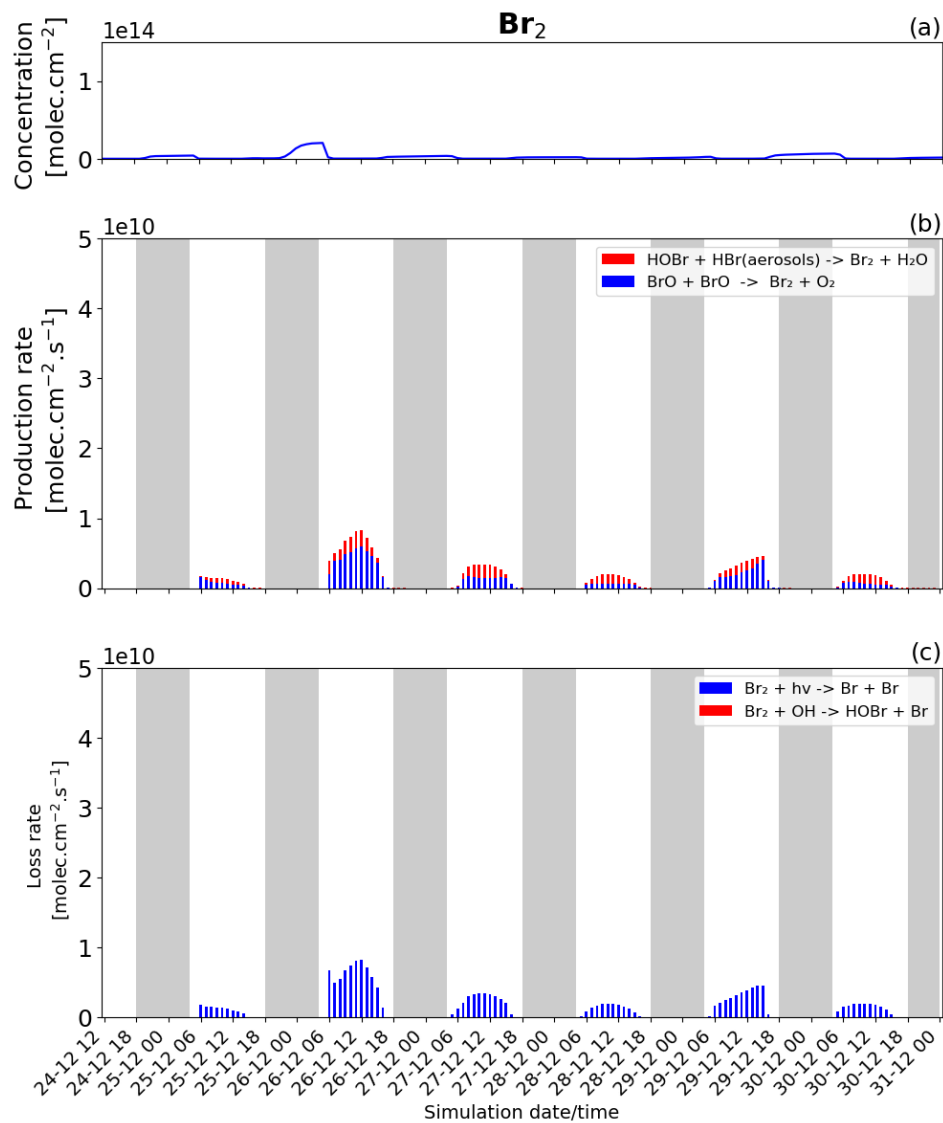


Figure S12. Time evolution of : (a) Br₂ column concentration in [molec.cm⁻²], (b) production rates and (c) loss rates for Br₂ both in [molec.cm⁻².s⁻¹] from 24 December at 20:00 to 31 December 2018 at 00:00 UTC in the aged plume.

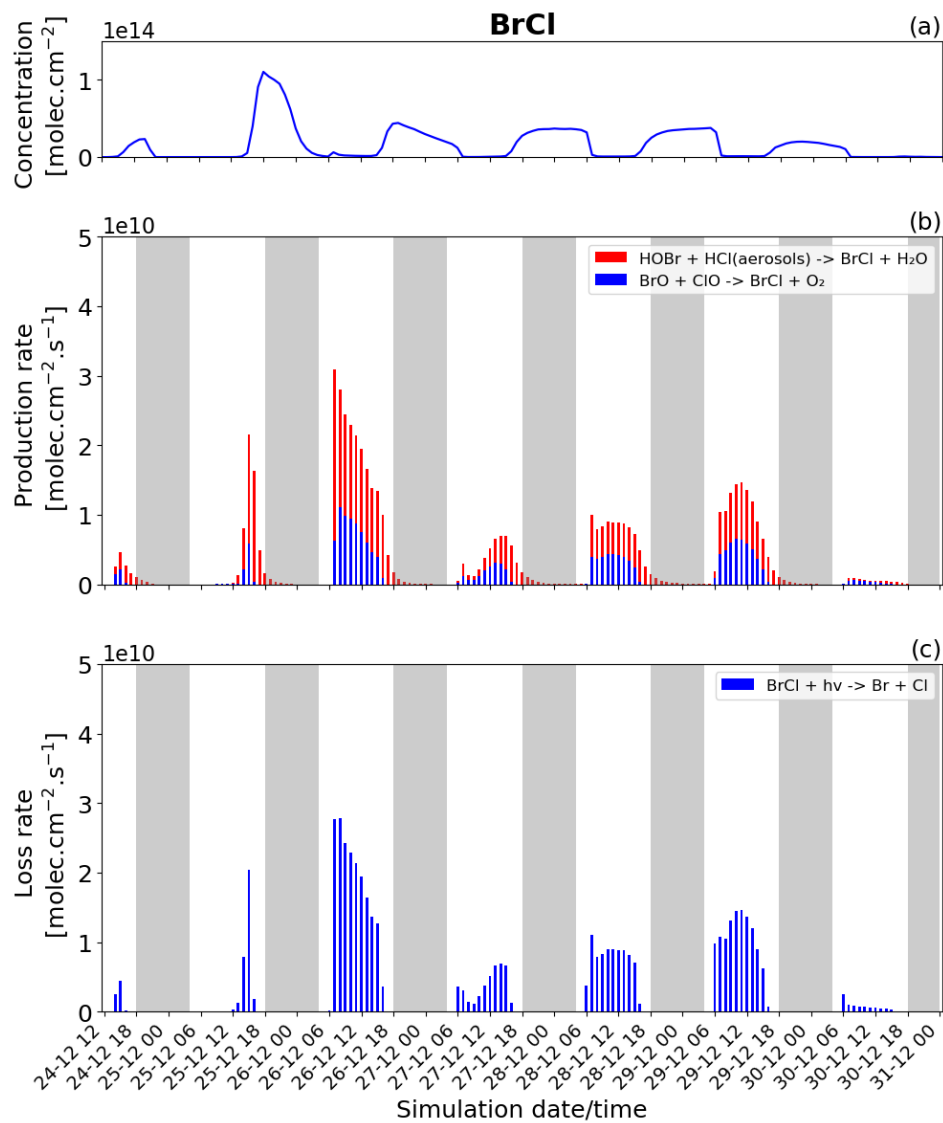


Figure S13. Time evolution of : (a) BrCl column concentration in $[\text{molec.cm}^{-2}]$, (b) production rates and (c) loss rates for BrCl both in $[\text{molec.cm}^{-2}.\text{s}^{-1}]$ from 24 December at 14:00 to 31 December 2018 at 00:00 UTC in the young plume.

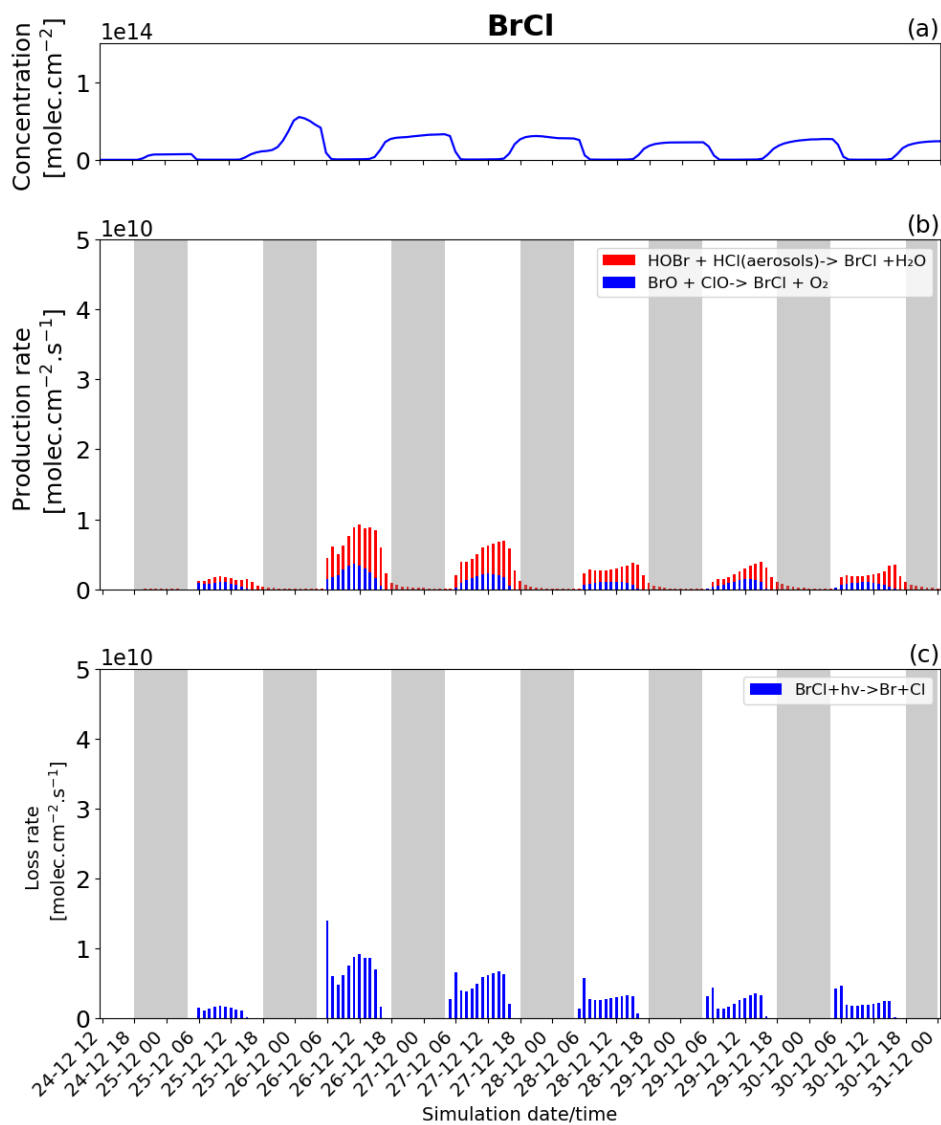


Figure S14. Time evolution of : (a) BrCl column concentration in $[\text{molec.cm}^{-2}]$, (b) production rates and (c) loss rates for BrCl both in $[\text{molec.cm}^{-2}.\text{s}^{-1}]$ from 24 December at 20:00 to 31 December 2018 at 00:00 UTC in the aged plume.

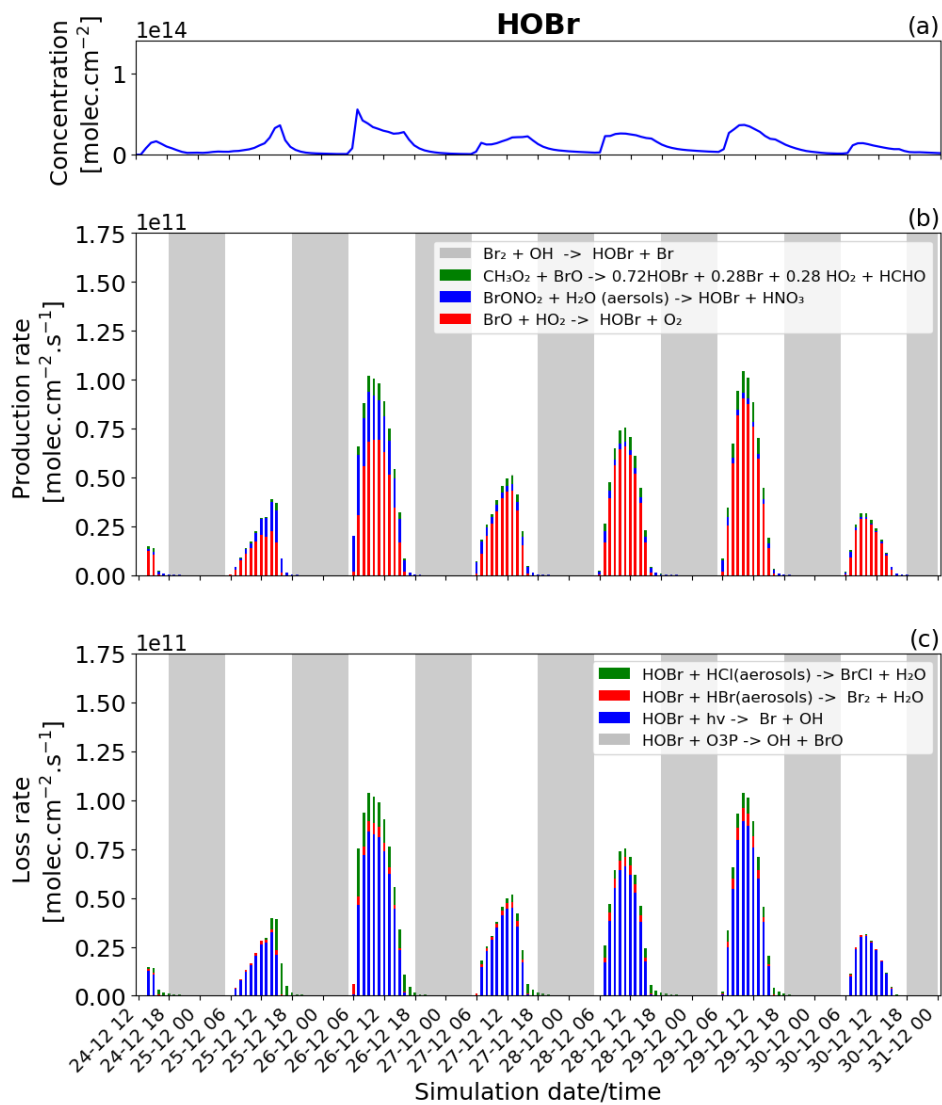


Figure S15. Time evolution of : (a) HOBr column concentration in $[\text{molec.cm}^{-2}]$, (b) production rates and (c) loss rates for HOBr both in $[\text{molec.cm}^{-2}.\text{s}^{-1}]$ from 24 December at 14:00 to 31 December 2018 at 00:00 UTC in the young plume.

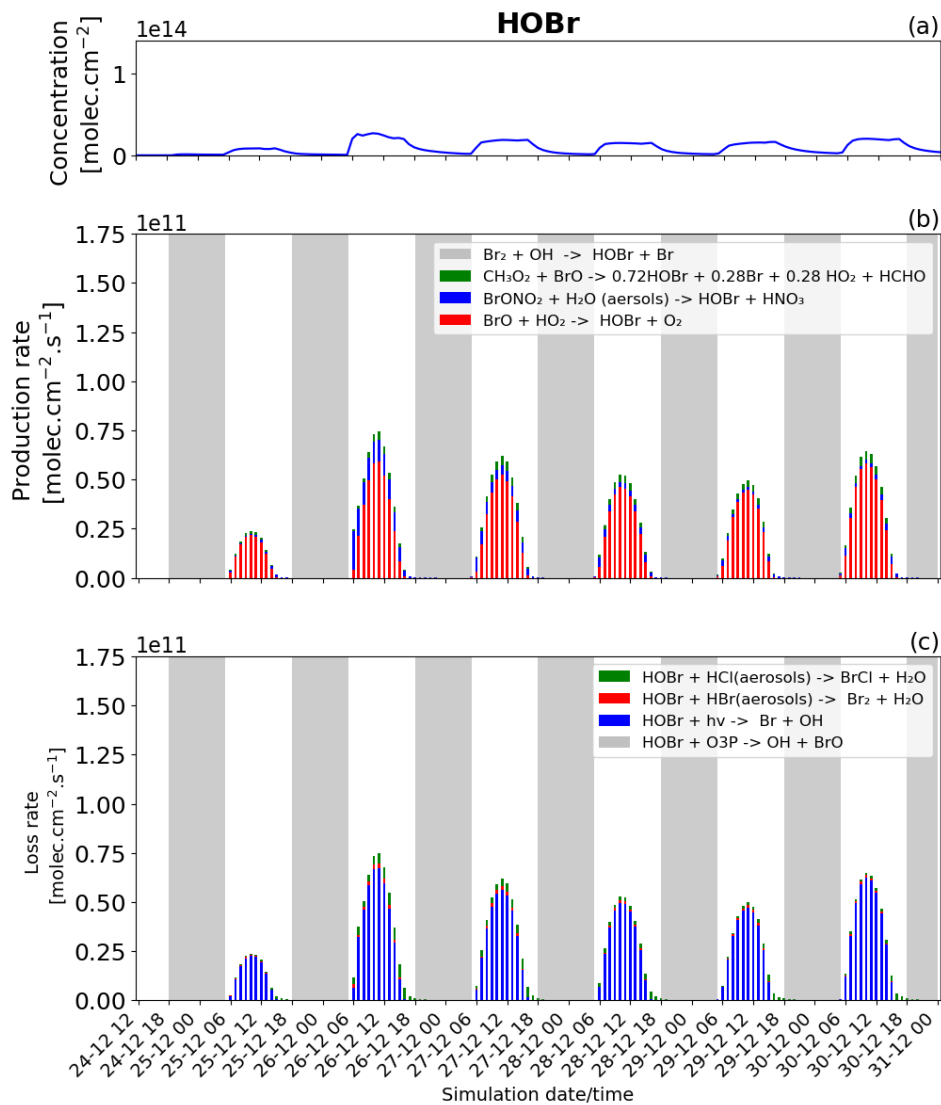


Figure S16. Time evolution of : (a) HOBr column concentration in $[\text{molec.cm}^{-2}]$, (b) production rates and (c) loss rates for HOBr both in $[\text{molec.cm}^{-2}.\text{s}^{-1}]$ from 24 December at 20:00 to 31 December 2018 at 00:00 UTC in the aged plume.

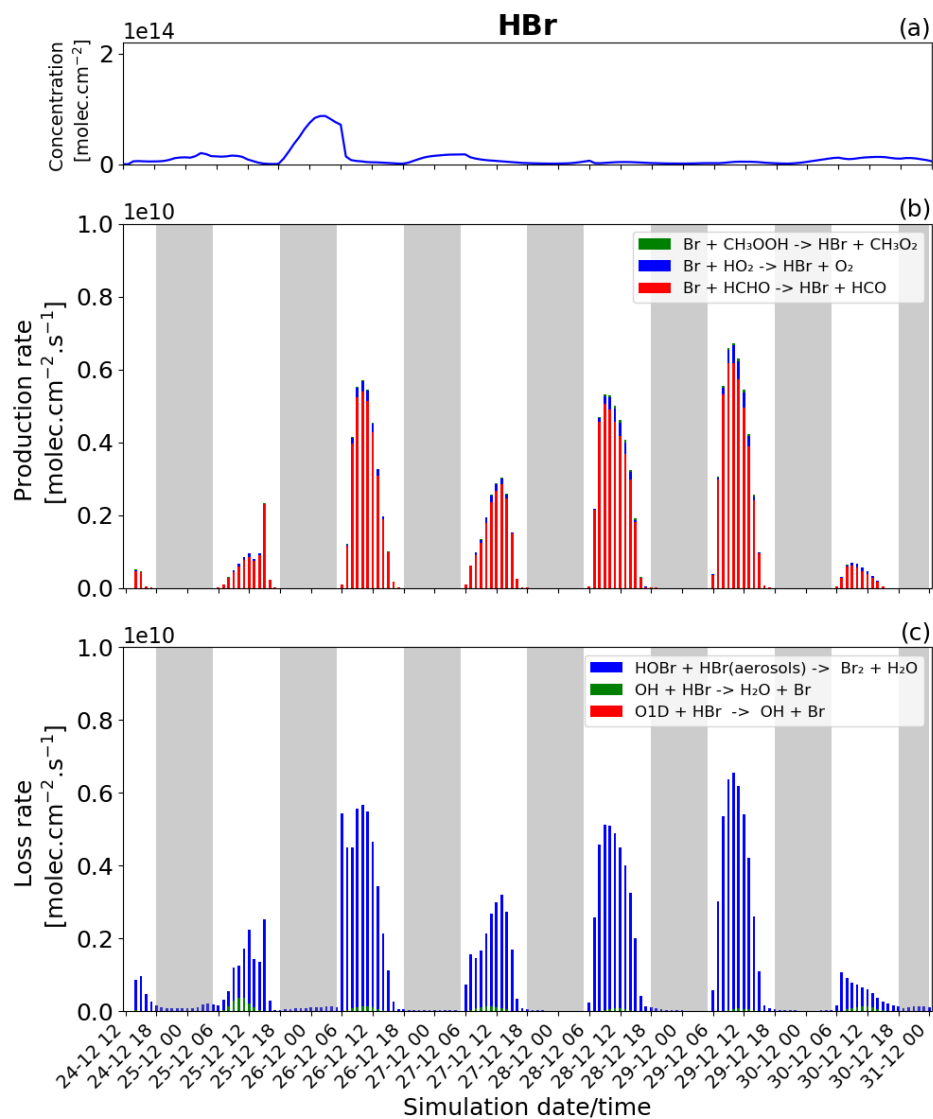


Figure S17. Time evolution of : (a) HBr column concentration in $[\text{molec.cm}^{-2}]$, (b) production rates and (c) loss rates for HBr both in $[\text{molec.cm}^{-2}.\text{s}^{-1}]$ from 24 December at 14:00 to 31 December 2018 at 00:00 UTC in the young plume.

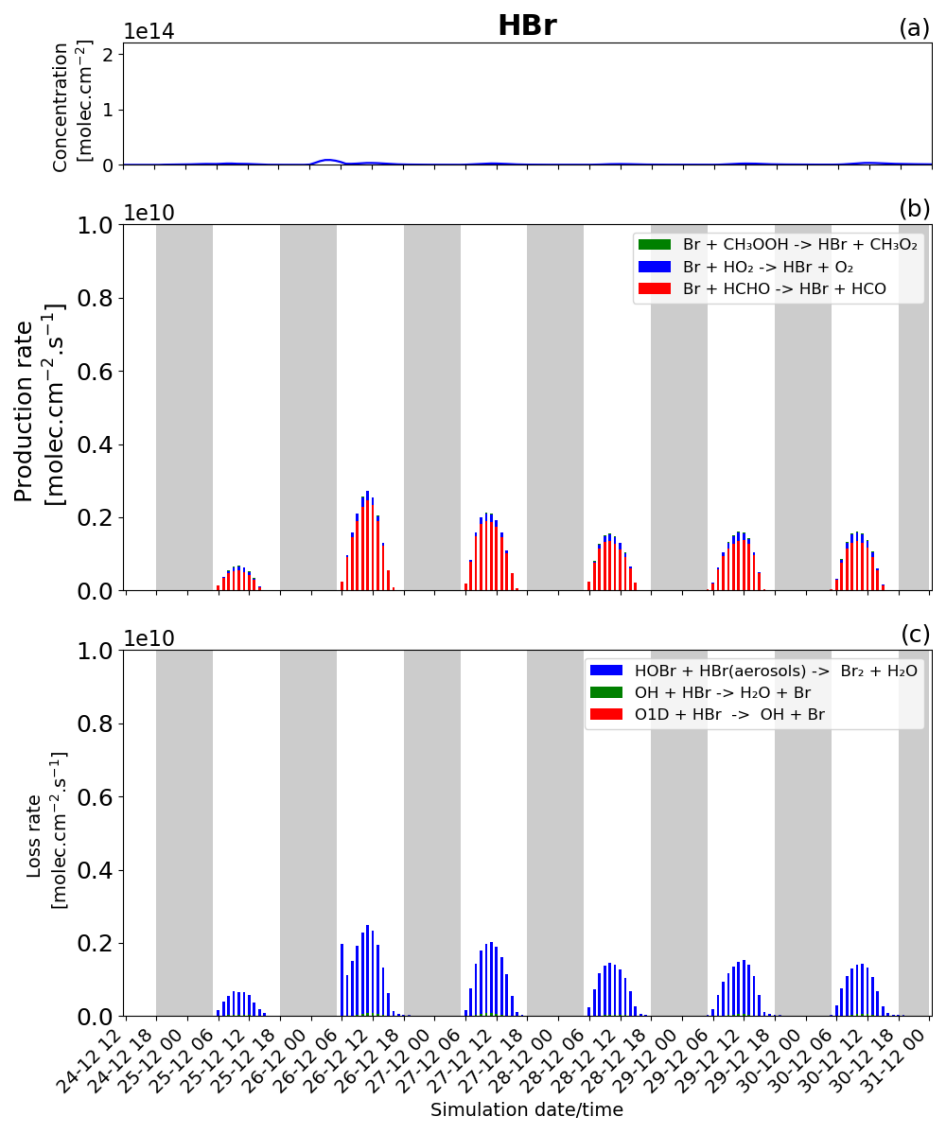


Figure S18. Time evolution of : (a) HBr column concentration in $[\text{molec.cm}^{-2}]$, (b) production rates and (c) loss rates for HBr both in $[\text{molec.cm}^{-2}.\text{s}^{-1}]$ from 24 December at 20:00 to 31 December 2018 at 00:00 UTC in the aged plume.

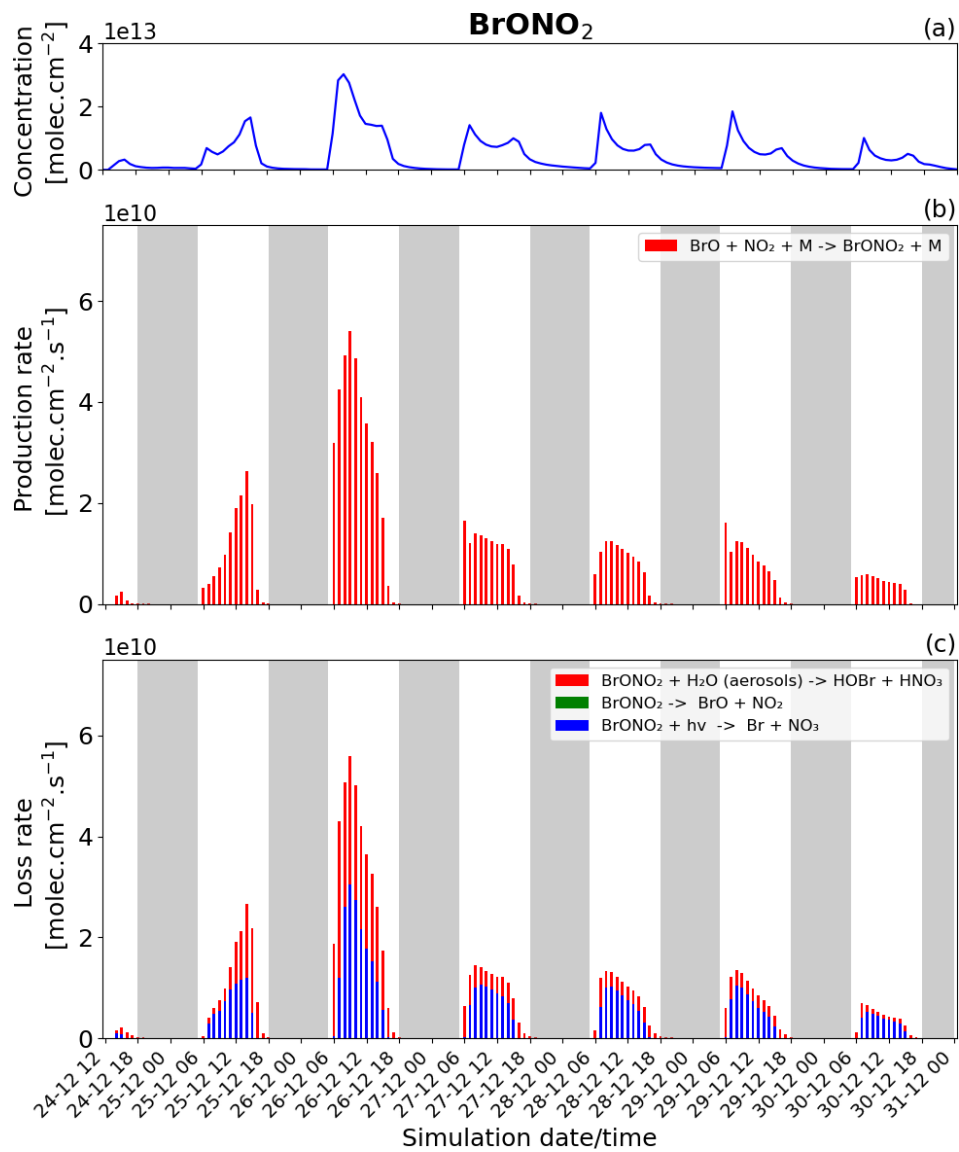


Figure S19. Time evolution of : (a) BrONO₂ column concentration in [molec.cm⁻²], (b) production rates and (c) loss rates for BrONO₂ both in [molec.cm⁻².s⁻¹] from 24 December at 14:00 to 31 December 2018 at 00:00 UTC in the young plume.

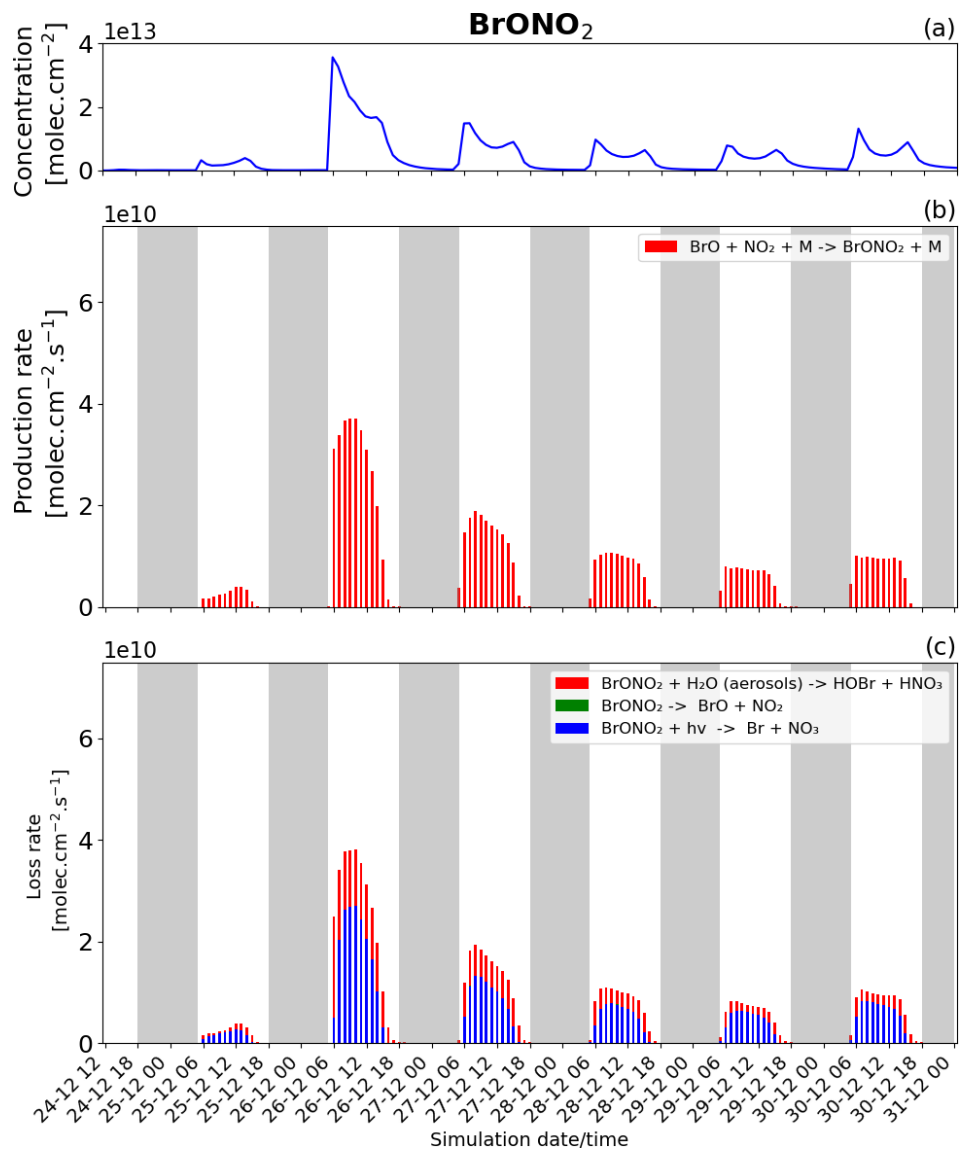


Figure S20. Time evolution of : (a) BrONO₂ column concentration in [molec.cm⁻²], (b) production rates and (c) loss rates for BrONO₂ both in [molec.cm⁻².s⁻¹] from 24 December at 20:00 to 31 December 2018 at 00:00 UTC in the aged plume.

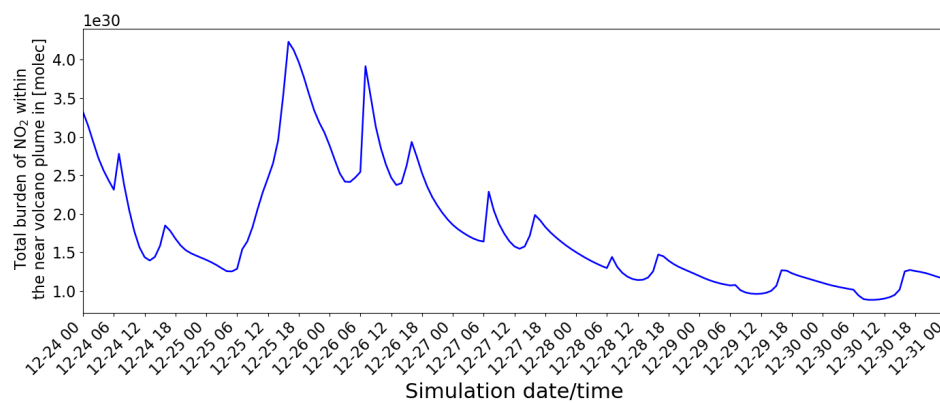


Figure S21. Time evolution of the total burden of the NO₂ within plume in [molec] from 24 December at 12:00 to 31 December 2018 at 00:00 UTC in the near volcano domain.

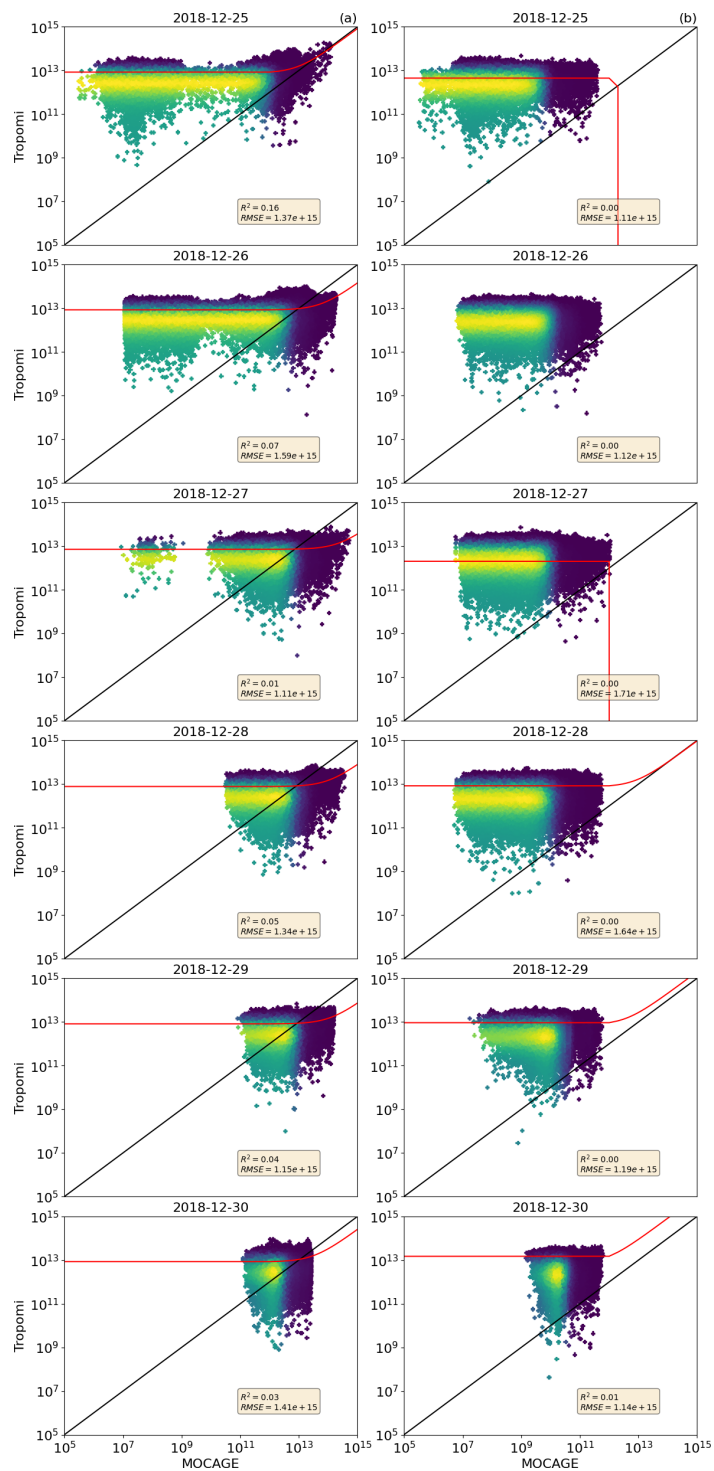


Figure S22. Linear regression of BrO column of TROPOMI and MOCAGE within volcanic plume (left column) and outside of the volcanic plume (right column) in molec.cm^{-2} from 25 to 30 December 2018 for the whole domain of the Mediterranean basin. The red lines correspond to the linear regression and 1:1 in black colour lines.