

Supplement of Atmos. Chem. Phys., 19, 7151–7163, 2019
<https://doi.org/10.5194/acp-19-7151-2019-supplement>
© Author(s) 2019. This work is distributed under
the Creative Commons Attribution 4.0 License.



Atmospheric
Chemistry
and Physics
Open Access


Supplement of

Implication of strongly increased atmospheric methane concentrations for chemistry–climate connections

Franziska Winterstein et al.

Correspondence to: Franziska Winterstein (franziska.frank@dlr.de)

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

Contents

1	Evaluation of reference with observations	2
2	Difference in the annual cycle of O₃	5
3	Climatological annual cycle of O₃ total column change	7
5	4 Adjusted temperature	9

1 Evaluation of reference with observations

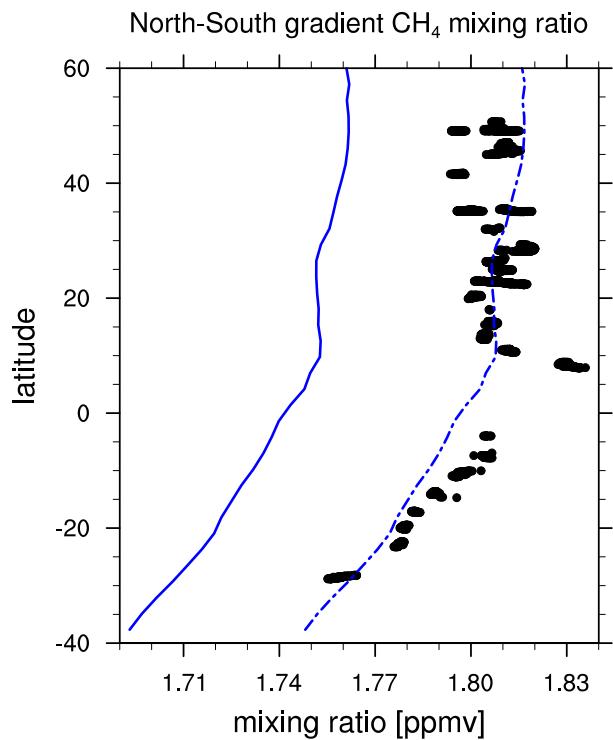


Figure S1. Comparison of observations on the research vessel *Polarstern* Klappenbach et al. (2015) (black) to annual zonal mean methane (CH₄) columns of the reference simulation (blue) in [parts per million volume (ppmv)]. The solid line represents the original column derived from the reference simulations and the dash dotted line are the columns moved by +0.055ppmv (see text for explanation).

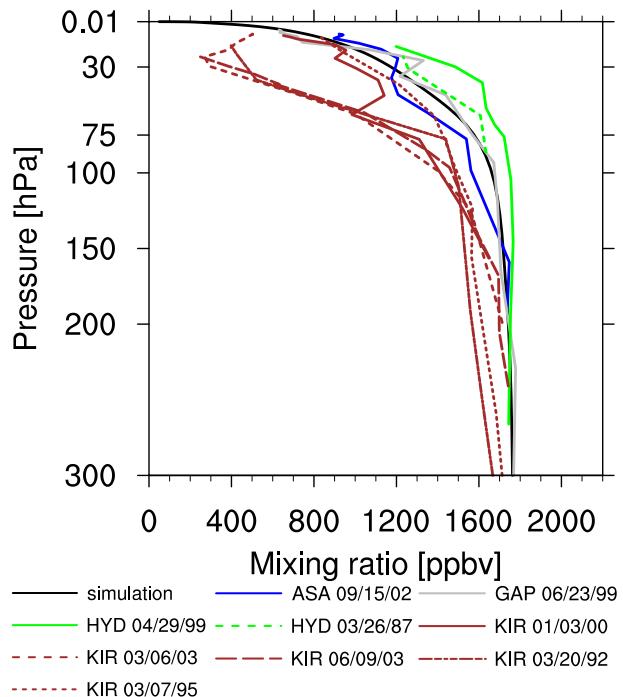


Figure S2. Comparison of vertical global mean CH₄ profile of simulation with balloon borne observations provided by Röckmann et al. (2011). The balloon launch sites are Hyderabad, India (HYD, 17.5° N, 78.60° E), Kiruna, Sweden (KIR, 67.9° N, 21.10° E), Aire sur l'Adour, France (ASA, 43.70° N, -0.30° E) and Gap, France (GAP, 44.44° N, 56.14 E) (see text for explanation).

2 Difference in the annual cycle of O₃

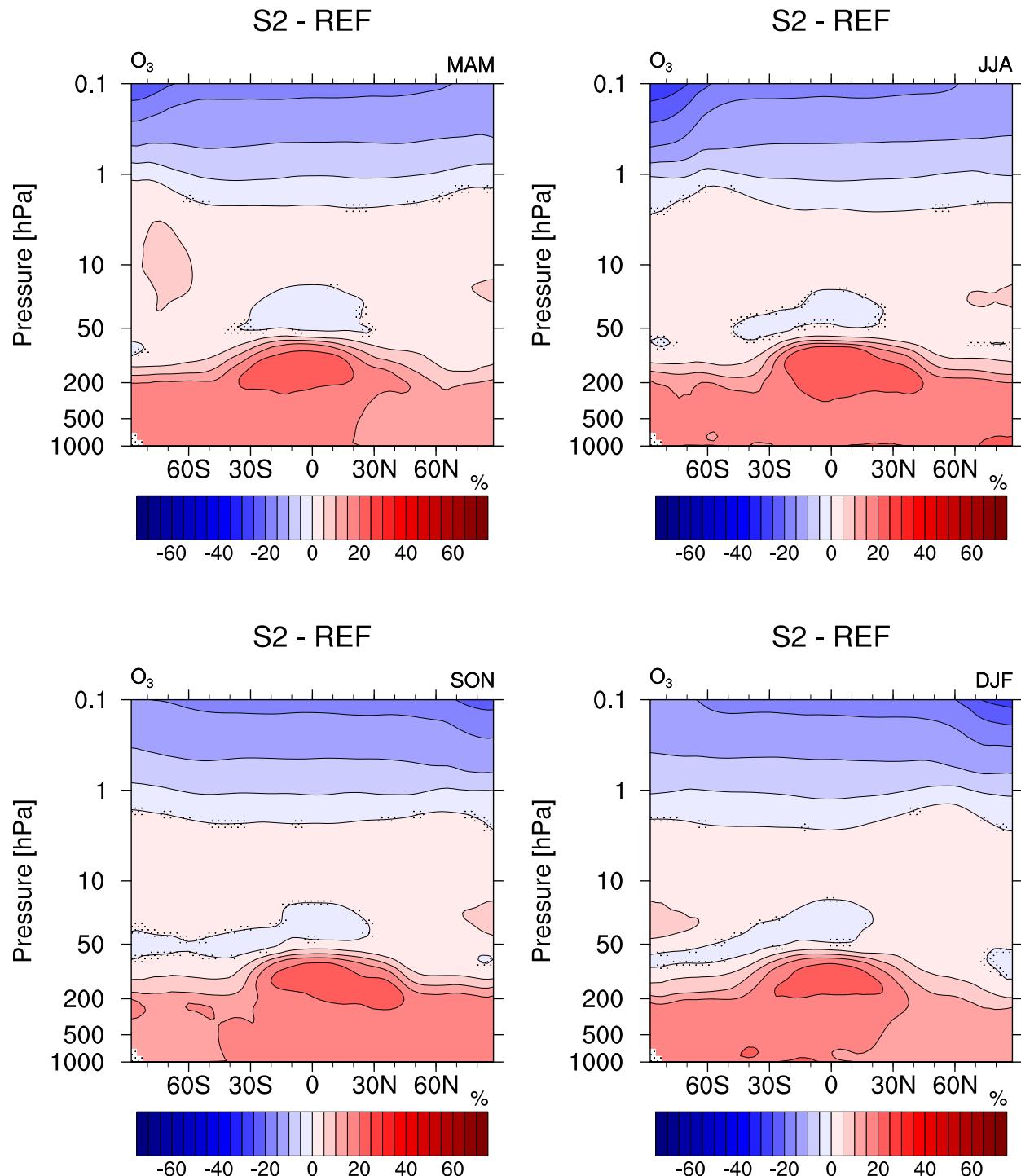


Figure S3. Seasonal differences in ozone (O₃) between S2 and REF. Non-stippled areas are significant on a 95% confidence level according to a two sided Welch's test.

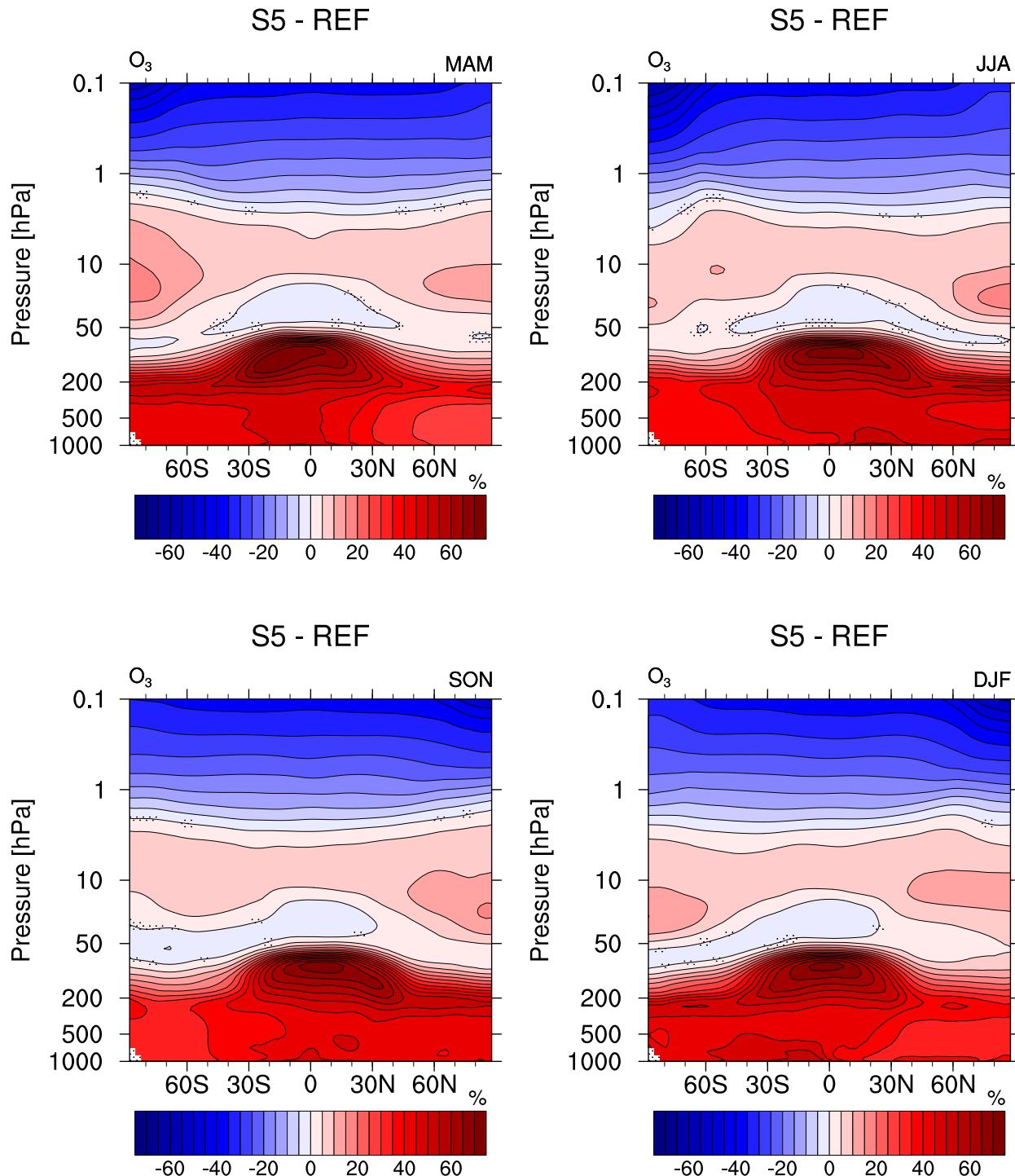


Figure S4. Seasonal differences in O₃ between S5 and REF. Non-stippled areas are significant on a 95% confidence level according to a two sided Welch's test.

3 Climatological annual cycle of O₃ total column change

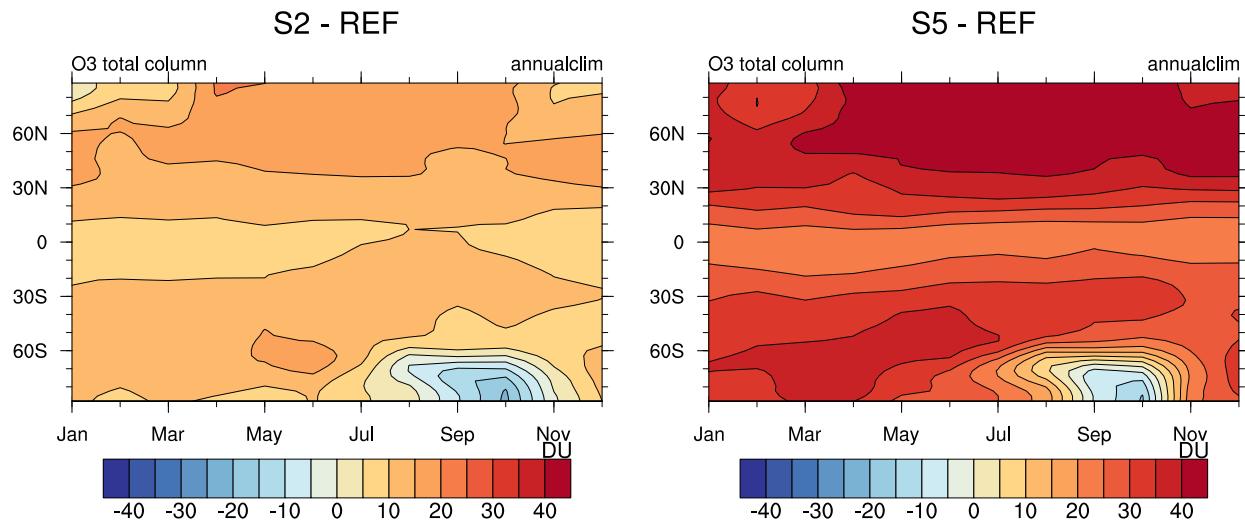


Figure S5. Climatological annual cycle of the total O₃ column change in Dobson Units (DU).

4 Adjusted temperature

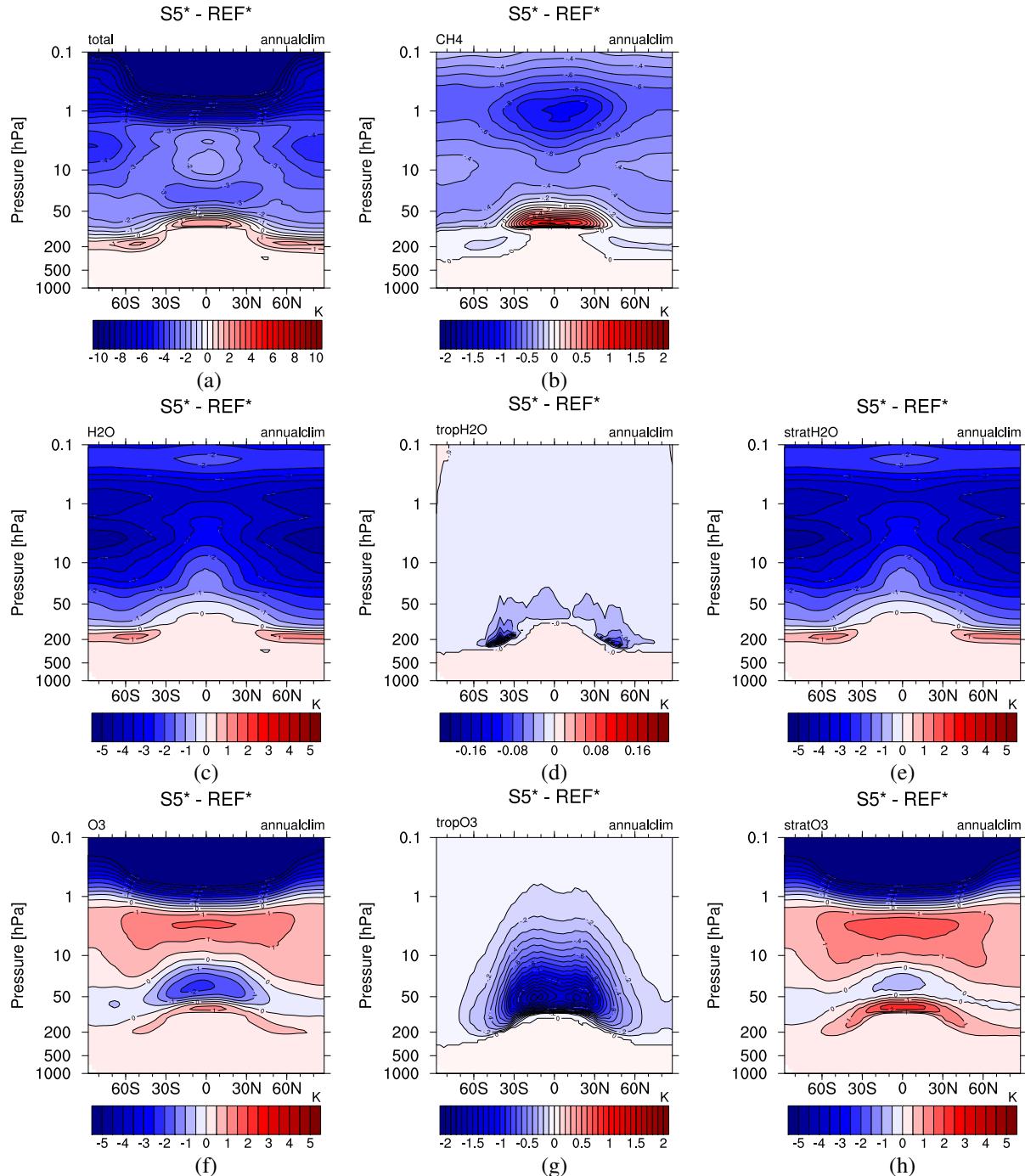


Figure S6. Stratospheric adjusted temperature based on chemical changes in simulation S5* (5xCH₄) in (a) CH₄, water vapour (H₂O) and O₃ together, (b) CH₄, (c) H₂O, (d) tropospheric H₂O only, (e) stratospheric H₂O only, (f) O₃, (g) tropospheric O₃ only, (h) stratospheric O₃ only. Note the different color bars in panels (a), (b), (d), and (g).

References

- Klappenbach, F., Bertleff, M., Kostinek, J., Hase, F., Blumenstock, T., Agusti-Panareda, A., Razinger, M., and Butz, A.: Accurate mobile remote sensing of XCO₂ and XCH₄ latitudinal transects from aboard a research vessel, *Atmos. Meas. Tech.*, 8, 5023–5038, <https://doi.org/10.5194/amt-8-5023-2015>, <https://www.atmos-meas-tech.net/8/5023/2015/>, 2015.
- 5 Röckmann, T., Brass, M., Borchers, R., and Engel, A.: The isotopic composition of methane in the stratosphere: high-altitude balloon sample measurements, *Atmos. Chem. Phys.*, 11, 13 287–13 304, <https://doi.org/10.5194/acp-11-13287-2011>, 2011.