The Cryosphere Discuss.,
https://doi.org/10.5194/tc-2018-182-RC2, 2018

The Cryosphere
Discussions

Interactive comment on "Intrusion, retention, and snowpack chemical effects from exhaust emissions at Concordia Station, Antarctica" *by* Detlev Helmig et al.

Anonymous Referee #2

Received and published: 1 December 2018

In "Intrusion, retention, and snowpack chemical effects from exhaust emissions at Concordia Station, Antarctica," Helmig, et al. show the impact station exhaust can have on even the clear air sector, at a remote, high-latitude, research station. The show incidents of high NOx above the snowpack correspond with winds from camp. They also show the lag in higher NOx concentrations in the snowpack and that the higher concentrations at depth persist for longer than those over the snowpack.

This work is important, but not unique. It reemphasizes that more researchers need to look at the potential impacts of station activities on snow and air chemistry, even in the designated "clean air sector" at these stations. Others have shown the impact of

Printer-friendly version

Discussion paper

station emissions on snow and air chemistry at remote stations, including the impact of NOx from station power generation.

General comments:

The authors do not cite other work showing the impact of station exhaust on NOx in the air and nitrate in the snow. Fibiger et al. (2016) show the impact of station exhaust on NOx concentrations above the snowpack and on nitrate in snow at Summit, Greenland. They use d15N to quantify this influence on snow nitrate. More discussion of how the influence at Dome C compares with these findings would greatly strengthen this analysis. Wolff et al. (1998), also show this issue with filter collections at various stations, including Durmont d'Urville, which could result in deposited nitrate.

The authors state in the methods section that the NO measurement is more accurate than NOx, which contains several other NOy species. Throughout the manuscript, however, the authors use the NOx measurement. Why has this been chosen over NO? The enhancements should still show up in NO, without the interference issues.

In figure 6 the authors show the impact on firn NOx continues past day 198, which is 6 days after event onset. Separately, the authors state there are 15 (abstract) or 50 (text) occurrences of plumes over the sampling site. They conclude that less than 10% of the measurements were contaminated by the plume, but this is difficult to reconcile. The authors should provide more detail on how many events there are, how long they last. Also, the abstract states the NOx levels last “a few days to one week,” but in the text it says “1-5 days.” These statements need to be verified and data needs to be presented more consistently and clearly.

Specific comments:

Lines 18-20. This sentence needs to be reworded. It is not clear how many inlets there are or how many are above or below the snowpack.

Line 102. The authors explain how they set inlets in the snow for sampling firn air.

They do not explain how confident they are that digging a pit and refilling it does not change the porosity of the snow or the dynamics of air flow. This could influence how applicable the firn results are.

Line 130. The authors say their calibration gas was diluted with NOx scrubbed air. Was this tested against dilution with true zero air? Most NOx scrubbers emit a low, constant, level of NOx, which must be accounted for in calibrations. This tends not to be important in polluted areas, but is for 1 ppb NOx measurements.

Line 192. Show this data in the supplement. It's hard to know what these qualitative and quantitative comparisons look like without showing the data.

Line 220. The authors say the difference becomes weaker at depth, but only one point seems to have a smaller difference. Support this statement with statistics. What are the differences at the surface and at depth? Is that difference significant?

Line 242. Do not cite unpublished results. Either publish them here, or do not include them. Also, which way is the 15% difference in ozone loss? Using data that others cannot see is bad scientific practice.

Line 264. Something is wrong in this sentence. You need to delete "organic gases" or reword.

References

Fibiger, D. L., J. E. Dibb, D. Chen, J. L. Thomas, J. F. Burkhart, L. G. Huey, and M. G. Hastings (2016), Analysis of nitrate in the snow and atmosphere at Summit, Greenland: Chemistry and transport, J. Geophys. Res. Atmos., 121, 5010–5030, doi: 10.1002/2015JD024187.

Wolff, E. W., M. R. Legrand, and D. Wagenbach (1998), Coastal Antarctic aerosol and snowfall chemistry, J. Geophys. Res., 103(D9), 10927–10934, doi: 10.1029/97JD03454.

Interactive comment on The Cryosphere Discuss., https://doi.org/10.5194/tc-2018-182, 2018.