

Interactive comment on “HO₂NO₂ and HNO₃ in the coastal Antarctic winter night: a “lab-in-the-field” experiment” by A. E. Jones et al.

Anonymous Referee #2

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The manuscript "HO₂NO₂ and HNO₃ in the coastal Antarctic winter night: a "lab-in-the-field" experiment", from Jones et al. presents atmospheric measurements of HNO₄ and HNO₃ made during a 4 month winter period at the Halley research station located at coastal Antarctica. Being one of the leader in the research of reactive Nitrogen chemistry in Antarctica, the research group of the British Antarctic Survey set here new benchmarks by providing the first long time high resolution records of HNO₃ and HNO₄ in the Antarctic winter.

In addition to the absolute relevance of the data themselves, unique until now, the conditions in winter in these regions (absence of sunlight) allowed to use coastal Antarctica as a “natural laboratory” and to quantify physical exchange processes.

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This study is a highly relevant contribution for the scientific community and should be published in ACP. The manuscript is well structured and fully understandable. Therefore no major revisions are required for publication, and I have just a few minor questions to the authors:

1) Atmospheric measurements indicate rather unchanged HNO₄ mixing ratios over all the winter (see Figure 1). Since no atmospheric HNO₄ sources are likely at that season a overall positive net flux out of the snow would be needed to maintain the atmospheric HNO₄ mixing ratios unchanged over this long period in view of the limited lifetime due to thermal decomposition of this species (to my knowledge around 10 to 20 hours at -30°C). If true, the question would arise how this HNO₄ winter reservoir in the snow has been built up ? Is it possible that this is created during summer, in spite of an even shorter lifetime in summer than in winter and a rather restricted available amount of NO₂ to proceed with the NO₂ plus HO₂ production reaction (a few pptv of NO₂ at noon at Halley in summer, Bauguitte et al. 2012) ?

Could drifted snow from inner Antarctic sites (more rich in HNO₄) can contribute to the HNO₄ snow reservoir at the coast ?

What HNO₄ snow concentrations would be needed at the end of summer to create the required HNO₄ winter reservoir?

Is it possible that the snow reservoir is refilled (also in winter) due to precipitation events which wash out the atmospheric HNO₄ ?

Did you detect a change of HNO₄ (and HNO₃) mixing ratios after a precipitation event?

2) You assume that measurements made at 5 m height are representative to interstitial concentrations. What makes you sure of that? Was it possible to do any measurements on site in the snow interstitial air ?

Couldn't it be possible that at least for HNO₄ interstitial concentrations are systematically enhanced in view of the expected overall net flux out of the snow (see comment

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above)?

Is it possible to estimate the gradient (and with that the net flux) between atmosphere and the interstitial air via the atmospheric lifetime of HNO₄ and the diffusive coefficients in atmosphere and the interstitial air?

3) Could you report an error estimation for the enthalpy calculations?

4) Is it straight forward to compare the ratio of HNO₃ and HNO₄ obtained at Halley with the one obtained at the South Pole since species do not have the same lifetime?

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 12771, 2014.