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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The fate of NO_x emissions due to nocturnal oxidation at high latitudes: 1-D simulations and sensitivity experiments" *by* P. L. Joyce et al.

Anonymous Referee #2

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This paper is fine as it stands however there is a conspicuous absence of any discussion of the sensitivity of the N2O5 uptake frequency and the assumption used in the model. The authors should provide a far more detailed discussion of the effects of gamma (N2O5). The parametrization of Betrand and Thornton has been shown not to work in the ambient and in any case the simple size independent approach used in this study is coarse and unlikely to be true. There are number of papers which discuss the appropriateness of various gammas and the authors should give a deeper discussion. If gamma is composition depend as a number of studies have shown (organic content, nitrate, etc) then if the composition is size depend then gamma will be size dependent

over a number or orders of magnitude. I am aware that the authors do not have a highly detailed set of particle measurements available, but this is why they should present a far more detailed analysis of the effect of variable gammas on their model results as it is likely that the assumptions in the particle distributions and gammas is a large portion of the uncertainty.

Other points.

The referencing is sparse and previous measurements of N2O5 and measurements of N2O5 heterogeneous losses are not cited widely. There have been others measurements of N2O5, nocturnal nitrate and ClNO2 production in the USA and even outside of the USA. Conversely there is an inappropriate reference given for measurements of N2O5 (Sommariva et al. 2009). I have read through this paper again and not found any N2O5 data presented. There is a mention such data exists, but it is not discussed or presented. The analysis concerns ambient measurements of NO3. There are other studies which explicitly show data, why not cite one of those?

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 7385, 2014.