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Atmospheric Chemistry and Physics Discussions

Interactive comment on "NAT nucleation and denitrification in the Arctic stratosphere" *by* J.-U. Grooß et al.

Anonymous Referee #1

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Review of ACPD-13-22107-2013 NAT nucleation and denitrification in the Arctic stratosphere

In general this paper is well written, and I only have a few specific comments and suggestions.

Abstract: There are also models using equlibrium approaches for PSC formation, i.e. not nucleation rates. Whether these could be affected by the finding would be interesting, e.g. to what extent does the new parameterisation change O3 depletion?

P22112, L24: What does "critical Lyapunov coefficient" mean? I assume it has to do with how fast you assume full mixing?

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P22113, L16: I see no need for "respectively" here. P22113, L16-17: Just out of curiosity, does JPL consider Plenge et al (2005)? Could add a note that the suggestion of Suminska-Ebersoldt et al (2012) is based on comparison with measurements?

P22114, L29: "simulation with" -> "simulation below 350 K with"

P22118, L10: "As a rule of thumb ..." Not very scientific; please rephrase. Also, where does this "rule" come from? Is it based on e.g. Hanson and Mauersberger 1988?

P22118, L26: "above": perhaps "poleward of" or "higher" is better?

P22119, L5: "minor deviation" and "slightly too low altitude reduction": But you are still about a factor 2 off close to the lower boundary, so "slightly" is a bit misleading, even though you talk about the rate. I would remove "minor" and add e.g. "... below 400K, leading to about a factor 2 difference at the lower boundary."

P22119, L9: "extremely well": I think the correct wording is "very well".

P22119, L12-14: "is unlikely to contribute..." It took me some time to understand the meaning of this; but I wonder if the sentence could be clearer. If the profile was off at high altitudes, then it could be the calculated denitrification is wrong. But at first reading it was not completely clear to me that "in these fields" was at high altitudes only. What if you later fail to model H2O and HNO3 transported into the vortex from above? I think you should remove "any" and perhaps rewrite "from observed", e.g. "to deviations of modelled PSC properties or denitrification, compared to obsevations".

P22120, L8: "under-estimate" -> "underestimate"

P22120, L26: "enough particles": What is enough? Be specific.

P22121, L21: "to a far greater degree": Although the extent is larger, the pattern differs greatly also for HR vs CALIOP. It may be an idea to skip "far", since it suggests that HR is much better?

P22122, L5: "simulation" -> "simulations"

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P22122, L11: Suggest rewrite: "less than that of" -> "smaller than in"

P22123, L3: Suggest "to investigate" -> "for investigating and evaluating"

P22123, L8: "sufficient number": Be specific.

P22124, L17: Comma after "Especially"

P22124, L21: The ERA-Interim data, is that 6-hour temporal resolution?

P22126, L10-11: But for O3 studies, it does not seem to be of much importance? Other than the fact that one should have the best physical parameterisations as possible. Is perhaps this also a finding of the study?

Figure 4: "grater" -> "greater"

Figure 11: NOy: At highest altitudes the model underestimates. Any thoughts on this? Source missing? Below 650K there is an overestimation. Is the vertical downwelling too fast?

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 22107, 2013.