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Interactive comment on "Growth of upper tropospheric aerosols due to uptake of HNO_3" *by* S. Romakkaniemi et al.

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We thank Referee 1 for the comments. In general, we agree that the ability of low temperature H2SO4 aerosols to condense HNO3 is well known. However, to our knowledge, the effect of HNO3 on the hygroscopic growth of UT sulfate aerosols has not been quantified so far.

Response to detailed comments:

1. The figure captions are not very informative and should carry more information.

We will improve the figure captions for the revised version of the article.

2. Size distribution

Geometric mean diameters and standard deviations of the distribution A in table 1 are the same as reported by Petzold et al (2000). Number densities are slightly adjusted from those measured at S = 0.53 (see table 4 in Petzold et al. 2000) to get better agreement with observation data at low saturation ratios (see figures 5 and 6). In distribution B there is an extra letovicite mode and so the geometric mean diameter of mode 1 needs to be smaller than in distribution A to keep the results in agreement with observations at $S < 0.5$.

When the distribution is varied, the most important thing is to maintain agreement between results and observations at low saturation ratios. To do so the relative number concentrations of different modes can not be changed dramatically. With lower total number concentration the HNO3 effect is naturally stronger. That would increase the ratio of haze mode particles to all particles but at same time the ratio of accumulation mode particles to all particles would also increase. We could also change both mean diameters and standard deviations so that results still agree with observations at S <0.5 but it was found that best overall agreement is achieved with values close to those given by Petzold et al (2000) and used in the paper.

3. Backward trajectories

We have now carried out the trajectory analysis and it supports the assumption that air masses close to the polar tropopause can be influenced by boundary layer air masses from lower latitudes and can thus carry chemical species of continental origin. We will add these results to the revised version of the article.

4. HNO3 concentration

As mentioned in the end of a case study section, the VMR of a HNO3 during

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the POLSTRAR 2 experiment was of the order of 1 ppb. For more information the reference to Krämer et al. (2003) is given in the same paragraph.

References

[1] Krämer, M., Beuermann, J., Schiller, C., Grimm, F., Arnold F.,Peter, Th., Meilinger, S., Meier, A., Hendricks,J., Petzold, A., and Schlager, H.: Nitric acid partitioning in cirrus clouds: a synopsis based on field, laboratory and model studies, Atmos. Chem. Phys. Discuss.,3, 413-443, 2003

[2] Petzold, A., C. Hoell, C., Kärcher, B., Beuermann, J., Schiller, C., Ziereis, H., and Schlager, H.: In situ observations of aerosol properties above ice saturation in the polar tropopause region, J. Geophys. Res., 105, 29387–29395, 2000

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