

Interactive comment on “Growth of upper tropospheric aerosols due to uptake of HNO₃” by S. Romakkaniemi et al.

Anonymous Referee #1

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Based on a thermodynamic equilibrium model, the authors study the uptake of HNO₃ on aerosol particles in high relative humidity conditions. The model results are compared with airborne observations taken at the polar tropopause. In support of observed tendencies of aerosols to grow when air masses cool, it was found that HNO₃ may contribute significantly to haze particle size.

It is well known that aqueous sulphuric acid is able to condense HNO₃ at cold temperatures. It is also known that the presence of ammonium in solution may considerably enhance uptake of HNO₃ by further lowering its saturation vapor pressure. Insofar this study does not reveal any new aspect, rather the interesting part comes from a comparison to actual in situ measurements.

I find the model approach sound and straightforward. The role of letovicite is nicely

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

It is the comparison with the particle data that raises some questions that must be addressed in a revised version of the work.

I am confused why the authors do not use the same average aerosol size distribution parameters as quoted by Petzold et al (in their Table 4) ? How sensitive are the results upon variations of the initial aerosol size distribution and the size partitioning of ammonium/letovicite ?

Obviously, the model requires a phase change to explain the observed step-like increase in haze particle concentrations with increasing relative humidity. How realistic is the presence of letovicite at the point of measurements and what could be the range of possible concentrations ? Backward trajectories may provide more insight and further support of the model assumptions.

At the very end, the authors state that "required HNO_3 levels were on the order of 0.5–2 ppb." But how much HNO_3 was actually around during the measurements ? Was HNO_3 observed, and if not, what are typical HNO_3 mixing ratios at this location and time of the year (1998) ?

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 121, 2004.

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