

## ***Interactive comment on “Growth of upper tropospheric aerosols due to uptake of HNO<sub>3</sub>” by S. Romakkaniemi et al.***

### **Anonymous Referee #1**

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Several remarks of the second reviewer are similar to the points I have raised in my report (in particular concerning aerosol size distributions and chemical composition of modes); here, I will take up a few issues from the reply of S. Romakkaniemi et al to my own review that warrant further discussion.

1. The authors stress that “to our knowledge, the effect of HNO<sub>3</sub> on the hygroscopic growth of UT sulfate aerosols has not been quantified so far”.

This statement ignores that fact that at least two of the papers cited by Romakkaniemi et al do present a discussion of these effects (Karcher and Solomon, 1999; Lin and Tabazadeh, 2002).

2. The authors state that, after having carried out trajectory analyses, “air masses close to the polar tropopause can be influenced from boundary layer air ...”.

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As it is stated, this general view is undebatable. In their study, the authors should be able to provide very strong arguments that the air masses during the measurements had been perturbed by air probably containing significant amounts of ammonium, i.e., the trajectories indeed emerged from ammonia source regions.

3. The authors refer to 1 ppbv of HNO<sub>3</sub> being measured during POLSTAR 2.

I find no definite reference for that value. Petzold et al, who performed and analyzed the measurements under scrutiny, quote no measurements of HNO<sub>3</sub> made during POLSTAR 2, but use an upper limit of 0.5 ppbv measured under similar conditions during POLSTAR 1. Kramer et al, in their Table 3, quote inferred total HNO<sub>3</sub> mixing ratios of 0.26 and 0.57 ppbv for POLSTAR 2. Schneider et al 1998 report midlatitude measurements, but does not provide information about POLSTAR 2.

In summary, it is mandatory that Romakkaniemi et al clarify the above issues 2 and 3, because their POLSTAR 2 analysis strongly relies on robust estimates of NH<sub>3</sub> and HNO<sub>3</sub>. If necessary, uncertainties in underlying assumptions must be spelled out more clearly.

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