

Interactive comment on “Composition analysis of liquid particles in the Arctic stratosphere” by C. Weisser et al.

Anonymous Referee #1

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The MS shows interesting measurement on PSC by different in-situ instruments. In the present MS, discussions are focused on HNO₃ and HCl uptake by liquid aerosol.

The topic is highly relevant to the polar stratospheric research. The paper is well written. The figures are in good form.

I have two major concerns, which have to be considered in the revised MS.

Major comments

1) HNO₃ concentration: The disagreement of measured and simulated H₂O/HNO₃ ratio is too big to be understood. A ratio of 10 (measured value) means a HNO₃ concentration of 26 wt%. We know that a) the temperature is above T-ice. b) the aerosol volume is about 1 μm³/cm³, corresponding to 5-10 ppb HNO₃ with the rest mostly of

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water (H_2SO_4 amount is negligible small (~ 0.2 ppb)). In order to remain above the frost point, an acid concentration (the sum of H_2SO_4 and HNO_3) of more than 40 wt% is required. The authors report a 26 wt% at high aerosol volume. The missing 14 wt% of acid can not be H_2SO_4 , because its mixing ratio is too small. A nearly binary 26 wt% HNO_3 is unlikely and is well below the frost point. I see no good alternative than to increase the HNO_3 concentration as the models predicted. 2) HCl concentration: The HCl concentration depends strongly on the gas phase concentration. The assumption of 1 ppb is highly uncertain. At such low temperatures, the gas phase HCl could be already mostly activated. In order to make a reliable comparison, the knowledge on gas phase HCl in the local cold air is necessary. In such cold air with large surface area, the lifetime of ClONO_2 and HCl could in order of several hours. The assumption of 1 ppbv HCl is questionable.

Minor comments:

1) Page 2516, line ~15: The Paper Luo et al (GRL,1994, 21) discussed exactly the solubility of HCl on T., see their Fig.3. This paper should be cited. 2) Page 2518, line 20-21: §The color index Ęindicator of the particle phase, indicating solid particlesĤ, The color index is only a indicator of size, not a indicator of phase. 3) Page 2522, line 20-21: §If they have enough time and if there is enough gas phase nitric acid available they reach equilibrium, which here seems to be the case.Ĥ The presence of large amount of HNO_3 is not a condition for HNO_3 equilibrium. The equilibrium time constant is controlled by the available surface area. It is true that due to the H_2O and HNO_3 uptake, equilibrium time constant becomes smaller due to increased surface areas.

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 2513, 2004.

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