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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Homogeneous nucleation rates of nitric acid dihydrate (NAD) at simulated stratospheric conditions – Part II: Modelling" *by* O. Möhler et al.

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Reply to the open comment by A. Tabazadeh

As mentioned in the manuscript, the saturation ratio of nitric acid dihydrate (NAD) is calculated from the nitric acid saturation or equilibrium pressure with respect to the liquid phase divided by the saturation pressure over solid NAD. The liquid particle composition and the activities of water and nitric acid are of course considered for the calculation of the vapour pressures. Therefore, the NAD saturation ratio S_{NAD} also regards the liquid particle composition. We think there is no need to change any plot axis here.

The only fit line in our manuscript that refers to literature work is the dashed line shown

in Figure 1 which is taken from the paper by Salcedo et al. (J. Phys. Chem. A, 105, 1433, 2001). No fit lines are shown here referring to the work by Tabazadeh et al. (J. Phys. Chem. A, 106, 10238, 2002).

We do not insist that the nucleation of NAD in binary solution particles is volume-driven. We first of all trust our own experimental results and conclude that both the parameterisation by Salcedo et al. (2001) and Tabazadeh et al. (2002) are insufficient to explain what we observe. In comparison with all available literature data sets we believe to have strong evidence that there is reasonable agreement between the different data sets if we apply the activation energy parameterisation as suggested. At least we can very well explain and reproduce our own experimental results with respective model runs. In the revised version of the paper we give an estimate for uncertainties of the nucleation rate, NAD saturation ratio and activation energy. Error bars can only be shown if available. Most of the previous papers on NAD nucleation did not report all errors needed to calculate the uncertainty for S_{NAD} or the activation energy. Therefore we omitted error bars in Figures 1 and 2.

We believe to know well how to interpret our experimental data. Concerning the paper by Lu et al. (Appl. Phys. Lett., 87, 184107, 2005), there is another recent paper (Duft and Leisner, Atmos. Chem. Phys. 4, 1997, 2004) which shows evidence for volume-dominated nucleation of ice in supercooled water microdroplets. Recent measurements of ice nucleation in water droplets with diameters between 5 and 10 μm using our AIDA facility (Benz et al., J. Photochem. Photobiol. A, 176, 208-217, 2005) very well agreed with the volume-based nucleation rates measured by Duft and Leisner (2004).

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