

Interactive comment on “Parameterization of N₂O₅ reaction probabilities on the surface of particles containing ammonium, sulfate, and nitrate” by J. M. Davis et al.

Anonymous Referee #2

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The paper under review presents a parameterization of the reaction probability for the heterogeneous hydrolysis of N₂O₅ on dry and aqueous ammonium sulfate and ammonium nitrate aerosol particles. The parameterization is based on laboratory measurements published in the recent literature and includes the effects of relative humidity and temperature. The new parameterization was then applied in a 3D CMAQ simulation for the eastern United States.

The adequate treatment of the heterogeneous hydrolysis of N₂O₅ in comprehensive atmospheric chemistry models is currently an important open question. Hence this paper clearly addresses a relevant topic and falls nicely within the scope of ACP.

The strength of this paper is that it presents a parameterization that, for the first time, unifies recently published laboratory measurements for γ on ammonium sulfate and ammonium nitrate aerosols. An objective method is used to determine the regression coefficients of this parameterization. It will be easy and very useful to implement this parameterization in current 3D atmospheric models. The paper is clearly structured, and well presented. I recommend publication after some comments are taken into account.

1. A conceptual concern is the following: As the authors point out themselves (p. 16122, line 14), the laboratory procedures differ considerably from one another. Is it therefore legitimate to base the parameterization on the collection of all of the seven studies? In other words, could (part of) the dependence on RH and/or temperature be introduced by combining data from different sources?
2. The dependence of γ on RH for the dry particle case seems strange and non-physical (as the authors note themselves). The authors mention a potential interference with the homogeneous hydrolysis reaction. Despite the fact that the data gives this dependence when the fitting procedure is applied, I suggest that it is not implemented in the parameterization and a constant value is applied instead.
3. Since the authors have carried out simulations with CMAQ and show plots for γ , it would be interesting to see what impact the different formulations have on, e.g. aerosol nitrate or nighttime NO_3 . In particular, is including the RH and/or temperature dependence really important for the results?
4. The labels in Fig. 1, 2, and 3 are very small. Especially the labels on Fig. 2 are unreadable and should be improved.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 16119, 2007.

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