

Interactive comment on “The Acidity of Atmospheric Particles and Clouds” by Havalá O. T. Pye et al.

Anonymous Referee #2

Received and published: 13 November 2019

Pye et al. provides a detailed review concerning aerosol and cloud acidity. This is a much needed review, as the studies concerning aerosol acidity has increased. I applaud the large author list on this work, as it is very extensive and impressive. The review provides a much needed discussion concerning various aspects of cloud and aerosol pH, including definition, measurements and calculations, observations, and comparisons with models. I foresee this paper becoming an important source, both in the field and for introducing this subject in classes. This paper should be published upon consideration of the following comments:

- 1.) Similar to Reviewer #1, occult is not a term that I am familiar with. If it could be defined, or a synonym could be used, that would be appreciated.
- 2.) I appreciate Table 1, as there are numerous abbreviations throughout the

manuscript. However, there appears to be some abbreviations missing, such as NVCs. Please include all abbreviations in the manuscript into Table 1, as it can be hard to find them in this large manuscript.

3.) I think a Table that summarizes Section 2.6 would improve the quality of the paper. This will be one of the many reasons people will want to read and cite the paper, concerning a discussion and comparison of the thermodynamic models in order to calculate pH. Including a table that summarizes how each model calculates pH, the pros and cons of each model, any assumptions, and etc., would help the readers remember that discussion better.

4.) Throughout the sections, it is apparent that different people wrote them with different styles coming through in each section. For example, some sections briefly state future research while other sections devote a subsection about future research (and some sections do not have any discussion about questions/future work). Starting with at least Section 3, if not some aspects of Section 2 (i.e., Measuring pH), it would be beneficial for the authors to include a description of what they consider future questions/work to be.

5.) For Section 3, it would be good to include a couple of items in discussion, including: (a) How many of the reactions have been conducted for dilute, laboratory conditions, therefore, for aerosol, where the ion activity is higher and water is lower, there is large uncertainty in how the reactions may occur. (b) How there is debate occurring the field about various reactions (e.g., production of sulfate in aerosol in China) and the questions/future studies needed to move this questions forward. (c) N₂O₅ chemistry appears to be missing in your discussion throughout, including in Section 5.

6.) For Section 8, a table that summarizes the CTMs with the thermodynamic models they use and the species they use to calculate pH would help with the discussion.

7.) For Section 9, I appreciate that it summarizes the very large review. However, at this point, I really think a description of remaining questions, studies, observations and

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future outlook is necessary so that we, as a community, know what should be done to move forward.

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