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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The Acidity of Atmospheric Particles and Clouds" *by* Havala O. T. Pye et al.

Anonymous Referee #1

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This is an excellent and thorough review of the current state-of-science on the acidity of atmospheric aerosols and droplets. Below are some comments intended to improve the manuscript:

1. The Abstract is focused on the electrolytes and does not discuss the organic fraction and its contribution. Something should be mentioned about organic bases, such as amines, and organic acids such carboxylics and dicarboxylics.

2. Same in section 1 around line 22.

3. The use of the world "occult" is completely foreign to me. It should at least be defined, but better would be to use a word more familiar.

4. Page 4, line 32. Nicotine (and cocaine for that matter) are organic bases. increasing

pH partitions these compounds to the gas phase (so-called free-basing). The gaseous compounds have a much higher deposition efficiency to the respiratory tract than particles increasing the dose.

5. section 3, page 17, line 26. Change The to This.

6. Section 5, page 30, line 17: Why do you say that cloud liquid water is not in equilibrium with the gas phase? Well, nothing is completely in equilibrium but the surface area in a cloud is huge so equilibrium is nearly attained.

7. The authors many not be aware of the work by Beverly Cohen published in 2000 using a metal plate to assess aerosol acidity.

8. Page 33, section 5.1.3, line 31: Comment should be common.

9. Page 58, lines 22-27: Something should be said here about the role of volatile acids (HCl, HNO3) and bases (NH3, amines). If these exist in the gas phase, they serve to equilibrate acidity across the particle size distribution. If the particles are so acidic that the volatile bases are depleted from the gas phase, I can see how there could be a gradient in acidity with particle size. Likewise for the particles being alkaline and the volatile acids being depleted. As the authors discuss elsewhere, these gases are key to understanding the acidity of particles but unfortunately they are infrequently measured. I encourage a simple discussion of this logic.

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