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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Particle hygroscopicity during atmospheric new particle formation events: implications for the chemical species contributing to particle growth" *by* Z. Wu et al.

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Wu et al. presented an interesting observation of two different NPF events at a mid-mountain site in Germany. I find these observations strikingly similar to a study we conducted at a mid-mountain site in the Sierra Nevada Mountains in California presented by Creamean et al.1 We observed two different periods of NPF events during the 2-week winter study; with contribution of amines and sulfate to the growth of the newly-formed particles. Further, our study presented direct measurements of the newly-formed aminium sulfate particles as being CCN-active, thus highlighting the broader impact on cloud formation in mountain regions. Wu et al. speculated the

contribution of organics in addition to sulfuric acid to their observed NPF events. A discussion about the contribution of amines was briefly presented, citing studies conducted by Smith et al. (2010) and Barsanti et al. (2009), both excellent references for the case of amines.

I wanted to make the authors aware of the similarities between their observations and those presented in Creamean et al. Both sites appeared to be fairly remote, mid-mountain locations. The growth rate (5.0 nm/h) was within the range of our calculated growth rates (2-8 nm/h) and similar to those calculated by Lunden et al.,2 which were 1-7 nm/h at another fairly remote, mid-mountain site. Wu et al. also suggest ammonium may contribute to condensational growth via neutralization of sulfuric acid, although the concentrations of ammonium were quite low and only contributed to 18% of particle volume. We also suggest ammonium likely did not contribute greatly to particle growth due to a lack of a correlation between particles with sulfate and ammonium (see Figure 4 in Creamean et al.). We did however see a strong correlation of sulfate with amine species (Figure 4 in Creamean et al.), in addition to an increase in particles containing amine species throughout the course of the NPF events (Figure 3 in Creamean et al.). Our mass spectrometric technique (aerosol time-of-flight mass spectrometry or ATOFMS) enables us to examine the size and chemical composition of individual ambient particles, therefore, we observed amines and sulfate present within the same individual particles during the NPF events in the Sierra Nevada Mountains. Although the Wu et al. allude to the fact that organics could be responsible for particle growth, and that amines may contribute, more emphasis could be placed on amines due to the recent observations presented in Creamean et al. and the similarity between the sites. Amines are stronger bases than ammonium and have been shown to displace ammonium in sub 3-nm clusters by Bzdek et al.,3 which might be a useful point for Wu et al. to address.

Overall, the observations presented by Wu et al. were intriguing. However, the authors might benefit by comparing observations with Creamean et al. due to the similarities

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that existed between the two different studies.

(1) Creamean, J. M.; Ault, A. P.; Ten Hoeve, J. E.; Jacobson, M. Z.; Roberts, G. C.; Prather, K. A. Measurements of Aerosol Chemistry during New Particle Formation Events at a Remote Rural Mountain Site. Environmental Science & Technology 2011, 45, 8208-8216.

(2) Lunden, M. M.; Black, D. R.; Mckay, M.; Revzan, K. L.; Goldstein, A. H.; Brown, N. J. Characteristics of fine particle growth events observed above a forested ecosystem in the Sierra Nevada Mountains of California. Aerosol Science and Technology 2006, 40, 373-388.

(3) Bzdek, B. R.; Ridge, D. P.; Johnston, M. V. Amine exchange into ammonium bisulfate and ammonium nitrate nuclei. Atmos Chem Phys 2010, 10, 3495-3503.

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/12/C2448/2012/acpd-12-C2448-2012-supplement.pdf

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 11415, 2012.