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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Gas/particle partitioning of water-soluble organic aerosol in Atlanta" *by* C. J. Hennigan et al.

Anonymous Referee #2

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This study investigated the gas/particle partitioning of water-soluble organic aerosols in Atlanta in summer 2007. An extensive dataset is obtained and the relationships between the fraction of total WSOC in the particle phase (Fp) and various parameters such as temperature, RH, NOx, organic aerosol mass, WSOCp, and ozone are examined in detail. While many of previous studies on gas/particle partitioning of SOA have been done in the chambers, this paper gives an excellent overview on gas/particle partitioning based on ambient data. By measuring the WSOCg and WSOCp simultaneously and carefully examining the various parameters that may affect the partitioning of WSOC, this work provides a powerful test of our understanding of the gas-particle partitioning in the atmosphere, particularly on the role of fine-particle water and heterogeneous reactions in SOA formation and growth. This paper is well-written; the results

are original and would be of great interest for the community, I recommend it to be published in ACP. I only have a few minor comments.

Specific comments:

1. Page 642, line 16 onwards. It was found that while the WSOCg have another maximum increase at night, there was no corresponding increase in the WSOCp. This is an interesting observation. The authors wrote "Smog chamber studies by Hallquist et al. (1999) observed significantly lower SOA yields from the reactions of NO3 with a-pinene, compared to reactions of NO3 with either b-pinene, delta3-carene, or limonene. Additionally, nighttime chamber studies by Griffin et al. (1999) observed significantly lower SOA yields from the ozonolysis of b-pinene than either the ozonolysis of a-pinene or the photooxidation of b-pinene". I understand that the author are citing these studies to suggest that it is possible that oxidation is taking place at night but not forming condensable products. However, the citations should be clarified. a. For instance, the first sentence is saying Y of NO3+a-pinene is less than Y of NO3+others, and the second sentence is saying Y of O3+b-pinene is less than Y of O3 + a-pinene and Y of OH and/or O3+b-pinene. Without knowing all these SOA yields, it is difficult to get an idea of what the authors are trying to get to. (These sentences make it sound like the authors trying to imply that "NO3+a-pinene" and "O3+b-pinene" may be the most important reactions here, and since their SOA yields are lower than other reactions, this may explain the lack of increase in WSOCp). b. At night, the monoterpenes can react with NO3 and/or O3. What is the typical ozone concentration at night? Do the authors think that the ozonolysis of monoterpenes at night is occurring at a significant extent in this study? Ozonolysis of monoterpenes typically have pretty high SOA yields, it is surprising that an increase in WSOCp is not observed with such an in increase in WSOCg at night. c. There are several recent studies pointing to the formation of SOA from reactions with NO3 radicals (e.g. isoprene with NO3 by Ng et al. 2008 and b-pinene with NO3 by Fry et al. 2009). Perhaps it is unlikely that the reaction of isoprene and NO3 is leading to the increase in WOSCg (as it is unlikely that isoprene mixing

ACPD

9, S620–S622, 2009

ratio increases that late into the night?), but what about the reactions of NO3 and b-pinene? Could the authors comment on why an increase in WSOCp is not observed with respect to this reaction? d. What is the cause of the decrease in WSOCg from midnight to 6am?

2. Page 646, line 17. What is the Henrys Law constant calculated in this study? Kroll et al (2005) determined an effective Henrys Law constant of 2.6e7 M/atm for glyoxal uptake on aqueous aerosols. How does the value from this study compared to that?

3. Page 647, line 7. It does not look like there is a definite conclusion from lab studies on the effect of RH on SOA formation. There are some other studies suggesting that higher humidity can result in higher SOA yields in monoterpene ozonolysis (e.g. Jonsson et al., 2006; Stenby et al., 2007). These work should also be cited. Certainly more laboratory work is needed in determining the effect of humidity on aerosol formation.

4. Page 649, line 21. If O3 is abundant, one would expect that ozonolysis should be contributing to SOA formation at night. This goes back to the question on why the WSOCp does not seem to be increasing with the increasing WSOCg at night?

5. Page 663, figure 1. The full scale should be shown (i.e. show the origin, also, the maximum of WSOCg observed is 73.1 ug/m3, but the x-axis is only up to about 54 ug/m3).

6. Page 664, figure 2. What is the average daily temperature profile? From this figure it looks like Fp varies over the course of the day (highest during the middle of the day). Is there a correlation between Fp throughout the day and the average daily temperature profile?

7. Page 668, figure 6. What is the aerosol composition used in performing the ISORROPIA calculations? And why? Also, what is the temperature used in the calculations?

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ACPD

9, S620–S622, 2009

Interactive Comment