Atmos. Chem. Phys. Discuss., 8, S4034–S4036, 2008
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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The influence of chemical composition and mixing state of Los Angeles urban aerosol on CCN number and cloud properties" *by* M. J. Cubison et al.

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Received and published: 23 June 2008

We would like to thank Referee 1 for the positive remarks and constructive comments on our discussion paper, which are highly appreciated and will be taken into account upon manuscript revision. Responses to individual comments are given below.

- *pg. 5643: the authors exclude from discussions the results at S=0.1 only for technical reasons. Can the authors prove that the disagreement between modelled and measured CCN at this saturation is not due to chemical or surface tension effects? I suggest them to add a brief comment on that.*

  The authors cannot prove that chemical or surface tension effects are not responsible for the gross over-prediction in the models at $S = 0.1\%$. However, it seems

unlikely that these effects lead to an overprediction:

According to Koehler theory, an increased surface tension leads to an increased critical diameter, and, thus, in terms of CCN prediction, to a smaller fraction of activated particles. In our model we assumed the surface tension of water due to the lack of any surface tension information. Increased surface tension has been only observed for inorganic salts - however, these increases are at most 10 $\%$ as compared to water in concentrated solutions, and much less in dilute particles as present close to saturation. Organic solutes tend to decrease the surface tension. Thus, a strong surface tension effect of organics would rather lead to an even higher over-prediction of CCN.

Other composition effects seem unlikely as well: The assumptions we made for the organics correspond to slightly hygroscopic or even non-activating species. We are confident that the representation of the inorganic fraction is reasonable due to the similarity in hygroscopicity of sulfate and nitrate salts even though the model does not consider the exact inorganic composition (cf Section 3). In order to predict a lower CCN number concentration a significant fraction of this inorganic fraction would need to be non-activating. As mentioned briefly in the text, a hydrophobic organic coating could such particles prevent from activating. However, such an effect seems only likely during low photochemical activity. But since we see the gross over-prediction at $S = 0.1\%$ independent of the time of day, we think that this effect might not be causing the strong bias. The text has been modified to reflect this discussion as follows:

The much larger over-prediction at the lowest $S = 0.1\%$ was also observed by Ervens et al. (2007). This has been attributed to problems with either temperatures (Roberts, G., personal communication) or high flow rates (Lance et al., 2006) in the CCN instrument, which may not allow for enough time for particles to reach sizes large enough to be counted by the OPC at the exit of the CCN chamber. Recently, Rose et al. (2008) noted that deviations between the measured su-

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persaturation and the flow model exceeded 20% for $S = 0.1\%$, which may also lead to over-prediction in the CCN model. Composition effects such as surface tension and-or other assumptions about soluble organics tend to increase rather than decrease CCN number, and thus cannot explain the observed discrepancies at $S = 0.1\%$. The results are thus shown for $S = 0.1\%$ for all the model schemes, in part to demonstrate the limitations of the instrumentation used in this work, but disregarded in the discussion.

- *I think that* scenarios *is a term more appropriate than model schemes. Actually, the model is the same, only the assumptions on chemical composition and state of mixing change. I also suggest to use only one mark for different scenarios; M or C.*

  To avoid confusion with supersaturation (abbr. to S), the different model scenarios are defined as cases. The word case and letter C should have been used throughout. Typographic mistakes have been rectified.

- *pg. 5666: Table 1 has a question mark after* size-resolved composition

  This typo has been fixed.

- *Fig. 4 will be more comprehensible if the legends will contain the same information as the legend of Fig. 10*

  Figure 4 altered as requested

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 5629, 2008.