Atmos. Chem. Phys. Discuss., 9, C3207–C3213, 2009
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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol optical properties relevant to regional remote sensing of CCN activity and links to their organic mass fraction: airborne observations over Central Mexico and the US West Coast during MILAGRO/INTEX-B" *by* Y. Shinozuka et al.

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Received and published: 23 July 2009

General Comments:

In the present work authors have examined relationship of chemical composition to cloud condensation nuclei (CCN) activities and optical parameters during the MILAGRO/INTEX-B aircraft campaign. The measurements were carried out over the Central Mexico City and the west coast of United States. The manuscript is carefully

prepared and well written considering the size of the data set reported. The data appear to be of high quality and of high relevance for atmospheric science studies and manuscript is within the scope of Atmospheric Chemistry and Physics (ACP). I recommend publication in ACP after the following points have been addressed.

Specific comments:

1) Introduction

1.1) I would suggest to include more references to other recent studies of CCN and aerosol optical properties applying similar and complementary methods (e.g. Wang et al., 2008, Sorooshian et al., 2008, Kuwata et al., 2008, Bougiatioti, et al., 2009, Rose et al., 2008b, Garland et al., 2008, Andreae, 2009, Kinne, 2009 and references therein)

1.2) Could you strengthen your argument on page 12522, line10 "Because aerosol chemistry……. impact the satellite remote sensing of CCN" with appropriate references?

1.3) Page 12522, line 12-16: Following up on the comment of Referee#1 (page C3176, point number 3 under specific comments) I would suggest to clarify the use and distinction of κ as an "effective hygroscopicity parameter" (assuming surface tension of pure water) as opposed to an "effective Rault parameter" (with variable surface tension). For more information see Gunthe et al. (2009 Sect. 3.3, page 3836), Pöschl et al. (2009, page 65) and references therein. Note that the following clarifying statement will be added in the revised version of Gunthe et al. (2009. Sect. 2.2). "The kappa values derived from CCN measurement data through Köhler model calculations assuming the surface tension of pure water have to be regarded as "effective hygroscopicity parameters" that account not only for the reduction of water activity of the solute ("effective Raoult parameters") but also for surface tension effects (Petters and Kreidenweis, 2007; Rose et al., 2008b; Pöschl et al., 2009)".

2) Experiement/Instrumentation

2.1) Please specify how pressure compensation was managed for all the instruments, in particular for the CCN which is highly sensitive to pressure changes (Lance et al., 2006, Rose et al., 2008a)

2.2) Please specify exactly which type of CCN counter was used (commercially available instrument from DMT)?

2.3) Page 12526, line 29: 0.18% supersaturation is not at the lower end of the range of the supersaturation in tropospheric clouds. In stratus clouds much lower values are typically found. Please reframe the statement.

3) Results

3.1) I would suggest including also the numbers of the estimated critical dry diameter from the US west coast measurements for orientation (page 12530, line 7)

3.2) Page 12531, line 13, I would suggest saying κ is close to 1 or something similar.

3.3) Page 12534, line 10, Please correct that AMAZE-08 tower was $\sim$39 m tall (not 110 m)

3.4) I would suggest testing the κ-OMF analysis/regression also on linear scale (in analogy to Gunthe et al., 2009). According to Petters and Kreidenweis, 2007, κ should depend (near) linearly on chemical composition (mass or volume fractions). It may be worthwhile to compare the goodness of fit (R2) on linear and log scales.

3.5) Page 12534, line 28 I would suggest calculating CCN number concentrations for different supersaturation levels assuming different values of κ. It would be interesting and helpful to see if you get a stronger dependence on κ, or if the variability is still totally being dominated by the variability of aerosol particle number concentration and size distribution. I feel this test will help to strengthen your claim. In addition please keep in mind that apart from number and size the available conditions of the CCN activation (amount of water vapor) tend to reduce the influence of κ even further as demonstrated by Reutter et al., 2009.

DeCarlo et al., 2008 have shown size distributions obtained from AMS measurements. It is apparent from those size distributions that variations in modal size are in the range of factors of 2-10. Clearly such variations would have a much stronger effect on CCN efficiency than composition variations of a factor of 2-3. The only way to really make a quantitative statement is to do a test along the lines of Dusek et al., 2006 where one compares the effects of using a fixed mean kappa and varies the size distribution using observations, and on the other hand, applies a fixed mean size distribution and varies kappa. You can then compare which better explains the observed variability.

Technical corrections:

Page 12521, line 7: Did you mean ..100-nm particles decreased with increasing organic. . .

Page 12521, line 8: OMF is accurately described here, on page 12532, line 4: Replace organic mass fraction (OMF) with OMF

Page 12522, line 23: Replace US with United States

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