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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Measurements of size-resolved hygroscopicity in the California coastal zone" *by* D. A. Hegg et al.

Anonymous Referee #2

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The manuscript presents size resolved growth factor data collected over the Pacific Ocean using two optical particle counters and nephelometers. A receptor model based on principle component analysis is used to represent the aerosol as mixture of three basic aerosol types, marine, polluted, and biomass burning. Sub- and super-micron hygroscopicity is modeled using the three principle components and the ZSR mixing rule and compared to the observed values.

Measuring and modeling aerosol hygroscopicity is an important topic that is well within the scope of ACP. However, the manuscript would benefit from a more clear presentation of the data and the statistical analysis. In particular it is not clear how the water contents were derived from the DHGF and scattering data and whether the water contents retrieved by the UNMIX model are realistic with respect to the source attri-

bution. Furthermore it is not clear how the forward calculation UNMIX-derived water contents yields component and in turn model-derived growth factors. I recommend the manuscript for publication after some clarifications are added to the manuscript.

Specific comments:

I would expect the largest particles (2-3 micron) to be composed mostly of sea-salt generated from bubble bursting. The composition of the largest particles should be affected least by organic coatings or processing with NSS-sulfate. Since sea-salt is clearly the most hygroscopic component in the atmosphere it is surprising that the DHGF spectra consistently show a decrease in hygroscopicity with size. Is this supported by the MOI data?

It should be explicitly stated what the RH range used in the AHS is. The method says "normally 45% and 85%" which leaves room for deviations from those values. If those occurred they should be specifically stated in the manuscript.

Optical detection of aerosol growth factors is subject to potentially severe measurement artifacts introduced by absorbing particles and a superimposed lensing effect, changes of particle refractive index with relative humidity, particle asphericity, and the dry aerosol refractive index (Snider and Petters, 2008). There is no discussion about these artifacts and the error bars shown in the figure do not show biases.

There is a lot of discussion about the measurement of light-scattering with RH. The only data shown are the calculated water contents in Table s1 and 2. It is not shown how these water contents were derived from these data, which requires knowledge of the size distribution, refractive index (real and imaginary), particle shape, and a scattering mode, or at minimum the assumption of a mass scattering efficiency and the humidity dependence of the mass scattering efficiency. Also the RH spread is different than that for the AHS method and it is not clear whether these water contents are comparable or not, i.e. normalized to dry aerosol mass. The authors should clearly state their assumptions and show that the two measurements give consistent results.

ACPD

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Interactive Comment

The authors should demonstrate that the water contents predicted by the UNMIX model are consistent with their interpretation of the sources, i.e. marine, biomass burning, and polluted. A comparison to literature values for these quantities should be performed.

The results shown in Fig. 9 are encouraging. If the water contents associated with the components is correct the variance explained by the PMF analysis should be similar to the variance in the modeled DHGF. This seems not to be the case, particularly with respect to the supermicron aerosol population. The authors should add some discussion on where this additional error is coming from and discuss the potential errors in the component DHFG spectra shown in Fig. 7.

Table 1: minimum and maximum seems to be switched

Table 1 and 2: Please give the units of the quantities. Also what is the RH associated with the water contents?

If I assume that all the units are in micrograms per m3 and that the RH is greater than 50% for the reported water contents it appears that the water contents reported in the tables is too small for an aerosol that is composed to 75% of sea-salt. (Sea salt has a growth factor of ˜2 at 80% RH and hence the water content is ˜8 times the initial dry mass. The mean water contents in Table 1 are on the order of the dry aerosol mass.)

References

Snider and Petters, ACP, 2008. Optical particle counter measurements of marine aerosol hygroscopic growth, 7, 1949-1962.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 10531, 2008.