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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A single parameter representation of hygroscopic growth and cloud condensation nucleus activity" *by* M. D. Petters and S. M. Kreidenweis

Anonymous Referee #4

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The authors propose that a single parameter (κ), which can give information of the particles hygroscopicity, can be determined by calculating it from Köhler theory or fitting hygroscopic growth and CCN activity data. The method is different from other formulations of Köhler theory since it does not require the knowledge of the aerosols properties such as density and molecular weight. κ for multicomponent systems was shown to follow the mixing rule.

Specific Comments:

Introduction

Köhler theory predicts CCN activity from physicochemical properties which are difficult to know in mixtures especially when organics are involved. It is not mentioned directly and the reason this is proposed is as a way to predict the critical supersaturation if a particle of a known diameter and hygroscopicity is known for single, multicomponent and atmospheric aerosols. Make the paragraph flow better.

As said in the paper, it has been found that organics contribute substantially to the mass concentrations of aerosols. Reference some papers.

In paragraph 2, what insufficient data? Be specific like molecular weight, dry particle density, etc.

κ -Köhler theory

Define Dd as dry diameter.

In Figure 1, κ values are shown down to 0.001. It is said that for κ > 0.01 have a slope of -3/2. What slope does the constant k line have for values of κ < 0.01. What is responsible of changing the slope?

Derivation of κ values for atmospherically-relevant species and particle types

How do you know what is the range for inorganics, hygroscopic organics and non-hygroscopic organics? Is this range based from calculations, observed data, literature values? If it based from literature reference it.

Again you mention up to κ values of 0.01, what species would fall in 0.001 < κ < 0.01 range?

Table 1 should be written in the form of instead of κ low and κ up.

Give reasons why you are assuming the surface tension of water. Also were there any surface tension measurements done in the papers you cite in which you can compare if κ is affected?

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Figures

Figures 1 and 2 could be put together.

In Figure 3, mention Equation (7) as the linear mixing rule used.

In Figure 4, write particle consists of ammonium sulfate and non-hygroscopic organic.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 8435, 2006.