Atmos. Chem. Phys. Discuss., 11, C4968–C4970, 2011
www.atmos-chem-phys-discuss.net/11/C4968/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Measurements of cloud condensation nuclei activity and droplet activation kinetics of wet processed regional dust samples and minerals" *by* P. Kumar et al.

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Received and published: 15 June 2011

Measurements of cloud condensation nuclei activity and droplet activation kinetics of wet processed regional dust samples and minerals P. Kumar, I. N. Sokolik and A. Nenes

This is another in a series of papers by this group dedicated to ascertaining the importance of adsorption as the mechanism of water uptake in the CCN activity of insoluble aerosol in the atmosphere. This is an important and timely subject, and appropriate to the scope of this journal. As these and other authors have previously shown it is important to implement insoluble CCN activation with a parameterization consistent with the appropriate mechanism. In this paper the authors present measurements of

particle size distribution, CCN activation and kinetics for several regional dust samples and minerals. There are two principle objectives of the paper. One objective is the comparison of CCN activity for laboratory aerosols formed by a 'wet generation' technique in this work with previous characterization of lab aerosols generated by a dry technique. The other objective is the derivation of a hybrid activation theory where both adsorption and solution based water uptake are admitted and weighted by the composition and adsorption characteristics of an aerosol comprised of both insoluble core and soluble shell. I find the results compelling and of significance. It is shown clearly through measurements of the dependence of critical supersaturation on dry diameter that the wet processed aerosols exhibit significantly different CCN activity than the more hydrophobic, dry generated samples. And more activity than is consistent with measured soluble components of these materials. The authors contend that the use of wet generation techniques have produced laboratory aerosol samples that are not representative of the atmospheric versions of these materials. These conclusions must be taken into consideration if future studies, as well as forming the basis of a reconsideration of past measurements. The new activation theory is well posed, and the constraints of equilibrium and constant activity are of course appropriate. The limiting forms of the theory are shown to be correct and calculations are compared to previous measurements of mixed aerosol from dry salt lake sources. This new theory will enable mixed aerosol to be appropriately parameterized without have to apply either KT or AT activation theory. Finally, the additional observation that the hydrophobicity of the large particle component of the wet generated aerosol was not affected by dissolution in the wet generation technique has very interesting ramifications for models of aging and transport, as the authors note.

I recommend publication with some minor modifications noted below.

The color labeling of Fig. 1b is not consistent with Fig. 1a,c or d. I believe that Dw and Dp indicate the same thing (wet diameter). This is a bit confusing. There is a typo on pg. 12585 ln. 26 "framework world" should be "framework would"