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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The role of organic aerosols in homogeneous ice formation" *by* B. Kärcher and T. Koop

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Dan Cziczo states that the atmospheric aerosol is most realistically described as an internal mixture of sulfate, organics, and perhaps further chemical components. This statement is based on measurements using single particle mass spectrometry.

We tend to agree with that view, especially when we deal with particles in the upper troposphere away from sources (see our discussion paper on page 6732, lines 8ff). The typical residence time of aerosols emitted at the surface required to reach the tropopause should be long enough to form internal mixtures of chemically complex particles (by coagulation or gas diffusion). One exception are liquid sulfuric acid and carbonaceous particles in aircraft corridors, which are emitted from jet engines in flight as external mixtures.

The motivation for choosing a two-mode appraoch is the lack of knowledge of size-

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resolved chemical composition and hygroscopicity, among other factors, of real atmospheric aerosol particles. We do not exactly know which organics primarily reside in which size category. Atmospheric observations (and available laboratory information on low temperature aerosol thermodynamic properties) are not yet detailed enough to better constrain the model.

However, technically, we expect our two-mode approach to be largely equivalent to using one aerosol mode with variable (size-dependent) solute mole ratios, except that we may not capture all possible effects that can occur during homogeneous freezing of complex aerosol mixtures. To this end, even chemically variable sulfate/organics mixtures simplify reality, as other chemical species and/or aerosol types are present as well at cirrus conditions.

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 6719, 2004.