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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Do atmospheric aerosols form glasses?" *by* B. Zobrist et al.

Anonymous Referee #2

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Do atmospheric aerosols form glasses? ACPD 2008

This manuscript presents calorimeter data showing that a variety of organic solutes prevent water from freezing in sufficiently concentrated solutions. Instead, the particles solidify to a glassy state. The data are clearly presented and it seems very clear that the glass transition is reached for these particles in an emulsion.

The major issue is that the particles in an oil emulsion cannot take up water in the same way that particles in the atmosphere can take up water from the gas phase. This limitation is clearly stated in the manuscript, but in places the atmospheric implications need to be a little more careful.

For example, the statement is made that "water uptake from the gas phase would be drastically impeded or even completely inhibited in glassy aerosols." This might be true, but I can also imagine a mechanism whereby the surface monolayer is more liquid-like

and can take up water, making it even more liquid. The rate of water uptake is then limited by the rate at which the liquid to glass phase boundary can propagate inward from the surface rather than diffusion in the glassy phase itself. The former rate might be faster. If so, it would reduce the significance for the atmosphere.

The excellent experimental data here merit publication even with this issue. Probably there could be some suggestions on what experiments are needed to determine if glassy particles can form under atmospheric conditions as well as in emulsions.

Minor comments:

Specify the "commercial water activity monitor."

I found Figure 9 difficult to understand: the x-axis is only qualitative and the smooth curve connecting the symbols seems imprecise. For example, does the relative humidity really reach a maximum between the uppermost symbols?

Another difference for atmospheric particles is that they can often take up nitric acid and perhaps light organic acids just before reaching the ice nucleation threshold. Would this additional inorganic content tend to stop glasses from forming?

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 9263, 2008.

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