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Comment

## ***Interactive comment on “Effects of relative humidity on aerosol light scattering in the Arctic” by P. Zieger et al.***

**Anonymous Referee #2**

Received and published: 11 March 2010

This paper presents new findings on the  $f(\text{RH})$  quantity in a region with large uncertainty in modeling due perhaps to a lack of such measurements. The dual-nephelometer method appears useful and would be beneficial if extended to other sites in the Arctic. The most surprising finding was that  $f(\text{RH})$  stays mostly constant throughout the observation period despite changes in composition and size distribution.

My comments refer to questions I had in order of appearance:

[1] ‘Observations made at the Zeppelin station are in general less affected by local particle production occurring in the surf zone and assumed to represent boundary layer conditions’ I do not follow the difference between the ‘surf zone’ and the ‘boundary layer’. To me they imply the same thing, although I suspect the authors mean differently. A simple clarification would make this sentence better, and perhaps explain why the

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local surf zone is not as important.

[2] Why is coarse mode fraction defined as  $D_{dry} > 462 \text{ nm}$ ? Modes have often have ambiguous definitions in the literature, and coarse is sometimes defined as particles greater than 1 micron, or even particles greater than 2.5 microns, and sometimes greater than 10 microns. Maybe a different term could be used, to avoid confusion with regulatory terms?

[3]How were soluble ions measured? I would expect ion chromatography to be used, but it was unclear what method was used.

[4]How is it possible to have losses in BOTH accumulation and coarse? Diffusion and Impaction are separate processes that should occur in different flow rates.

[5]"Kelvin effect is small for large particles. . .relevant to light scattering and absorption"

The term 'small and large' are vague. Again, I am confused by size definitions. This statement would be better if distinct diameter values were stated?

[6]Could the assumption of fixed refractive index (without an imaginary part) actually be controlling the rather constant optical properties? If chemical composition changes, then so should index of refraction. Especially with the seasonal influence of black carbon to the Arctic, which would add imaginary absorption.

[7] A HGF can be predicted with thermodynamic water uptake, as in the Ming and Russell papers that were cited. Which could be used as the  $g$  in your equation.

[8] Why 24-hour e-folding lifetime? What size has this decay?

[9]"No clear long range transport of pollution to the measurement site has been observed within our measurement period?" How do you know this?

[10] Could the last 3rd of the campaign be influenced by sea ice? This is when sea salt is higher if coming over Arctic. I recommend considering sea ice as sea salt aerosol source.

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My biggest comment is the feasibility of extrapolating the findings to the whole Arctic for the whole annual cycle. Especially when no long range transport was noticed, and when sea ice probably covered some of the ocean. Have you considered what might happen to the constant  $f(\text{RH})$  if biomass burning, long range pollution/dust and sea ice influence reached the station? This is not a pan-Arctic study, and these findings might be different in Alaska, Siberia or Iceland, where chemical influences vary by region.

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Interactive comment on Atmos. Chem. Phys. Discuss., 10, 3659, 2010.

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