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Interactive comment on "Aerosol light-scattering enhancement due to water uptake during TCAP campaign" *by* G. Titos et al.

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Titos et al. present and discuss in their manuscript the results of a measurement campaign at Cape Cod, Massachusetts, where aerosol optical measurements were measured for one year. The focus is the scattering enhancement factor f(RH) which is defined as the aerosol particle scattering coefficient at enhanced relative humidity (RH) divided by its dry value. This parameter was measured by a humidified nephelometer system for approx. 7 months within this year. f(RH) was analysed with regard to air mass origin and compared to other aerosol optical parameters like the single scattering albedo (SSA) and Ångström parameter. A parametrization is being proposed which allows estimation of f(RH) using the SSA as a proxy.

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Interactive Discussion
Discussion Paper

I have read this paper with great interest and would like to share some comments (and questions) to further improve the quality of this manuscript:

- The authors use a two-parameter equation to parametrize the measured humidograms of f(RH), but focus only on the discussion of the γ-parameter and ignore the intercept a. How did it vary for the different air masses? I would guess that $a > 1$ during sea salt periods, or? Looking at Fig. 7, I have the impression that all measured humidograms are slightly biased towards larger values at low RH (where it should, ideally, reach 1). Could this be an effect of the slight disagreement between the two nephelometers at dry conditions?
- Page 3367, Line 4: Was the difference between the two nephelometers accounted for when calculating f(RH)? Could the authors speculate on why the agreement is much better for PM_1 compared to the PM_{10}?
- If I am correct, it should be mentioned in the revised manuscript that the applied humidified nephelometer set-up will only capture the lower branch of the hysteresis curve and will miss the upper branch because no active drying (keeping the humidifier on maximum) is performed before the particles reach the second nephelometer (see Fierz-Schmidhauser et al., 2010).
- Page 3370, Line 24 and Sect. 4.2: We have made an interesting observation in the Arctic (Zieger et al., 2010) of compensating effects between size and aerosol hygroscopicity. At the beginning of the campaign we had mainly small and less hygroscopic particles compared to the end where large but more hygroscopic particles (mainly sea salt) led to the same magnitude of f(RH). Can this maybe also be seen in your data set, when e.g. comparing size distribution parameters to f(RH)?
- Page 3371, first paragraph: A nice way of showing the influence of sea spray on the deliquescence could be to plot $\mu = 1 - \gamma_{<65\%}/\gamma_{>75\%}$ vs. a size distribu-

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tion parameter (see Fig. 8 and Eq. 9 in Zieger et al., 2010). In the Arctic these parameters were clearly correlated.

- Sect. 4.4: I think the limitations of the proposed parametrization should be further discussed. It might be true that a simple site-specific proxy can be found to predict f(RH) at Cape Cod, but the same proxy can fail for another (even marine) site. We have done a sensitivity analysis to exactly address this question (see Sect. 6.3 in Zieger et al, 2013) because it was not possible to find one simple parametrization for all different analysed aerosol types. A reliable prediction, especially for climate models, will always need a full determination of the particle number size distribution (fine and coarse mode) and information on the chemical composition or particle hygroscopicity.

- How should a be treated within the proposed parametrization?

- Page 3363, Line 17: The authors should also mention recent studies of Zieger et al. (2011, 2012) where humidified nephelometer measurements were explicitly performed to validate or compare remote sensing measurements of the aerosol extinction coefficient with in-situ measurements at ambient conditions.

- Page 3364, Line 11: The longest campaign was actually 4 months long (Cabauw).

- Fierz-Schmidhauser et al. (2010) also performed PM_{10} and PM_1 measurements of f(RH) (actually together with the humidograph system of DOE/ARM).

- Page 3366, Line 7: Could you state the mean and standard deviation of temperature and relative humidity within the dry nephelometer?

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