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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Measured and predicted aerosol light scattering enhancement factors at the high alpine site Jungfraujoch" *by* R. Fierz-Schmidhauser et al.

Anonymous Referee #2

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General Comments

This paper presents interesting observations of aerosol hygroscopicity, which is closely related to the fate of aerosol particles (wet deposition), heterogeneous chemistry, cloud, and radiative forcing. Especially, Jungfraujoch is an important high alpine site for such related studies regarding the global background, long range transportation, and interaction between PBL and free troposphere. However, the results and discussion were not organized and described well enough. Some necessary technical details are lacking. A few shortcomings need to be addressed before it is published.

Specific Comments

Line 21-24 on page 3
Since the status of Schmidhauser et al. (2009) is “submitted”, the necessary technical details about the humidification nephelomter are needed. Did the authors modify the TSI nephelometer and use the humidifier control the relative humidity inside the nephelometer? Or the humidifier was set up in the upper stream of the nephelometer, then how was the relative humidity inside the nephelometer measured? By the internal sensor of the TSI 3563 nephelometer or any other extra sensor were mounted? Since there could be large uncertainties regarding the RH control and especially inside the nephelometer because of the light source heating in the sampling chamber.

Line 34-38 on page 3
The correction parameters given in Anderson and Orgen (1998) are particle size spectrum and chemical composition dependent. Since the nephelometer measured light scattering for total suspended particles, whether the no size cut parameters from Anderson and Ogren (1998) can be directly taken to correct the scattering coefficients measured at Jungfraujoch? Is the particle refractive index calculated with the AMS measure chemical compositions within the suitable range suggested by Anderson and Ogren (1998)?
However, especially during the dust events, the particle size distributions may be very different than those at normal conditions and the forward scattering increase significantly. Due to the changes of particles size spectrum, particle shape and chemical compositions, similar truncation simulation as in Anderson and Ogren (1998) might be needed to find out the specific correction parameters for the Jungfraujoch dust cases.

Line 23-25 on page 4 and line 13-19 on page 9
The authors should be careful to simply state that the $\sim$20% discrepancy between calculated dry/humid scattering and the measured ones were attributed to a systematic bias in the measured model input parameter. Because when the SMPS and OPC measured particle number size distributions were combined, a simple multiplication of the diameter by 1.12 (12%) were applied to the OPC data. Actually this cannot be

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described as a “slightly shift”, because the connecting point was at ∼340 nm. Around this particle size (accumulation mode), particle number concentrations are normally high, and they are also within the most efficient light scattering size range at mid-wavelength. So a “slightly shift” at this size range, may cause notable changes in the simulated scattering coefficients. Uncertainty analyses are needed for both scattering simulation and also the for the calculated enhancement factor for scattering coefficients by taking into account uncertainties of all the input parameters in the Mie calculations.

Line 48-49 on page 7 and line 32-38 on page 8
The changes of wavelength dependency in the time series of measured f(RH) is quite interesting. Do the authors think the universal correction parameters for the measure scattering coefficient might introduce some uncertainties into this wavelength dependency? Since Mie calculations were used to predict the f(RH), whether similar wavelength dependency were found in the calculated f(RH) as well when the input size distributions significantly changed during the dust events?

Line 40-43 on page 8
As described in section 2.2.1, the humidifier first raises the RH of the aerosol flow up to 95

Line 48-50 on page 10
Do the authors have some clue why the Nessler’s simple Ångström approach performs better even during dust events, what mechanism drove this results. . . ?

Figure 4 on page 22
If we take a look at specific RH range (e.g., 30-50%, 50-60%), the model (except Nessler’s approach in Figure 4d) has the tendency to underestimate the f(RH) at certain RH range, especially at lower RH range. What is the significance of this linear correlation? The uncertainties of the measured and calculated f(RH) need to be taken into account when doing the linear regression.

Technical corrections

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Line 24 on page 3
"which dries to aerosol to the desired RH..." should be "which dries aerosol to the desired RH. . .".

Figure 1 on page 19
It is hard to distinguish the light green and grey color in Figure 1a. And why not to add a time series of AMS data in to Figure1 too, for example, time series of sulfrate, BC and OC (or their percentage in particle mass).

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 20063, 2009.