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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Size-resolved and integral measurements of cloud condensation nuclei (CCN) at the high-alpine site Jungfraujoch" *by* D. Rose et al.

Anonymous Referee #1

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This paper presents measurements of size resolved and total CCN concentrations as well as aerosol composition and hygroscopicity from the high-alpine site Jungfraujoch. The authors do a good job of presenting the measurements and results and their data should contribute to the growing understanding of global aerosol hygroscopicity. However, there are a few changes which would improve the paper and make their results and conclusions more useful.

General comments:

The authors do a good job of describing the measurements and results, but draw very

few scientific conclusions from their data. Further, little explanation is given in the introduction for how these measurements add to or improve our understanding of aerosol hygroscopicity. For example, the authors state that the campaign averaged kappa value was similar to the generally assumed value for continental locations, 0.3, but then show that kappa actually changed significantly with aerosol size, air mass origin and weather events. Are these changes important or should modelers just use the campaign averaged value and not worry about these changes in hygroscopicity? Some discussion of the importance, or lack thereof, of these changes in kappa, perhaps discussing the importance of size resolved kappa representations in models or regional differences in kappa, would greatly strengthen the results of this paper and provide a more compelling motivation in the introduction.

The authors mention many other papers which present size resolved CCN and derived aerosol hygroscopicity but could do a better job of discussing their results in the context of these other studies. For example, Levin et al.(2013) performed very similar analysis comparing size resolved CCN measurements and AMS measured composition at a high altitude site. Their results are similar to those shown here with organic fractions increasing at smaller diameters, although overall their kappa values were lower. Paramonov et al. (2013) also found similar trends of aerosol composition and hygroscopicity with size. These, as well as other studies (Levin et al., 2012; Sihto et al., 2011; Gunthe et al., 2009), have also found background continental kappa values lower than 0.3 in areas far from human sources. The values of kappa shown in this work, therefore, seem to indicate some influence from anthropogenic sources. Some discussion of how the results presented here compare and differ from these previous studies and what, exactly, is represented by the measurements presented here (i.e. is this really a background site or representative of a mixture of natural and anthropogenic sources) would also greatly increase the utility of this work.

Specific comments:

Page 32579, Line 10: What is meant by "larger particles"? Give a specific size.

Page 32580, Line 20: Four distinct regions are identified from the HYSPLIT analysis, but only those from the easterly direction are discussed in the results. Some discussion should be included about air masses from these other directions, even if it is just to say that no changes in kappa or Nccn were detected. Have previous studies at this site seen any changes in aerosol type or concentration due to air mass origin?

Page 32581, Line 10: What RH was achieved in the heated inlet?

Page 32585, Line 26: Could the SMPS measured size distribution be used to calculate losses?

Page 32587, Line 2: Why was nitrate and not sulfate used to scale ammonium?

Page 32588, Line 28: Were gravitational and inertial losses accounted for? Could these explain the differences?

Page 32594, Line 26: An assumed aerosol density was used to convert AMS measured aerodynamic diameter to physical diameter, why not use the same assumed density here? Also, some mention should be made that using mass fractions instead of volume fractions will lead to an overestimate of kappa, since the density of the inorganic fraction is likely higher than that of the organic fraction.

Page 32597, Line 19: More discussion should be included as to the differences between these measurements and those made previously at this site, as well as other sites as mentioned above.

Figure 6: I suggest making this figure larger, or splitting it into multiple figures. As it is, it is hard to discern anything from it.

References:

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Interactive comment on Atmos. Chem. Phys. Discuss., 13, 32575, 2013.