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Atmospheric Measurement Techniques Discussions

Interactive comment on "A new experimental approach to study the hygroscopic and the optical properties of aerosols: application to ammonium sulfate particles" *by* C. Denjean et al.

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We would like to thank to reviewers for their helpful comments which surely ameliorate the quality of the paper. We realize that we omitted a number of important details on the experimental conditions and this led to a very severe misunderstanding of the interpretation and relevance of our results. We apologize for this. We have taken these comments very seriously into account to overcome these shortcomings.

We have also worked very hard to improve the quality of the writing in order to help the clarity.

Below, we provide a point by point response to the questions, comments and suggestions of the reviewers #1.

> The implications section (Sect 6) reaches fairly lofty conclusions that I think should be toned down, especially lines 3-7 on Page 6954. It is quite narrow to view only the existence of ammonium sulfate in the atmosphere. There are numerous other species in ambient particles including hundreds, if not thousands, of organics that can complicate the entire picture. In general I think the paper could do with either a reduced version of Section 6 or to just omit it

The reviewer is right when saying that the estimation of the aerosol radiative effect requires taking into account the aerosol temporal variability and thus the hygroscopic behavior of mixed aerosols. And surely we agree on the fact that more studies are needed to investigate the hygroscopic behavior of more representative aerosols in the atmosphere, in order to input it in a radiative code of a global circulation model. Previous global modeling treatment of aerosols assumed that aerosols are composed by a fixed chemical composition and usually by ammonium sulfate particles, which are the largest contribution to the global anthropogenic accumulation mode aerosol mass budget (Pilinis et al., 1995; Haywood et al., 1997; Boucher et al., 1998; Haywood and Boucher, 2000). More recently, the changes of chemical composition and the partitioning between nitrogen and sulfur species, their changes with time and space depending on the distribution of sources have been taken into account (Martin et al., 2004). In this approach, ammonium sulfate is still the most abundant species by mass, both at low and high relative humidities. However, this more sophisticated work, and others which followed (Deandreis et al., 2012) still consider than ammonium sulfate has a step-wise curve when considering the increasing branch of the humidity growth curve (deliquescence). This is exactly the specific point we addressed in our paper. Thus, we thought that the hygroscopic behavior of ammonium sulfate particles obtained in this article could be inserted in a radiative code of a global circulation model.

> Technical Comments Page 6936, Line 13: reader does not know yet what the “two

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methods" are. Clarify.

The two methods used to retrieve the complex refractive index have been more detailed in the abstract.

> Page 6938, Line 23-24: not necessarily. Several studies now show that there may not be a direct correspondence between the sub- and super-saturated regimes in terms of water-uptake behavior. See for instance Hersey et al. (2013): Hersey, S. P., et al. (2013), Composition and hygroscopicity of the Los Angeles Aerosol: CalNex, J. Geophys. Res. Atmos., 118, doi:10.1002/jgrd.50307.

We agree that the CCN activity of aerosols can be different from the extrapolation of GF to supersaturated conditions, especially for secondary organic aerosols or for an internally mixing of inorganic and organic aerosols. The sentence means that the CCN activity can be calculated from GF for some kinds of aerosols, but we understand that it was not clear enough. We specified in the text that this can be applied for inorganic particles.

> Page 6939, Line 25: change "particles" to "particle"

The correction has been made.

> Page 6940, Line 8: change "GF" to "GFs"

The correction has been made.

> Page 6940, Line 9: change "an" to "a"

The correction has been made.

> Page 6940, Line 11: change "scatter" to "scatterer"

The correction has been made.

> Page 6941, Line 17-18: "details" should be "detail"

The correction has been made.

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> Page 6945, Line 16: “was” should be “were”

The correction has been made.

> Fig 6 caption, line 3: the “of” at the end of the line should be removed

The correction has been made.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 6935, 2013.

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