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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Measurement of ambient aerosol hydration state at Great Smoky Mountains National Park in the Southeastern United States" *by* N. F. Taylor et al.

Anonymous Referee #2

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The manuscript describes measurements of aerosol hydration state at a Great Smoky Mountains National Park. The hydration state was measured using a novel instrument that operates similarly to the conventional HTDMA, but differs from it by using three different ways of conditioning the monodisperse aerosol flow. The aerosol is either 1) dried (RH is reduced below 15%), 2) humidified to force deliquescence and then returned to ambient RH, or 3) dried and then returned to ambient RH. Depending on the behavior of the particle size, it is generally possible to derive the hydration state of the particles, i.e. whether they are in the upper or lower hysteresis branch and whether or not they contain any water. The instrument and the results reported in this manuscript are unique and of considerable importance for the research community.

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Interactive Discussion
Discussion Paper

The manuscript is generally well written, though lengthy at times. It would probably be better to split the manuscript into two, one dealing with the instrument and its characterization, the other concentrating on the results of the field campaign. This, however, is a minor issue and the manuscript could be published as a single paper. I have only a few comments that should be addressed prior to publication.

Were any aerosol neutralizers used in the instrument? Their position should be indicated in the flow diagram (Fig.2.).

The output of the first DMA always contains multiple-charged particles. How were these multiple-charged particles accounted for when correlating modes measured at different RH (section 2.3.2)?

The internal enclosure is said to have been maintained at 29C. Was this so also during winter? I am concerned about potential volatilization losses of ammonium nitrate and semi-volatile organics that could affect the observed particle size changes.

The manuscript is missing some relevant citations. Martin et al. (2008) reported measurements of ambient aerosol hydration state using a similar, though differently implemented, approach . Work of Stanier et al. (2004), Khlystov et al. (2005) and Engelhart et al. (2011) on the water content and, thus, the hydration state of ambient aerosol should also be cited.

Figures 6 and 7: I do not think the color gradient as a function of size is needed here. It makes the picture more confusing and difficult to read. The minor tick labels are missing '.' before the numbers (should be '.9' or '0.9' instead of '9').

Figures 8 and 9: I suggest to remove the error bars. They represent the width of the mode, which does not really contribute to the story here, but obscure the midpoints considerably, making the figures very difficult to read.

References

Martin et al. (2008) Phase changes of ambient particles in the Southern Great Plains

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Interactive Comment

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Stanier et al. (2004) A method for the in situ measurement of fine aerosol water content of ambient aerosols: The dry-ambient aerosol size spectrometer (DAASS). Aerosol. Sci.Tech. V38, 215-228

Khlysov et al. (2005) Water content of ambient aerosol during the Pittsburgh air quality study. V110, D7, D07S10, doi: 10.1029/2004JD004651.

Engelhart et al. (2011) Water content of aged aerosol. Atmospheric Chemistry and Physics. V11, 911-920.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 21877, 2011.