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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Quantifying aerosol mixing state with entropy and diversity measures" *by* N. Riemer and M. West

Anonymous Referee #2

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Riemer and West present a nicely developed framework for quantifying aerosol mixing state that is deployable within the framework of a particle resolving model. The model framework is based on a suite of diversity metrics that have been used in other fields of study (e.g., Ecology). The study is timely and will likely serve as a stepping stone for future model development in this area and the testing of these models against a growing set of single particle measurements. I recommend that the paper be published, with the author's attention to a few general comments:

1)The mixing state framework appears to be primarily built around diversity measures. This is intuitive and the tables and figures support the use of diversity measures in quantifying mixing state beyond simply the extremes of internal and external mixing. However, I stumbled to see how the use of entropy helped to advance this understand-

ing? It was not clear in Section 2 whether entropy was a completely parallel concept with diversity, or whether part of the diversity argument was mathematically based entropy. Further clarification of the unique information that is gained from entropy measures should be included to justify its use in the title/abstract. I think this would help alleviate some of the confusion that it brings forth as many readers will be struggling to relate the thermodynamic interpretation of entropy to its use in this analysis.

2)The authors are commended for tackling this challenging question. It would be incredibly useful to the reader to have an assessment of how the properties that depend on mixing state (e.g., optical, water uptake, trace gas reactivity) would be incorporated into such a model. There are few laboratory experiments that are run on complex, known mixtures spanning ranges in mixing state. Is this a call for more laboratory studies on these types of system? Even if this information were available, how challenging would this be to implement (e.g., each particle in the population having a different value for hygroscopicity)?

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 15615, 2013.