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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol measurements at a high elevation site: composition, size, and cloud condensation nuclei activity" *by* B. Friedman et al.

Anonymous Referee #1

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Friedman et al. report on the relationship between physical and chemical characteristics of aerosol at a high-elevation site and their propensity for activation to cloud condensation nuclei (CCN). Significant variations in CCN activation are observed during the case studies detailed, and the description of the aerosol mixing state and composition afforded by the SPLAT instrument is very useful for investigating the influence of mixing state on the CCN activation.

A couple of expansions on the current discussion could significantly enhance the scientific content of this study:

The variations in the different observed particle classes, descriptions of the classes and the CCN activity are well described; however, an attempt to utilise the mixing state information from SPLAT (ie ratios of particle classes of interest) by correlating this to the CCN activity would, I feel, greatly enhance the impact of this study. Otherwise the reader is forced to study the time-series patterns and it is difficult to gauge to which parameter the CCN activity is most sensitive. Although SPLAT is not quantitative in the true sense of the word, if the %age of pure organic particles were to correlate inversely with the CCN activity, for example in the sulfate-dominated case study, this would be an important result. As would a lack or correlation, which would suggest mixing state is less relevant. I would recommend some carefully-selected correlations plots, showing trends or not, be included in a revised version of the paper.

One of the principal aims of such studies is, as indeed stated, to try an help simplify the description of aerosol chemical and physical properties required for global CCN modeling. The "kappa" parameter is often discussed in this light. The statement in this study that the observed kappa of $\sim$0.2 is consistent with that of sulfates and organics, whilst technically true, is tenuous and deserves a little more discussion than presented. This study indeed demonstrates kappa values in a similar range to those previously reported, but it is still lower than the components would suggest, particularly if SPLAT reports that 2/3rds of the particles are sulphate dominated. The authors state (18291 L16) that mixing state information is still required to assess the *individual* contributions to CCN, but the key for the models is how the bulk behaves (so they can do away with the need to account for mixing state). Can the observed kappa be related in any way to the SPLAT measurements? A correlation here would be most useful. A negative result is still worth mentioning.

Following an expansion of the discussion to include these two points, I would recommend publication in ACP; a deserving addition to the important global database being continuously assembled on this topic.

2.1. Please detail info only for the SPL site, and restrict funding agency plugs to the

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acknowledgements

2.2 I think it is optimistic to claim SPLAT can measure particle number concentation.

3.2 Replace "Salt Lake", with "Salt Lake City, population XX million" Particle class description is confusing: does "organic particles" include Org_Sulf or Org43_sulf aswell as the more "pure" Ox_Org and POA?

3.3 Emphasize that the CCN pattern is following the so4:organic ratio, this is presumably a mixing state issue rather than how much sulfate is on a given particle.

3.4 Last sentence: clarify that "the particles" are those <80nm diameter, if indeed that is the case.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 18277, 2013.