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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Chemical composition, microstructure, and hygroscopic properties of aerosol particles at the Zotino Tall Tower Observatory (ZOTTO), Siberia, during a summer campaign" *by* E. F. Mikhailov et al.

Anonymous Referee #3

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In this work, the authors combine several bulk chemical analysis and particle imaging techniques to relate hygroscopic properties of aerosols to their composition and morphological structure in ambient samples collected at a study site in Siberia. One of the most interesting contributions of this manuscript is the estimation of diffusion coefficient of water and its link to the phase-state of organic the phase. Overall, this is a nice manuscript that brings together observations with theoretical arguments to address an important topic to the ACP community. The manuscript is recommended for publication with a few minor revisions suggested below.

The authors infer much about the chemical and structural information from the single-particle images (Section 4.2) that seem outside of the analytical capabilities of the instruments and the figures provided. While a core-shell morphology appears to be present in particles shown in Figures 7d-f, it is not clear that they are solid organic shells since the images provided by Figures 5 and 6 do not match the spatial resolution of the structural variations. Furthermore, it is not stated how many of the observed particles shared this morphology so it is not yet convincing that the observed dehydration experiments of the larger population of particles can be explained by this proposition.

The inherent response time of the FDHA measurements to changes in RH is not mentioned, and it seems important in interpreting the timescales for evaporation of water estimated from Figure 10. Relevant arguments from past publications should be repeated here as the interpretation of evaporation timescales attributed to particle characteristics rests on this detail. Also, the authors attribute observed mass losses of hydration/dehydration to water instead of semivolatile vapors according to repeated cycles (Section 2.3.5); do the hydration/deydration points in Figure 8 consist of multiple cycles?

That mineral dust is not present in large quantities is argued by their absence from STXM analysis (Section 4.1) even while nss-potassium that is not due to burning and calcium. The detection limit for each element should vary according to the photon flux, sample response, and detector response at wavelengths corresponding to their ionization energies, so it is difficult to interpret this information directly from comparison of images across elements. The authors may wish to refer to absorption cross sections provided by CXRO for various elements (as the authors used to estimate N/O ratios) to justify part of the observed differences between calcium and O, N, and C.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 7837, 2015.