Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC1
https://doi.org/10.5194/acp-2021-590-RC1, 2021

Comment on acp-2021-590

Anonymous Referee #1

Referee comment on "Impact of Dry Intrusion Events on Composition and Mixing State of Particles During Winter ACE-ENA Study" by Jay M. Tomlin et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-590-RC1, 2021

General comments.

This manuscript "Impact of Dry Intrusion Events on Composition and Mixing State of Particles During Winter ACE-ENA Study" by Tomlin et al. measured aerosol particles collected during ACE-ENA study using CCSEM and STXM. They considered meteorology and back trajectories to understand the aging and sources of measured particles. The number of individual particle analyses is significant. The text is clear and well written. The conclusion is well supported by their observation. I have several suggestions regarding their figures and measurements, but overall, I support this paper to be published on ACP.

Specific comments.

1. (Page 4, Line 140-141) *After each flight, sample discs were sealed and refrigerated prior to transport for off-line multi-modal microscopy analysis.*

What temperature were the samples refrigerated? Could particles be exposed to high relative humidity (RH), i.e., above the deliquescence RH of sulfate or sea salt, in the refrigerator?

2. (Page 7, Line 231-234) *While "Carbonaceous" is the dominant particle-type found across all samples, we also see that the elemental composition of each cluster (Figure S5) has common contributions from C and O elements, suggesting substantial carbon content in all existing particles, likely because of condensation of organic content and coagulation of particles.*

What about the contribution from the substrate? Carbon substrate (which type?) could also emit C and O signals when the particles are thin.

3. (Page 7, Line 266-267) *The other cluster of "Aged Sea Salt" particles shows significant*

fractions of Na (~10%), but with substantially lower ratios of Cl/Na<0.1 which indicates chloride depletion (Figure S5) due to atmospheric aging.

In Fig. S5, "Aged sea salt" and "Mixed sea salt" cluster groups include a substantial amount of Al and Si. Based on Fig. S6 B, these cluster groups could be a mixture of sea salt + other particle types (possibly dust particles from long-range transport (Line 292)). Although it is understandable to use two different classification methods, I suggest discussing the contribution of dust particles for the clustering groups.

4. (Page 12, Line 455) κ_{inorg} *=0.6 is that of (NH4)2SO4 (Petters and Kreidenweis, 2007).*

I suggest considering sea salt here in addition to ammonium sulfate because both sea salt and sulfate have been discussed in the paper.

5. (Page 16, references) *Atmospheric Chem. Phys.,*

"Atmospheric" should be "Atmos." throughout the reference list.

6. (Page 26) *Figure 1*

I cannot read the details (e.g., equivalent potential temperature values and black dots for DI events) in Figure 1B in the PDF file.

7. (Page 27) *Figure 2.*

7-1. I assume projected area equivalent diameter (AED) was used for the SEM measurements judging from Page 9 in SI, and it should be also specified in the main text.

7-2. When comparing AED with FIMS size, they will not be able to be directly comparable because of different particle size definitions. I assume that AED can be larger than FIMS size because of particle flattering on the substrate. For example, it looks that the peak sizes of AED in Figure 2 right (e.g., the second one with FT and DI) is larger than those of FIMS. It may be helpful to discuss the difference in the particle size measurements.

7-3. Y-axes in the right panels for SEM particle sizes are missing (?).

7-4. Are the SEM images backscattering images, secondary images, or others?

7-5. Colors between "Mixed sea salt" and "Aged sea salt" are difficult to be distinguished.

8. (Page 29) Figure 4

I suggest adding color references in Figure 4A, similar to Figure 5.

9. (Page 30) Figure 5

Although it may be acceptable as is, Potassium is not carbon and will not be included in "Carbon K-edge NEXAFS spectra of 6 carbon types." I suggest reconsidering how Potassium is shown here.

10. (Page 31) Figure 6 B.

Adding a reference to the colors used in the mappings is helpful.