

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2021-590

Anonymous Referee #2

Referee comment on "Impact of dry intrusion events on the composition and mixing state of particles during the winter Aerosol and Cloud Experiment in the Eastern North Atlantic (ACE-ENA)" by Jay M. Tomlin et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-590-RC2>, 2021

The paper reports the observation of atmospheric particles in the marine boundary layer and free troposphere onboard a research aircraft flown over the Azores during dry intrusion events. The physiochemical properties of atmospheric particles were investigated using CCSEM and STXM. The data provided valuable information for understanding the influence of long-range transported air masses on the remote marine atmosphere. The figures are presented properly and the paper is well organized. Overall, I recommend this study to be accepted after the revision.

My comments are listed below:

- Line 232-233, did the authors consider the interference of the carbon membrane of TEM grid on C element analyses?
- Section 3.2, the authors should provide the definition of these four clusters at first, then discuss their fractions.
- Line 270, if "Aged Sea salt" is mostly driven by carboxylic acids, I do not agree that "Inorganics" is the sum of "Mixed Sea Salt" + "Aged Sea Salt" + "Ammonium Nitrate/Sulfate" (Line 240).
- Line 286, what is "marginal influence"?
- Line 434-435, how did the authors acquire the OVF enhancements? OVF values in the DI events compared with non-DI events?
- In the CCSEM result, carbonaceous particles decreased during the DI periods, while the STXM result shows that OVF increased due to the DI event. Seems the results are self-contradictory. Or maybe I have some problem understanding the data. If the authors believe that "Carbonaceous" particles identified by CCSEM/EDX are external mixing and OC particles from STXM are internal mixing (Line 445), I would prefer they mention this

earlier in the paper.

- Figure 1B, it would be better if the authors add black contour and red solid line in the annotation. PBL should be PBL height.

Minor:

- Line 25, physiochemical should be physicochemical.
- Line 28-31, the sentence is too long to follow.
- Line 56 Atmospheric particles exhibit complex internal heterogeneity in the troposphere (Ref). I might think that more references should be added here including American, higher level and East Asia and so on.

Li et al.,, A conceptual framework for mixing structures in individual aerosol particles. *J. Geophys. Res.* **2016**, *121*, (22), 13,784-13,798.

Riemer et al.,.: Aerosol Mixing State: Measurements, Modeling, and Impacts,

Rev. Geophys., *57*, 187–249

Buseck and Posfai., Airborne minerals and related aerosol particles: Effects on climate and the environment. *P. Natl. Acad. Sci. USA* 1999, *96*, (7), 3372-3379.

- Line 209, the degree symbol should be in front of N or W.
- Line 979, dolid should be solid.
- Line 982, arhived should be archived.