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Comment on acp-2021-277

Anonymous Referee #1

Referee comment on "Origin of water-soluble organic aerosols at the Maïdo high-altitude observatory, Réunion Island, in the tropical Indian Ocean" by Sharmine Akter Simu et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-277-RC1, 2021

The manuscript is overall good, scientifically robust and well written. Nevertheless, the following minor comments should be addressed before publication.

Page (P) 1, Line (L) 17. I do not think it is correct to associate marine aerosol WSOC to Ice Nucleating Particles in such a straightforward way. Usually, water soluble aerosol components are not considered good ice nucleators (Kanji et al., 2017) and there is no proof that WSOC contributes to the ice nucleating properties of sea-spray aerosol. On the other hand, it is likely that the ice nucleating properties of sea-spray is related to cell fragments or algal exudates (McCluskey et al., 2017; 2018; Wilson et al., 2015), which are typically insoluble (Orellana et al., 2011). I do not have the same problem with other parts of the text, like P2L3, where ice nuclei are associated to marine aerosol organics more in general (i.e., without a direct reference to the water soluble fraction).

Kanji, Z. A.et al., Measurement and Modeling Challenges, 58, 10.1175/amsmonographs-d-16-0006.1, 2017.

McCluskey, C. S. et al., Journal of the Atmospheric Sciences, 74, 151-166, 10.1175/jas-d-16-0087.1, 2017.

McCluskey et al., Journal of the Atmospheric Sciences, 75, 2405-2423, 10.1175/jas-d-17-0155.1, 2018a.

Orellana, M. et al., PNAS, 108, 3313612–13617, 201.

Sect. 2. The manuscript would benefit of some extra information. For instance, I noticed that the sampling times are not the same for day and night samples. This affects the detection limits (LOD) in terms of concentration per cubic meter. LODs will correspond to lower atmospheric concentrations in day samples than in night ones. To evaluate the impact of this difference on the reported concentrations, the authors should provide more information: how many samples have been analyzed in total? How many are MBL, FT, wet

and dry? How many samples have concentrations below LOD per each analysed species? What is the detection limit (in atmospheric concentration units) per species, in day and night samples? How the samples below detection limits have been treated to calculate the averages and st. deviations reported in Table 1?

For instance, Br^- represents an extreme case. Br^- presents always concentrations below LOD in night samples. Without more information, it is impossible to understand which of the following situation is represented by the data:

- there is a huge concentration gap between day and night samples for Br^-
- Br^- concentrations are pretty similar but in night samples they fall below LOD as an effect of the lower sampling times.

P3L10. This sentence needs revision: subject and verb are not consistent. Removing "The term" at the beginning of the sentence may solve it.

P4L8. What does "significant" mean? This paper is based on comparing different conditions: MBL vs FT, wet vs dry season; therefore, the statistical significance of the described differences should be addressed in a quantitative way. I invite the authors to report the result of the appropriate statistic tests, when presenting and discussing these differences (number of samples in the compared subsets, confidence interval, …).

P4L23-24. "The variation of the mass fractions was similar in MBL and FT in both seasons": the meaning of this sentence is not clear.

P4L30. Maybe the difference in WSOC concentration is indicative of some level of local contamination. This is an important issue and I invite the authors to discuss it. If possible, the authors should demonstrate that their measurements are representative of uncontaminated marine conditions. For instance, Fig. 3 shows a couple of samples with important NO3 contribution. According to my experience, NO3 indicates potential anthropogenic influence in marine aerosol.

P5L1-5. Provide a reference that links bromide emissions to sea-spray aerosol and biological productivity.

P5L5-8. A correlation analysis between the different aerosol species would make this part more quantitative.

Sect. 3.4. From the plots in Figure 9, I noticed a weird finding, which is never discussed in the manuscript. The contribution of "Marine PA" to WSOC is higher in FT samples than in MBL ones, both during the wet and dry seasons. This result should be addressed and discussed.

First of all, this seems in disagreement with the Br^- results. Br^- was presented by the authors as a tracer for biogenic organic matter from primary sea-spray and, accordingly, it presents higher concentration in MBL samples than in FT ones. How can this result be reconciled with the PMF output?

Absolute concentrations data for the WSOC contributing sources are not presented, so it is difficult to judge properly, but I have the impression that this high PA contribution to WSOC is driven by a few samples, while on the rest of the time series the signal is almost negligible. I invite the authors to analyse this aspect more in detail. I think this is an indication of the limits of the WSOC source apportionment performed by PMF, with such a limited number of samples and analysed species. I am not discussing the general PMF results, but maybe the authors are overconfident on the WSOC source attribution potential of this approach. For instance, I notice that the most consolidated organic aerosol source apportionment technique by PMF, the one based on Aerosol Mass Spectrometry data, makes use of much larger input matrixes, both in terms of number of samples and analytic information (mass spectra peaks) to resolve the organic aerosol sources. Considerations on these aspects should be added in the text. I do not think this spoils the work, as the WSOC source attribution is supported soundly by the carbon isotope results, but still, I would like to see the limits of the PMF clearly stated in the text.

P6L33-36. This would be clearer by showing a regression analysis.

P713-14. Please provide a reference. According to my experience, “models” do not consider either marine POA.

Figure 8. Change the colour palette. “Marine SOA” and “Terrestrial source” are too similar to each other.

Data availability statement. To me, this seems not in line with the journal policy:

“The output of research is not only journal articles but also data sets, model code, samples, etc. Only the entire network of interconnected information can guarantee integrity, transparency, reuse, and reproducibility of scientific findings. Moreover, all of these resources provide great additional value in their own right. Hence, it is particularly important that data and other information underpinning the research findings are "findable, accessible, interoperable, and reusable" (FAIR) not only for humans but also for machines.

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Please also note the supplement to this comment:
https://acp.copernicus.org/preprints/acp-2021-277/acp-2021-277-RC1-supplement.pdf