

Response to EGUSPHERE-2024-511 reviews for RC3

We thank Reviewer #3 for their effort and feedback on our manuscript EGUSPHERE-2024-511. In response to the suggestions and questions, please find our answers and corrections listed below: **Reviewer #3 comments are extracted in bold from original review supplement**; our responses are given directly below in normal font; *the original text in previous manuscript is repeated in red italic* and *revised text is typed in blue italic*.

General comments:

I read the manuscript and found it extremely interesting, well organized, clearly written and scientifically sound. The manuscript presents and analyses an extremely valuable observational dataset of INP properties and ancillary information, useful for interpreting INP sources under different circulation regimes in the Mediterranean climate hotspot. I recommend publication, once the following minor comments are addressed.

If I have to make a remark, the authors compare their results with a limited number of previous studies reporting INPs in the Mediterranean basin. Considering that the literature on the subject is not huge, they could have done something more thorough. Nevertheless, I understand that the paper is already long as it is and that the authors selected for comparison the available immersion freezing INP datasets for major comparability with the INSEKT data.

A second remark would regard the paper length. Maybe the authors could have chosen a different publication strategy to disseminate their data (two shorter publications, instead of this very large one).

We thank Reviewer #3 for their enthusiastically positive comments. We considered different publication strategies but concluded it would be best to have everything in one place. In terms of comparison, we decided to focus on the Mediterranean region – a future study could certainly focus on a more global comparison.

Minor comments

- 1. L280-281. “the distinction of marine aerosols above PBL is indicated by the highest Cl^- fraction compared to the other scenarios”: the motivation for this is not clear. Please, explain or support with an appropriate citation.**

Good point! The revised sentence now reads as: *“In addition, the distinction of marine aerosols above PBL is indicated by the highest Cl^- fraction range compared to the other scenarios not under the FT condition (Fig. 3f), given that high Cl^- concentration is reported as a character of marine aerosols (Xiao et al., 2018).”*

- 2. Fig. 5. It is not clear what the x-axis represents. I guess time? Please add the axis scale and clarify better. Moreover, double check this sentence in the caption: “The fraction of each type of particle from an identified aerosol source is shown by the x-axis”. Maybe it should be y-axis?**

We apologize for this lack of clarity. The issue was raised by the other reviewers too and now is addressed.

- 3. L556. Remove the symbol #.**

Done

- 4. L575. I have the feeling that the term “secondary” can be subject to misinterpretations given the different meanings that it can assume in aerosol literature (secondary aerosol, secondary ice formation...); maybe you could use the term “minor” to indicate a lower role of small-sized aerosol particles as INPs. This applies also in L655.**

Good point. The revised (relevant) sentences now read as:

*“In comparison to $Total_{APS}$, $Coarse_{APS}$, $Fluo_{WIBS}$ (Fig. 9) or $Total_{WIBS}$ (Fig. S7), the smaller R and ρ values for the relation between $Total_{SMPS+APS}$ and INPs also indicates that small-sized aerosol particles in the SMPS size range may play a *minor* role for serving as INPs compared to larger-sized particles measured in the APS and WIBS size range.”*

*“Such a difference suggests the INPs that are of a biological origin become less important when the overall IN ability and INP abundance of the source is higher, such as dust plumes, indicating a *less pronounced* role of biological particles in dust-containing sources in serving as INPs.”*

5. L612. I am not sure that “wrt.” Can be immediately understood by non-native speakers.

Good point. It is now spelled out (as “*with respect to*”) in the manuscript.

References:

Xiao, H.-W., Xiao, H.-Y., Shen, C.-Y., Zhang, Z.-Y., and Long, A.-M.: Chemical Composition and Sources of Marine Aerosol over the Western North Pacific Ocean in Winter, Atmos., 9, <https://doi.org/10.3390/atmos9080298>, 2018.