

Interactive comment on “Summertime surface PM₁ aerosol composition and size by source region at the Lampedusa island in the central Mediterranean Sea” by Marc D. Mallet et al.

Anonymous Referee #1

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The manuscript of Mallet et al. presents chemical composition and size distribution measurements conducted at the island of Lampedusa, Italy during a one-month period in the summer of 2013. It occurs that ammonium sulfate is the main contributor (63%) to the submicron non-refractory mass, followed by organics (33%). By performing Positive Matrix Factorization (PMF) analysis on the derived organic aerosol mass spectra it occurs that there are four factors contributing to the total organic aerosol, namely a hydrocarbon-like OA, a methanesulfonic acid-related OA, and two oxidized OA, a more-oxidized and a less-oxidized one. The two secondary OOA factors contribute the most (more than 80%) to the total OA, but with having different origin. The more-oxidized was observed during easterly air masses from the eastern Mediterranean and central

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Europe while the less-oxidized during westerly winds from the western Mediterranean, the Atlantic Ocean and high altitudes over France and Spain from mistral winds. Finally, an attempt is made to investigate the aging of aerosols by comparing concurrent measurements at Lampedusa and Corsica, revealing a dependence on travel time between the two sites and an enhancement of organics (40%) and a significant increase in sulfate and ammonium (by a factor of 6 and 4, respectively) between Erba (Corsica) and Lampedusa.

The paper is well written and easy to follow, though there are some issues and more thorough discussion should be made in specific sections. A very interesting point of the study is the study of the aging aerosol gradient and its dependence on the time travel of the air masses between Corsica and Lampedusa. Other than that the paper can be recommended for publication after addressing the issues listed below.

Specific comments:

1) More information about the c-ToF-AMS measurements and data analysis should be provided: - Response Factors and/or Relative Ionization Efficiencies of the different species

- Was there a collection efficiency correction applied?? Was a constant CE used or a chemical composition dependent one e.g. Middlebrook et al. (2012)?

Also I would suggest creating a separate section after Section 2.2 as Quality control/Quality assurance of the measurements where I would include the comparisons between PM₁ from chemical composition and SMPS, sulfate from c-ToF-AMS and PILS and the supporting measurements from the nanoMOUDI.

2) On multiple occasions in the manuscript the term “agreement” is mentioned, but no actual metric is provided. For example, in L307 “reasonable agreement between the PM₁ concentration calculated from composition measurements and the SMPS” is stated, but what does this translate to? Apart from the timeseries, no scatter plot is

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provided, no correlation coefficient, therefore how is this agreement defined? Same in L312.

Technical corrections:

L76 I would also add here the references of Bougiatioti et al. (2014) and Minguillon et al. (2015) as identifying biomass burning aerosol in the Mediterranean during summer

L126 change to “BBOA”

L140 secondary sites established (delete “were”)

L162 probably you mean Total Suspended Particulate (TSP)

L165 check font style

L157-164 More information on the c-ToF-AMS measurements should be provided here

L299 Dry NR-PM1? There is nothing mentioned about using a dryer in the instrumentation section (2.2)

L307 Reasonable agreement meaning what? R2 of how much?

L312-314 Do you mean between c-ToF-AMS and PILS? If yes I would suggest to change and state the methods used, preferably also give a correlation coefficient

L340 low-volatility/ highly oxidized

L340 Make title bold

L511-516 Night-time nucleation events have also been observed in the Eastern Mediterranean (Kalivitis et al. 2012)

Reference

Kalivitis, N., Stavroulas, I., Bougiatioti, A., Kouvarakis, G., Gagné, S., Manninen, H. E., Kulmala, M., and Mihalopoulos, N.: Night-time enhanced atmospheric ion concentrations in the marine boundary layer, *Atmos. Chem. Phys.*, 12, 3627-3638,

<https://doi.org/10.5194/acp-12-3627-2012>, 2012.

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2019-192>, 2019.

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