

Sources and mixing state of summertime background aerosol in the northwestern Mediterranean basin

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ACP-2016-1044

Summary

The manuscript documents a study about the aerosol environment in northwestern Mediterranean based on the data obtained during two intense sampling periods of ChArME_x-ADRIMED and SAF-MED campaigns in summer 2013. Aerosol properties were measured by a number of instruments, and the analysis involved primarily ATOFMS, provided significant information regarding aerosol mixing state. By making use of statistical techniques, k-mean clustering method, analysis of positive ions and negative ions spectral shape, the more than a million particle spectra obtained by ATOFMS were reduced to small number of particle classes and source apportionment was carried by referring backward trajectory analysis and some understandings of commercial, industrial, transportation, agricultural activities in the surrounding regions.

It is a well-written and organized manuscript; it offers significant information about the aerosols and their sources affecting the NW Mediterranean. It connects aerosol measurement to future possible studies of aerosol impacts on regional climate in NW Mediterranean. I recommend it for publishing in ACP after addressing some minor comments list below.

General comment

1. In the paragraph (line 165-170), it mentioned the conversion of diameters, and the conversion assumed the spherical shape of the particles. Could you please provide some more information about the shape of the particles detected in the campaign? Furthermore could you provide some discussion about the impact of the results of the particles classification and the conclusion if some of the particles are not spherical?
2. In the paragraph (line 171-175), it discussed the conversion of diameters requires the density. It is not clear to me how to obtain the density values, specifically, firstly how to obtain the equation on line 175? Secondly, based on equation on line 175, do you assume one density value, like an average density values when doing the diameter conversion for all particles? It is not entirely clear. Thirdly, any assumption needed in deriving equation on line 175? Last, could you elaborate how to use to measurements from like MAAP or ACSM or any other instrument you needed in this study to obtain the density based on equation on line 175?
3. For the ATOFMS analysis, it would be great if there is a figure showing the schematic how the 1.2 million single particle mass spectra obtained by ATOFMS during the sampling period being reduced to 80 clusters, then 27 classes and furthermore linked to source apportionment and background trajectory analyses. It would enhance the readers'

understanding and help readers quickly get across the key message of the manuscript. I suggest the authors add such schematic diagram.