We would like to thank the reviewer for their valuable comments and suggestions.

RC2 (Anonymous Referee #1):

The manuscript documents a study about the aerosol environment in northwestern Mediterranean based on the data obtained during two intense sampling periods of ChArMEx-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.

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?*

Response:

Unfortunately the ATOFMS is not capable of measuring particle shape. Any potential shape information would need to have been attributable to specific particle classes; again unfortunately this was not available. It is known that not all particle classes are spherical; for example elemental carbon typically takes the form of soot agglomerates, sea salt is non-spherical. However, atmospheric processing of particles, where they become coated with secondary species such as ammonium nitrate or ammonium sulfate typically produces a more spherical particle. This was expected to be the case for the majority of the particles observed at this site, after undergoing regional transport. The result of these factors was the use of a single shape value and assumption of sphericity for all particles in converting from aerodynamic diameter to volume equivalent diameter.

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?

Response:

Apologies for the unnecessary confusion – the following text, which addresses each of the points raised by the reviewer here, will be added after the equation on line 175:
"Where *m* is the average mass of BC and ACSM species. 1.5, 1.2, 1.52 and 1.75 (Allan et al., 2003) are material densities for BC, organic aerosol (Org), non-sea salt Cl^-, SO_4^{2-}, NO_3^- and NH_4^+ respectively. An average estimated density of 1.4 g/cm^3 was observed for bulk aerosol for the ADRIMED and SAF-MED campaigns. From the density calculation it is clear that neither metal-rich nor sea salt particles are taken into account. From the PILS-IC (PM_{10}) it was clear that sea salt particles constituted a significant fraction of PM_{10} aerosol (6% overall, 40-50% during the major sea salt event). The average density was therefore expected to be larger, thus a density of 1.7 (Reinard et al., 2007) was used to convert the diameters.

Mass concentrations can be obtained from the scaled number concentrations by (Reinard et al., 2007):

$$m = \frac{\pi}{6} \rho_p d_{ve}^3$$

A precise transformation of number to mass concentration requires knowledge of χ and ρ_p for each particle class. As discussed above, χ is assumed to be 1. The use of a single density, ρ_p, for ATOFMS scaling has previously resulted in satisfactory PM mass reconstruction when compared to other quantitative measurements (Healy et al., 2012, 2013; Qin et al., 2006). However, a single density assumption is known to be incorrect due to differing particle compositions (Maricq and Xu, 2004; Spencer and Prather, 2006). Different particle classes will exhibit different particle densities. A range of densities was therefore used to calculate mass concentrations for each particle class, which can be found in **Error! Reference source not found.**. The class densities were estimated from the bulk densities of the chemical components indicated in the mass spectra as described by Bein et al. (2006) and Reinard et al. (2007)."

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.*

Response: We agree that this would improve the reader's understanding of the numerous steps in the data analysis employed in this manuscript and will include the below schematic diagram of the process in the supporting information.

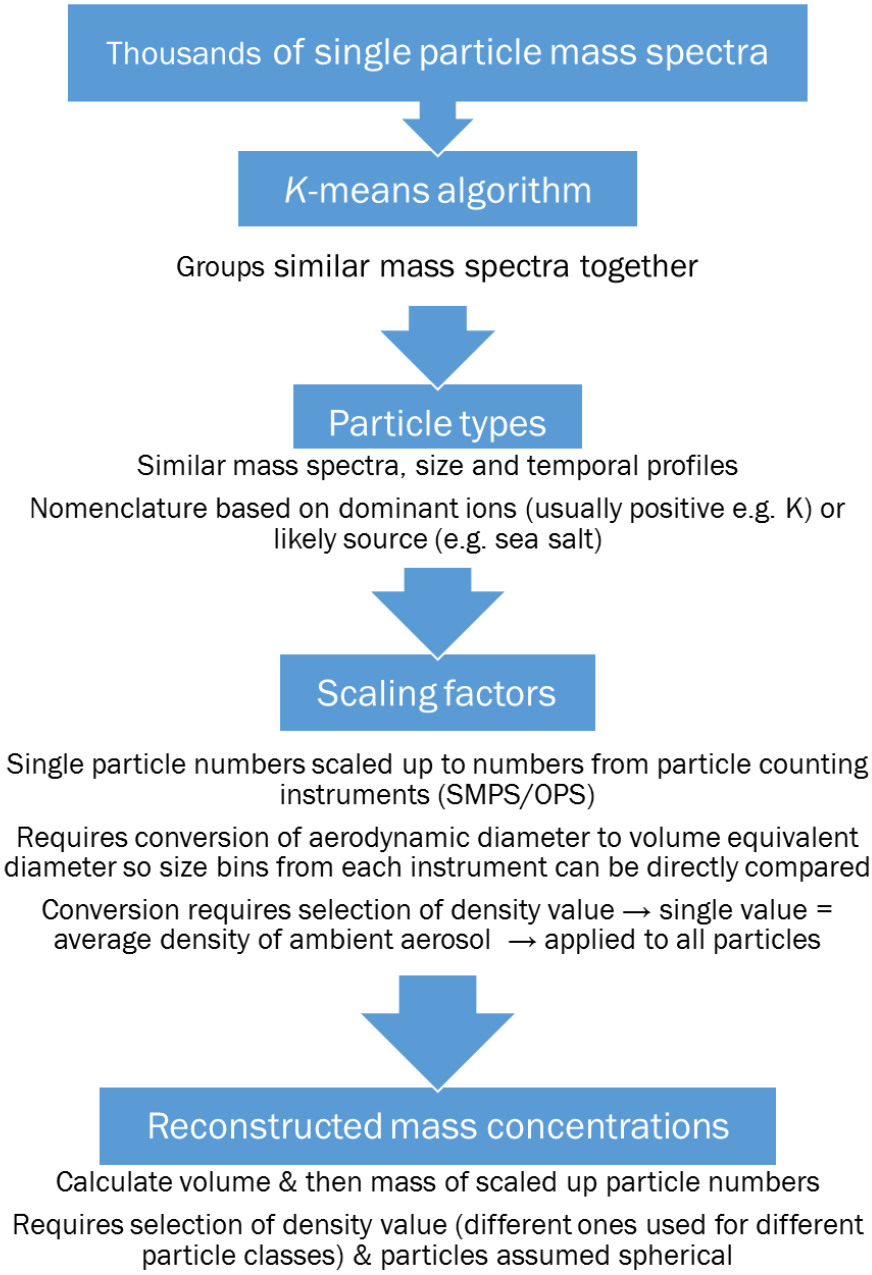

Figure 1. Schematic overview of ATOFMS data analysis.