

Characterization of PM₁₀ sources in the central Mediterranean Basin

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Keywords: Mediterranean Basin, aerosol sources, PM₁₀, PMF.

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The Mediterranean Basin is characterized by heavy atmospheric pollution, due to the insistence on the area of relevant environmental stress factors of both natural and anthropogenic emission. This work aims at assessing the contributions of the different aerosol sources affecting the Central Mediterranean Basin by a PMF (Positive Matrix Factorization) analysis on a 2-years PM₁₀ data set collected at the Global Atmosphere Watch Station of Lampedusa.

Lampedusa Island is centrally located in the Mediterranean Basin, being more than 100 km far from the nearest coast. Such a geographical position makes Lampedusa an ideal site for the study of the aerosol affecting the Central Mediterranean Basin, as it is far from every continental pollution source. Moreover, in Lampedusa, at the Station for Climate Observations maintained by ENEA (Italian Agency for New Technologies, Energy and Sustainable Economic Development), continuous observations of greenhouse gases concentration, total ozone, ultraviolet irradiance, aerosol properties and other climatic parameters are performed (Becagli *et al.*, 2012).

PM₁₀ samples are collected on a daily basis since 2007; data from years 2007 and 2008 (accounting for totally 562 samples) were used in this study. After mass gravimetric measurements, samples were fully characterized by analysing different portions with different analytical techniques: in detail, the ionic content was determined by Ion Chromatography (IC), soluble metals were detected by Inductively Coupled Plasma Atomic Emission Spectrometer (ICP-AES), and the total (soluble + insoluble) elemental composition was assessed by Particle Induced X-ray Emission (PIXE).

PMF was run with the algorithm PMF2 (Paatero1997) in the robust mode. Solutions from 5 to 10 factors were systematically explored and a seven-factors solution was selected. The resolved sources are the following ones: sea-salt, mineral dust, biogenic emissions, primary ship emissions, secondary sulphate, secondary nitrate, and biomass burning emissions (see Figure 1). The observed relative ratios and enrichment factors are consistent with literature data for such sources hence strengthening the results of the analysis.

Average source contributions to total PM₁₀ mass are estimated to be about 5% for primary ship emissions, biogenic emissions and biomass burning; 10% for secondary nitrate and secondary sulphate; 25% for mineral dust and 40% for sea salt.

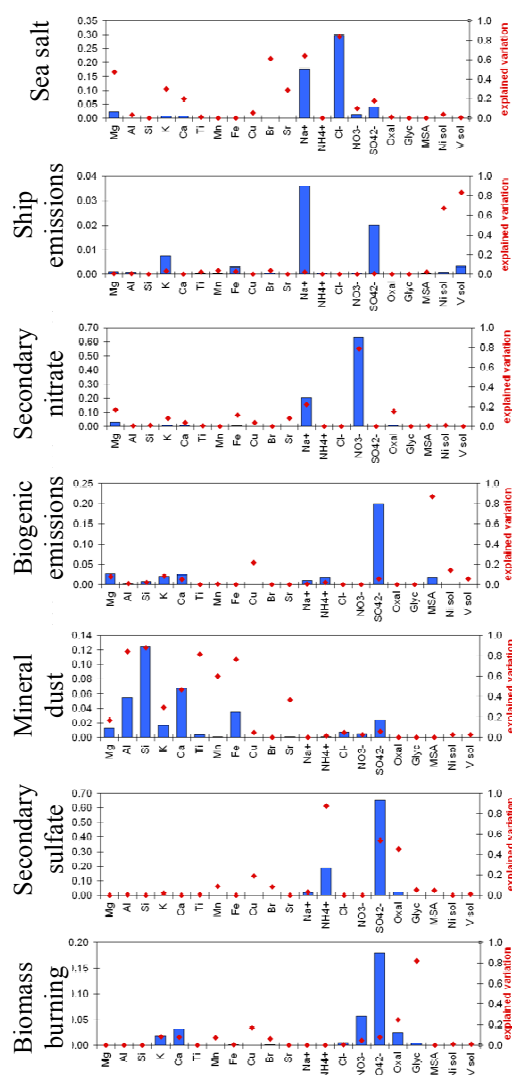


Figure 1. Source profiles and explained variations.

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