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Saharan dust impact in central Italy: a review on many year elemental data records

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In southern Europe, a significant contribution to particulate matter mass is made by desert dust transported from North Africa. Owing to the different health effects, it is important to distinguish between high concentration levels due to these natural episodes and those produced by pollution events (EU Air Quality Directives specify that limit values are not to be applied to events defined as natural).

The detection, with high sensitivity, of all the elements that compose mineral dust (Na, Mg, Al, Si, K, Ca, Ti, Mn, Fe, Sr, Zr) makes PIXE (Particle Induced X-ray Emission) analysis very effective in identifying and quantifying the impact of Saharan intrusions (Borbély-Kiss et al., 2004).

An increase in the concentration of all crustal elements can be a first indication of the occurrence of dust events. However, to distinguish between a local soil dust resuspension and a Saharan intrusion, an analysis of changes in elemental ratios is mandatory. Besides identification, it is also fundamental to quantify the contributions of local dust and desert dust, correctly separating each other. To accomplish this task, an accurate quantitative analysis of all the crustal elements is absolutely necessary. The application of statistical models, like PMF (Positive Matrix Factorisation) to elemental data sets can help in disentangling the contributions of these two components.

Diffusion models (backward trajectory calculations) and/or observation of satellite images can support the hypothesis of the Saharan origin. However, it is noteworthy that the passage of air masses coming from Sahara does not imply high PM10 concentrations at ground level, since several factors influence the particulate deposition. Only field campaigns followed by elemental analysis can assess the real impact of these episodes.

Since nineties, several aerosol sampling campaigns have been carried out, by the authors, in central Italy, and long time series of elemental concentrations have been obtained by PIXE.

In this work, a review of these data has been accomplished with the aim of identifying the occurred Saharan episodes and characterising them, in terms of composition and impact.

Backward trajectory calculations (HYSPLIT transport model by NOAA Air Resource Laboratory) have been performed for all the sampling days, at different heights and for different hours of the day, in order to investigate correlations between elemental composition and air trajectories.

During some of the more intense detected episodes (for example the one reported in Figure 1), soil dust accounted for more than the 50% of the PM10 mass concentration and it caused the overcoming of the 50 $\mu g/m^3$ limit (also in areas where overcomings never occur).

However, the occurrence of these episodes was altogether quite rare.

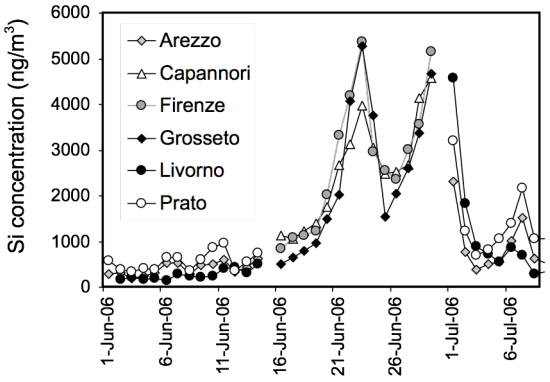

Figure 1. Si concentrations, simultaneously measured in six sampling sites in Tuscany. The high values registered from the 20th pf June to the 2nd of July are due to a Saharan intrusion episode.

Borbély-Kiss, I., Kiss, A. Z., Koltay, E., Szabó, Gy. & Bozó, L. (2004). *J. Aerosol Science*, 35, 1205-1224.