

Long-range Transport of Sahara Dust in Southern Europe: Initial Results from LIFE+ AIRUSE Project

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Large amounts of dust are transported each year from Sahara desert region to Europe and Eastern Asia and across the Atlantic to the Americas. These dust outflows may significantly increase concentration levels, as well as alter physico-chemical properties of atmospheric aerosol. In Southern Europe in particular, Saharan dust outbreaks are a recurrent phenomenon, affecting regional and local air quality, as well as compliance with Air Quality Standards (AQS).

In this framework, LIFE+ AIRUSE project aims to characterize the contribution of Saharan dust episodes to Particulate Matter (PM) concentration levels for four Southern European countries. PM₁₀ and PM_{2.5} samples were collected during a year-long campaign in 2013, at urban background sites in Porto (Portugal), Barcelona (Spain), Florence (Italy) and Athens (Greece). PM concentrations were determined gravimetrically on a 24-hr basis. PM samples were collected once every 3 days, as well as during days when dust episodes were expected. Information on potential occurrence of dust outbreaks was obtained by HYSPLIT, DREAM8b-v2.0 and SKIRON models. Back trajectory analysis for the whole year was also performed by HYSPLIT (archive trajectories) and FLEXTRA models.

Taking into account the available forecasts prior to any given sampling day, long-range dust transport was forecasted by HYSPLIT, DREAM8b-v2.0 and SKIRON models for 18%, 13%, 26% and 33% of the measurement days in Porto, Barcelona, Florence and Athens respectively. Back trajectories were also calculated by HYSPLIT and FLEXTRA from archived data. This analysis showed frequent desert dust transport events in Florence and Athens (21 and 26% of measurement days, respectively, versus 3% for Porto and 16% for Barcelona). Some of these events covered periods of several days. The largest number of dust-transport episodes for all cities except Porto were observed during spring time and in some occasions lasted for periods of more than two weeks.

Study of the measured PM coarse and PM fine

levels revealed that the highest coarse particle concentrations were indeed related with long-range dust transport (Figure 1). In Athens and Florence, where these events were more frequent, exceedances of the 24-hr EC limit value for PM₁₀ were always caused by dust outbreaks, clearly demonstrating the role of natural sources in achieving compliance with AQS for the Eastern Mediterranean region (Querol et al., 2009). Characterization of the chemical composition of the collected samples is underway in order to further examine the effect of desert dust episodes on PM characteristics in the studied areas.

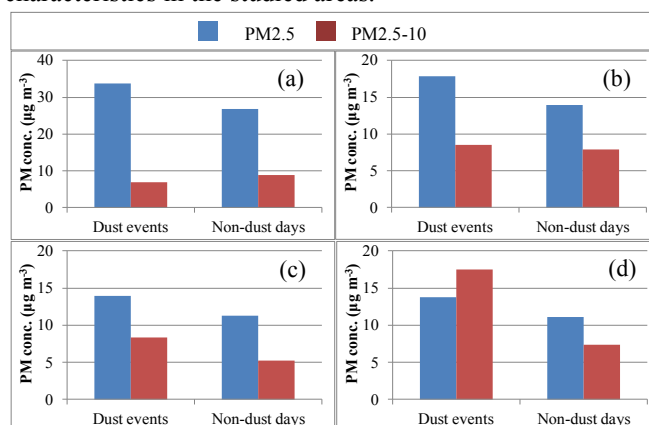


Figure 1. Mean PM_{2.5} (blue) and PM_{2.5-10} (red) for dust events and no-transport days in (a) Porto, (b) Barcelona, (c) Florence and (d) Athens.

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References

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