

Assessing the contribution of African dust outbreaks to annual PM levels and PM₁₀ exceedances of the daily limit value of 50 µg/m³

According to the Directive 1999/30/EC, article 5.4, and Directive 2008/50/EC, article 20, some natural events such as the Saharan dust episodes, may increase markedly the PM levels over the usual background concentrations, originating in many cases the exceedance of the daily limit value of PM₁₀ of 50 µg/m³ established in the mentioned Directives. The report of the European Commission Working Group on Particulate Matter titled GUIDANCE TO MEMBER STATES ON PM₁₀ MONITORING AND INTERCOMPARISONS WITH THE REFERENCE METHOD (<http://ec.europa.eu/environment/air/pdf/finalwgreporten.pdf>) propose a series of techniques and research tools which could be used to identify the contributions of natural events to measured PM₁₀ levels, including the detection of these kind of episodes using aerosols modelling tools, satellite imagery, back-trajectories analysis, and also PM composition studies. These methodologies are appropriate to identify this kind of events, but the quantification of the contributions to the PM₁₀ levels is not properly determined with these tools. Modelling tools on these issues have still to improve to give quantitative data with precision enough to be applied to the legal standards. However, these are basic to identify the dust outbreak episodes.

Spain and Portugal jointly developed a methodology to quantify the contributions of the African dust outbreaks at regional background (RB) locations in the Iberian Peninsula, and the Balearic, Canary, Azores and Madeira Isles. Modelling tools (such as SKIRON simulations, DREAM-BSC model outputs, NAAPs NRL model outputs, HYSPLIT-4 back trajectory analysis), satellite imagery data from MODIS and SeaWiFS project, and PM measurements from a dense monitoring RB stations are combined to this end. The daily net dust load in PM₁₀ or PM_{2.5} attributable to an African episode can be obtained by subtracting the daily RB level from the PM₁₀ or PM_{2.5} concentration value at a RB station. The daily RB level can be obtained by applying a monthly moving 30th percentile to the PM₁₀ or PM_{2.5} time series at a RB station after a prior extraction of the data coincident with African dust transport. For days with influence of African dust, the dust load is given by the difference between the daily PM₁₀ values minus the daily PM₁₀ RB levels. This method allows us to quantify the net African dust load without chemical speciation (see Figure 1, as an example). The description and justification of this methodology can be found in Escudero et al. (2007).

This methodology allows the monitoring networks to distinguish those exceedances originated by these African dust outbreaks from those originated by other causes (Figure 2). In addition, with this methodology it is possible to quantify the mean annual contribution of the African dust to the PM₁₀ or PM_{2.5} annual means (Figure 2, as an example).

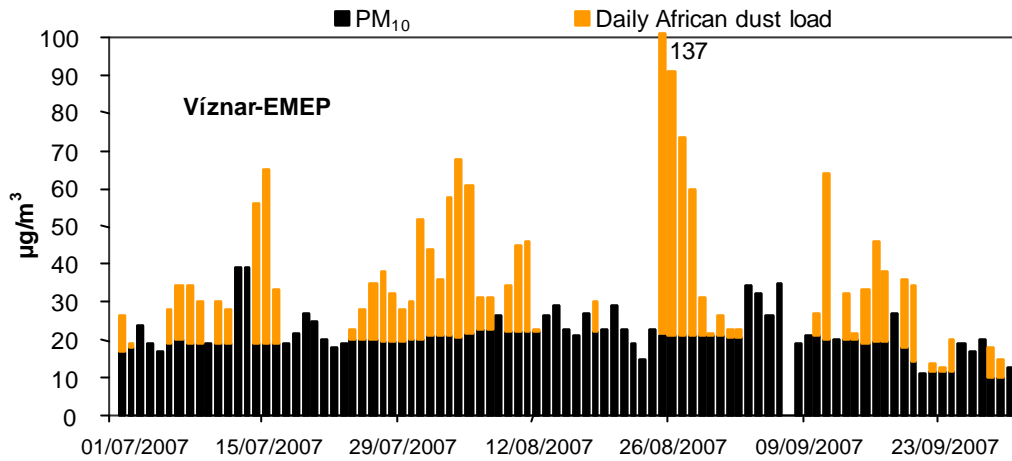


Figure 1. Example of determination of the net African dust (orange) to ambient PM₁₀ levels measured at an EMEP site (Víznar, SE Spain) during the period 01/07/2007 to 30/09/2007.



Figure 2. PM₁₀ mean annual contribution of African dust over the Iberian Peninsula, the Canaries and the Balearic Isles. The maps show the contribution of African dust to the bulk PM₁₀ annual levels measured at regional background sites (top left) and similar data presented in absolute concentrations to the annual PM₁₀ (top right). In the bottom map the partitioning between African caused number of daily exceedances of the PM₁₀ daily limit value in selected urban monitoring sites during 2007.

References

Escudero M., Querol X., Pey J., Alastuey A., Pérez N., Ferreira F., Alonso S., Rodríguez S. & Cuevas E., 2007. A methodology for the quantification of the net

African dust load in air quality monitoring networks. *Atmospheric Environment*, 41, 5516-5524.