Climatology and interannual variability of desert dust outbreaks over north-central Spain between 2003 and 2012

V.E. Cachorro, M.A. Burgos, Y. Bennouna, C. Toledano, B. Torres, D. Mateos, A. Marcos, and A.M. de Frutos

Grupo de Óptica Atmosférica (GOA-UVA), Universidad de Valladolid, 47011, Valladolid, España

e-mail: chiqui@goa.uva.es

One of the largest sources of natural tropospheric aerosols is the Sahara desert (North Africa). Air masses with a high concentration of dust usually reach the Iberian Peninsula and they cause several impacts on human health (by the exceed of the threshold in the particulate matter, PM, levels recommended by international organisms), and radiation levels at the Earth's surface, among others. Hence, this study aims to perform a complete characterization of the desert dust events and their PM levels in the North-Central area of the Iberian Peninsula for long-term series (between 2003 and 2012). The PM of aerodynamic diameters less than 10 μm (PM10) and 2.5 μm (PM2.5) data are taken from the Peñausende site of the EMEP (European Monitoring and Evaluation Programme) network.

The inventory of the desert dust events is carried out by the manual inspection of the aerosol optical depth (AOD), alpha Ångström parameter (α) and PM10. AOD-Alpha plot is one of the most useful tools in the identification of desert dust aerosols. To complete the identification, air masses back trajectories, satellite images and synoptic weather maps are also used. As a result, we are able to identify two types of desert dust intrusions: a) pure desert dust aerosols (D), which are characterized by AOD $\geq$ 0.2 and $\alpha < 1$, and b) a mixed of continental and desert dust aerosols (CD), with AOD $\geq$ 0.2 and $1 < \alpha < 1.5$. The required columnar aerosol data are obtained from the Palencia RIMA-AERONET site. The distance between the PM and AOD sites is about 140 km, but this fact does not introduce false estimations. The two areas present an identical sensitivity to detect desert intrusions, and both are isolated of big industrial areas.

The monthly climatology and interannual variability of PM10, PM2.5 and the ratio (PM2.5/PM10) are established for each day of the period 2003-2012 and for each day except those recorded in the dust inventory. Later on, absolute and relative differences between them are calculated. These differences represent the net desert dust contribution to the ambient PM levels in the analyzed area. This evaluation is the most relevant topic of this study. The monthly climatology shows a bimodal contribution, peaked in March and August. The interannual contribution emphasizes an important variability from one year to another. In the last place, the evaluation of the temporal trend rate shows a decreasing contribution along the decade 2003-2012 with a pronounced minimum in 2009 and new increases in 2011-2012. Actually, the largest desert dust contribution is achieved at the beginning of the period (2003-2004).

The study is complemented with the analyses of frequency histograms of PMx data for different subsets: the whole dataset (D+DC), D, and DC. With this classification, the analysis of each kind of desert dust intrusion is performed in detail.

- POSTER -