Air masses types over the remote Alborán Island

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During the last decades an enormous effort has been done to determine the effects of aerosols on climate. However, due to their large spatial-temporal variability and the different mixtures between aerosol types, there are still significant uncertainties in understanding the aerosol optical and microphysical properties.

The aerosol optical properties in origin, as issued by the sources, are conditioned by the potential changes during the path of the air masses as well as by the local aerosol properties at the reception site. A possibility in order to minimize the effect of the local aerosol is placing the measuring stations in remote locations far from the potential influence of local aerosol sources. Measurements taken at small islands are valuable because local sources are generally negligible, and medium and long-range transport, together with aerosol aging processes, play a relevant role, thus providing information on aerosol properties over a relatively large scale.

Backward trajectory analysis is a widely used technique in order to relate the air masses origin with the aerosol optical properties at the receptor site (e.g. Pace et al., 2006).

In this work air masses over Alborán Island (35.95º N, 3.03º W) from June 2011 to January 2012 were analysed by means of back-trajectories using HYSPLIT model. The aerosol radiative properties have been classified taking into account sun-photometric measurements and the air mass history. The aim is to classify columnar aerosol properties according to the potential aerosol origin sources. The air masses classification method identifies as a potential aerosol source that region which the difference between the height of the air mass and the height of the boundary layer is minimum.

Optical and microphysical aerosol properties were simultaneously retrieved from sun-photometric measurements (CIMEL CE-318) according to the methodology described by Olmo et al. (2008). The instrument provides solar extinction measurements at 340, 380, 440, 670, 870 and 1020 nm, and sky radiance measurements at 440, 670, 870 and 1020 nm using the almucantar and principal plane configurations.

From the air masses classification three broad geographical sectors have been identified: Sector A (Mediterranean sea and Europe Centre), Sector B (North Africa), and Sector C (Atlantic Ocean and Iberian Peninsula).

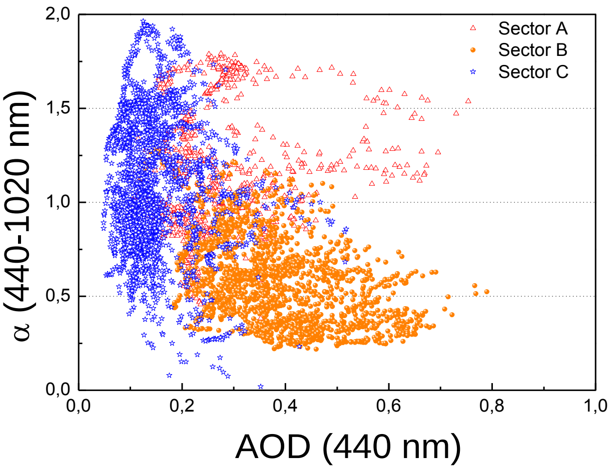

Figure 1. The Angstrom exponent (440-1020) versus AOD (440 nm) for each origin sector.

Figure 1 shows three main groups of particles corresponding to the three origin sectors. Although the values for sector B (African air mass) showed typical high aerosol optical depth (AOD) linked to low Angstrom exponent (α) (coarse particles) a small group of observations showed α values higher than 1, indicating also a contribution of fine particles during desert dust events. An important number of observations for sector C were concentrated in a range with AOD values below 0.2 and α value mainly concentrated in a region between 0.5–1.0 likely related to marine aerosol. The observations corresponding to the sector A contain points with AOD values in the range 0.2-0.8 and α mainly above 1, typical of fine mode aerosol from urban/industrial activities or biomass burning.

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