Chemical characterization of aerosol particles in Évora: comparison between summer and winter campaigns

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Introduction

Atmospheric aerosol particles play an important role in climate, air quality and human health.

In Portugal, extended time series on the chemistry and morphological parameters of atmospheric aerosol particles as well as on their seasonal dependency are still scarce and mostly confined to the North of the country.As part of a wider project on aerosol composition and distribution in Southwestern Iberia, in this study we compare aerosols collected in two intensive field measurement campaigns carried out in August 2011 and February 2012.

Experimental

In order to determine aerosol particle chemical and morphological properties, two sampling modes were adopted at the sampling site located on the roof of the Évora Geophysics Center:

- Active sampling:

Particles were collected on TEM grids by a cascade impactor and a vacuum pump with nominal particle diameter cut-offs at 1, 0.65, 0.45 and 0.25 µm. The samples were subsequently analysed by VP-SEM+EDS to obtain morphological and chemical compositional data.

- Passive sampling:

Particles were collected using a modified version of the aerosol passive sampler Type A “flat plates” by Ott and Peters (2008). The air could freely flow and particles were deposited by gravitation. The sampler was placed at the top of a university building about 15m above ground level. Sampling was performed weekly to account for the slow gravitational settling of particles.
Single particles automated analysis was performed using a HITACHI 3700N VP-SEM interfaced with a Bruker 5010 XFlash EDS and QUANTAX and automatic ESPRIT software.

The particles were classified into 9 chemical and mineralogical classes and into 4 morphological classes.

Results

Figure 1 shows an example of the relative % of the most abundant aerosol classes during two periods: 18-21 August 2011 and 14-21 February 2012. The relative amount of dust-related aerosols (quartz + silicates), increases generally with particle size. Dust aerosols seems to be more abundant in the larger grain-sizes and during the summer campaign, probably due to the incidence of desert storm episodes.

The sulphate concentrations are very different for the 2 set of samples in Fig. 1, with much higher % in summer suggesting a stronger sea salt contribution. It has to be noted that in winter campaign almost 50% of the smaller particles could not be attributed to one of the main chemical classes (Other). The majority of particles assigned to this *other class* did not display a EDS spectrum. On the other hand, the presence of organic and biological particles (with a low EDS signal also due to the C stub support) is to be expected if one takes into account the widespread use of wood as fuel for domestic heating and cooking is common in Évora especially during winter time.

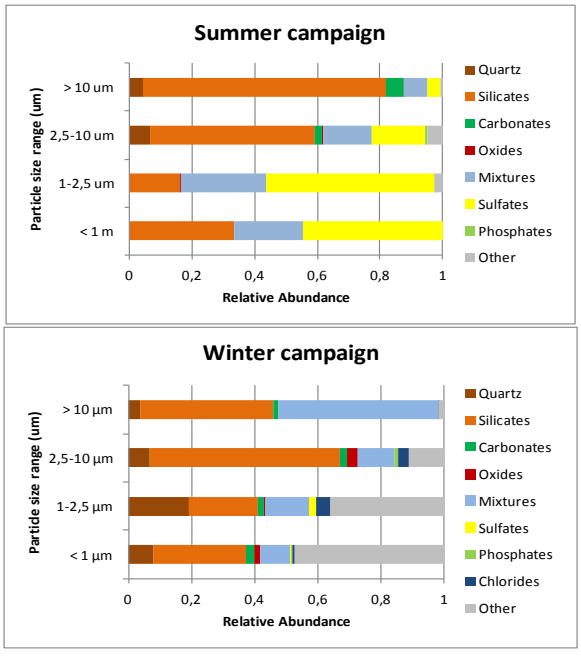

Figure1. Aerosol sampling periods: 18-21 August 2011 (top); 14-2 February 2012 (bottom)

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