On the microphysical and optical aerosol properties during AMISOC-ARN campaign

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Gas-aerosol interaction can significantly alter the concentration of gases in the atmosphere thus playing a role in the global heat balance and climate change. In particular, the atmospheric minor gases behaviour under high aerosol loading conditions such as desert dust episodes or nucleation processes are tasks demanding growing attention in last years due to their potential impact even at large scale. The AMISOC Project (Atmospheric Minor Species relevant to the Ozone Chemistry at both sides of the Sub-tropical jet) aims to improve the knowledge of the minor constituents of the atmosphere playing a role in the ozone chemistry. The core of the project is: two coordinated field campaigns, the development and improvement of instrumentation, modeling and applications system.

AMISOC started with an experimental campaign carried out at 'El Arenosillo' – Atmospheric Sounding Station from 20 May to 15 June 2012. This observatory is located southwestern Spain (37.1ºN, 6.7ºW) on the Atlantic Ocean coast. The location allows the first detection of Saharan dust plumes transported northward to Europe (Córdoba-Jabonero et al., 2011), and can be also affected by events with high levels of surface ozone (Adame et al., 2010) and ultrafine particles (Sorribas et al., 2011), due to natural or anthropogenic emissions under high levels of solar radiation.

This work shows the preliminary analysis of the microphysical and optical aerosol properties during the AMISOC-ARN campaign, as a first step to extend our understanding about the gas-aerosol interaction.

Mean value ± standard deviation for total particle concentration within (14-604) nm was 7750±6500 cm^{-3}, showing the highest levels at noon during the new particle formation events. Depending on wind direction, formation and growth properties of the new particles, seven new particle formation episodes were selected with the aim to analyze them with regard to iodine monoxide (IO), glyoxal (C_2) and sulfate (SO_2) concentrations.

Two desert dust episodes with impact on the columnar-integrated aerosol properties were detected during the AMISOC campaign: (1) 30 May - 3 June 2012 and (2) 6 - 7 June 2012. Mean AOD and Angström parameter (α) during the first episode were 0.30 and 0.61, respectively, and those same aerosol properties during the second one were 0.21 and 0.39. So, the particle contribution of fine size range was higher during the event from 30 May to 3 June (higher α) and the extinction process was strongest (higher AOD) than the other episode. Moreover, the impact on surface level of the first desert dust episode was also observed within the sub-micron and super-micron aerosol size ranges. Figure 1 shows the evolution of the particle volume size distribution during the episode, showing the strong impact on particle diameter about 10 μm was during the first hours of the episode.

The influence of the episode on the global heat balance was also observed with an increase of the scattering light with respect to non-dusty days from 32 Mm^{-1} to 69 Mm^{-1} and absorption light from 2.5 Mm^{-1} to 4.2 Mm^{-1}. It produces an increase of the radiative forcing from -4 W m^{-2} to -12 W m^{-2}.

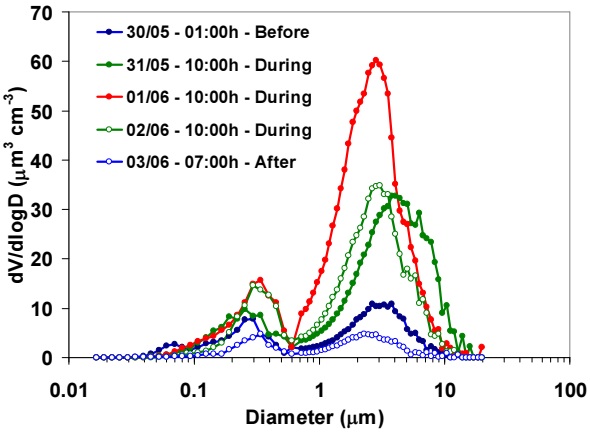

Figure 1. Evolution of the volume size distribution during a desert dust event from 30 May to 3 June 2012

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