Submitted Abstract

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Abstract

The Andalusian Global ObseRvatory of the Atmosphere (AGORA) is located in Southern Spain and includes several experimental sites. The observatory consists on multi-instrumental sites that develop activities contributing to increase our knowledge of the atmospheric processes and their impact on the Earth's Climate. AGORA include a high-altitude mountain station, Sierra Nevada Station (SNS, 37.10ºN, 3.39ºW, 2500 m asl), located at around 20 km from Granada city (680m asl), in the Sierra Nevada National Park. The high mountain station allows for the characterization of regional and long-range transport episodes as well as for local phenomena that might affect the air quality of this natural environment. The instrumentation deployed at SNS allows for the characterization of aerosol optical and microphysical properties and the study of cloud formation processes.

A multi-instrumental field campaign, BioCloud, was performed at SNS in summer 2021. In the frame of this campaign, a time-of-flight aerosol chemical speciation monitor (ToF-ACSM, Aerodyne Research Inc.) was deployed from 10 June to 15 July 2021 to measure real-time inorganic (nitrate, sulphate, ammonium and chloride) and organic submicron compounds (PM1). Co-located measurements, including real-time gaseous species (NO, NO2, SO2 and O3), in combination with an Aethalometer (AE33, Magee Scientific) for the determination of the equivalent black carbon (eBC), and off-line PM10 chemical analysis (high volume samplers), were also carried out. With this infrastructure, total mass of 60 chemical species, diurnal variations, relative species contributions and sources of organic aerosol (OA) were determined.

The chemical PM1 pool was mainly comprised of secondary aerosols, being the organic aerosol (OA) the key component of submicron particulate matter during the whole campaign. The mean PM1 concentration in the campaign was 4 µg/m3, distributed in 3 µg/m3 of OA, and 0.24, 0.27, 0.01 and 0.25 µg/m3 of nitrate, sulphate, chloride and ammonium, respectively. The large fraction of organic aerosols is principally originated from biogenic sources. The diurnal cycle of the submicron species shows a clear production of secondary aerosols during the afternoon hours. The intensity of photooxidation processes at these hours, the pollutant upward transport from Granada city and the atmospheric boundary layer growth dynamics, modelled the diurnal cycle of the species.

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