EGU21-10929
https://doi.org/10.5194/egusphere-egu21-10929
EGU General Assembly 2021

Analysis of the air mass dependency of the aerosol hygroscopic factor at Burjassot, Spain

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The atmospheric aerosols have an important role in the radiative forcing in the atmosphere. The solar radiation interacts with the aerosols, being absorbed or scattered in different directions, depending on the absorption and scattering coefficients. The scattering coefficient is highly dependent on the aerosol size, this being dependent on the relative humidity of air, if the aerosols are hygroscopic. The aerosol hygroscopic factor, f(RH), is the factor describing how the scattering coefficient depends on the relative humidity.

To understand the relation between scattering coefficients of aerosols and the relative humidity of air, and thus improving our estimations of the radiative effect of urban aerosols, we recently started to measure the aerosol hygroscopic factor, extending previous data series of scattering and absorption properties obtained at our Burjassot site, in Valencia (Spain). Preliminary results already showed values of fRH (75%) between 1.13-1.31.

In this study we are interested on analysing the effect of the air mass type on the aerosol properties at our site, mainly on the total scattering coefficients and the hygroscopic factor, so we can understand if the trajectory of the air masses carrying the aerosols influences their hygroscopic properties at our region.

The area represented by our station is mainly of urban coastal character. The Burjassot site is located in the suburbs of Valencia city in Spain. The population of the metropolitan area of Valencia is about 1 million. The distance to the Valencia city centre is about 5 km southeast, and the distance to the seacoast is about 10 km east. The site is locally affected by the traffic pollution, but also affected by light industry and occasional agricultural or forest fires.

The scattering coefficient measurements at ambient conditions were started at Burjassot site on the late 06's, by means of a three channel TSI 3563 nephelometer. In 2017, an ACS 1000 (Aerosol Conditioning System, manufactured by Eco Tech Company) with a tandem of Aurora 3000 nephelometers for dry and wet channels were added, although technical problems with the wet channel prevented us to obtain useful results before 2019. Additionally, angular scattering coefficients are simultaneously measured at ambient conditions only, with an Aurora 4000 polar nephelometer, available since 2019.

In the current analysis, we use a well-known trajectory computing model like HYSPLIT to determine the path of the air masses during the last 5 days before its arrival at our station. Then, the numerical backtrajectories are automatically analysed by the application of previously developed algorithms to derive the type of dominant air mass, and its origin. Finally, the scattering coefficients and hygroscopic factors are classified in relation to the air mass type, to understand how these aerosol properties are linked to the main air mass types that influence our region.

This work is supported jointly by the Spanish Ministry of Economy and Competitiveness (MINECO) and the European Regional Development Fund (FEDER) under Projects CGL2017-86966-R and RTI2018-096548-B-I00.