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Effect of sea breeze regime on aerosol optical properties over the city of Rome, Italy.

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Mesoscale meteorological phenomena, such as sea-land breeze regime, strongly impact meteorological conditions of coastal areas, affecting wind intensity, moisture, heat and momentum fluxes and polluted air masses dispersion. This effect must be considered in order to correct design urban spaces, predict the possible influence of land use change on air pollution and climate change and, consequently, improve the quality of life and urban comfort.

In recent years, it has been shown that the breeze regime does not only affect microclimatic conditions but also air quality in coastal areas, because of the mixing of different types of aerosols and condensable gases. Moreover, the advection of marine, colder and more humid air leads to the decrease of the boundary layer height and, consequently, to the increase of the surface concentration of locally emitted pollutants, that are trapped within the boundary layer itself.

The effect of breeze regime is particularly interesting in coastal cities, where the sea breeze entails large modification of physical, optical, chemical, and hygroscopic properties of the urban aerosol.

In this work, we developed an approach to determine the breeze effect on aerosol in correspondence of the BAQUNIN [1] Super-site urban location, in the centre of Rome, Italy. The city is about 28 km far from the Tyrrhenian coast and is often exposed to sea-breeze circulation and to extreme aerosol events [2] [3].

In-situ measurements obtained from different remote sensing instruments are used: (i) vertical profile of horizontal wind velocity and direction by means of SODAR wind profiler; (ii) moisture, air temperature and wind speed from ground-based meteorological station; (iii) aerosol optical depth (AOD), height and evolution of the Boundary Layer from Raman and elastic LIDAR; (iv) precipitable water, AOD, Ångström exponent (AE) and single-scattering albedo (SSA) from sun-photometer CIMEL [4], (v) AOD, AE and SSA from POM 01 L Prede sun-sky radiometer [5][6], (vi) superficial NO_2 and formaldehyde amounts from PANDORA spectrometer [7], (vii) particulate matter ($PM_{2.5}$ and PM_{10}) concentrations from ground-based air quality station.

The investigation is focused on several days, during summer of 2019, characterized by anemological breeze regime conditions.

In this study, we present preliminary results aimed to the in-depth analysis of the effects of the breeze regime on the optical properties of aerosols in coastal, urban environment and the impact of the aerosol vertical stratification on ground-level PM concentrations.

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