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Direct effect of aerosol on incident solar radiation at the surface as a function of aerosol mixtures measured in the center of Rome.

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Aerosols determine a radiative effect in the atmosphere by affecting the amount of solar radiation reaching the surface and then acting on the temperature of both the layer where they are located and the surface. The presence of very absorbent particles typical of the urban environment, is therefore dangerous not only for human health but also because they are able to increase the temperature of the atmospheric layer in which they are located interacting with the "heath island" phenomenon. The resulting variation of both surface temperature and temperature vertical profile influences the dilution of atmospheric pollutants and needs to be studied in more detail, particularly in the summer period when heat waves are more frequent.

Chemical analysis of surface particulate matter performed at the urban site of Rome (Perrino et al. 2009) showed that sea salt, locally produced urban aerosol and desert dust can be recognized depending on the intensity of the episodes transporting different particles types. As a result: i) the direct effect of aerosol at the surface change as a function of aerosol mixtures; ii) the variation of incident solar radiation affects the local convective air motion modifying the low level circulation and having an effect on the particles deposition and hence on the chemical characterization of the mixture.

On the base of above issues a day-time intensive field campaign was held in Rome (Italy) in June and July 2011 at the University of Rome, La Sapienza, located in the city center (lat 41.9°N, long 12.5 °E). Chemical analysis of the aerosol particles was performed on particulate collected by PM10 collectors. Columnar aerosol optical and physical properties in clear sky were retrieved by using a PREDE sun-sky radiometer, part of ESR/SKYNET network. Vertical profiles of aerosol were obtained by a Lidar and incoming total solar radiation was measured by a Black and White Pyranometer . A Brewer spectrophotometer, a Sodar, and a MFRSR provided columnar ozone, wind profiles, diffuse and direct solar radiation at several selected wavelengths, respectively.

The Rstar 6b radiative transfer code (Nakajima and Tanaka 1988) was used to calculate the vertical profiles of downward direct and total flux of solar radiation and of aerosol optical depth. The code was adapted to the needs of this work by changing: 1) "urban" standard vertical profile of aerosol according to the profiles of backscatter ratio measured by Lidar; 2) vertical ozone concentration according to the columnar ozone amount, measured by Brewer; 3) type and relative quantities of three chemical components of urban standard model (originally soot, dust-like, 75%H2SO4) according to the chemical analysis. In this work the first analysis of the direct effect of aerosol on surface incident solar radiation, by using Rstar code, is presented as a function of the changes in the measured mixtures of aerosol.

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