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The satellite-based remote sensing of particulate matter (PM) in support to urban air quality: PM variability and hot spots within the Cordoba city (Argentina) as revealed by the high-resolution MAIAC-algorithm retrievals applied to a ten-years dataset (2

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Particulate matter (PM) is one of the major harmful pollutants to public health and the environment [1]. In developed countries, specific air-quality legislation establishes limit values for PM metrics (e.g., PM10, PM2.5) to protect the citizens health (e.g., European Commission Directive 2008/50, US Clean Air Act). Extensive PM measuring networks therefore exist in these countries to comply with the legislation. In less developed countries air quality monitoring networks are still lacking and satellite-based datasets could represent a valid alternative to fill observational gaps.
The main PM (or aerosol) parameter retrieved from satellite is the 'aerosol optical depth' (AOD), an optical parameter quantifying the aerosol load in the whole atmospheric column. Datasets from the MODIS sensors on board of the NASA spacecrafts TERRA and AQUA are among the longest records of AOD from space. However, although extremely useful in regional and global studies, the standard 10 km-resolution MODIS AOD product is not suitable to be employed at the urban scale. Recently, a new algorithm called Multi-Angle Implementation of Atmospheric Correction (MAIAC) was developed for MODIS, providing AOD at 1 km resolution [2].
In this work, the MAIAC AOD retrievals over the decade 2003-2013 were employed to investigate the spatiotemporal variation of atmospheric aerosols over the Argentinean city of Cordoba and its surroundings, an area where a very scarce dataset of in situ PM data is available. The MAIAC retrievals over the city were firstly validated using a 'ground truth' AOD dataset from the Cordoba sunphotometer operating within the global AERONET network [3]. This validation showed the good performances of the MAIAC algorithm in the area. The satellite MAIAC AOD dataset was therefore employed to investigate the 10-years trend as well as seasonal and monthly patterns of particulate matter in the Cordoba city. The first showed a marked increase of AOD over time, particularly evident in some areas of the city (hot spots). These hot spots were put in relation with changes in vehicular traffic flows after the construction of new roads in the urban area. The monthly-resolved analysis showed a marked seasonal cycle, evidencing the influence of both meteorological conditions and season-dependent sources on the AOD parameter. For instance, in the Cordoba rural area an increase of AOD is observed during March-April, which is the soybean harvesting period, the main agricultural activity in the region. Furthermore, higher AOD signals were observed in the vicinity of main roads during summer months (December to February), likely related to the increase in vehicular traffic flow due to tourism. Long-range transport is also shown to play a role at the city scale, as high AODs throughout the study area are observed between August and November. In fact, this is the biomass-burning season over the Amazon region and over most of South America, with huge amounts of fire-related particles injected into the atmosphere and transported across the continent [4].

References

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