Workshop on "Recent advancements in remote sensing and modeling of aerosols, clouds and surfaces",
GRASP ACE Summer school,
Lille, France, May 22-26, 2023

Aerosol optical depth climatology from the high-resolution MAIAC observations product over Europe: difference between major European cities and their surrounding environment

L. Di Antonio[a*], C. Di Biagio[b], G. Foret[b], P. Formenti[b], G. Siour[b], J.F. Doussin[b] and M. Beekmann[b]

[a] *Univ Paris Est Creteil and Université Paris Cité, CNRS, LISA, F-94010 Créteil, France*
[b] *Université Paris Cité and Univ Paris Est Creteil, CNRS, LISA, F-75013 Paris, France*

***Corresponding author e-mail**: ludovico.diantonio@lisa.ipsl.fr

Air quality preservation represents one of the greatest challenges of our century, especially in densely populated areas. Several satellite missions have been launched in the last years with the aim of monitoring the atmospheric composition and distribution of pollutants over different spatio-temporal scales. Among all the atmospheric pollutants, aerosols have been shown to play a key role in the climate system, influencing it both directly and indirectly. The aerosol optical depth (AOD) is a derived measurement useful to investigate the aerosol load and the spatio-temporal distribution. The Deep Blue and Dark Target inversion algorithms have been extensively used to retrieve the AOD for the Moderate Resolution Imaging Spectroradiometer (MODIS) satellite sensor, resulting in a maximum spatial resolution of 3km. The MAIAC (Multi-Angle Implementation of Atmospheric Correction) algorithm for the MODIS data (Lyapustin et al., 2018) has been developed to provide 1km-spatial resolution AOD measurements at 470 and 550nm over land and oceans, allowing finer scale investigations of AOD. In this work, long-term (from 2000 to 2021) high-resolution MAIAC observations are used to investigate the climatological AOD variability and trends at different scales: European, regional and local. The latter two consist of concentric kernels of 100x100 km^2 and 3x3 km^2 respectively applied on several cities in Europe. Hence, a quantitative assessment of the cities impact on their regional AOD level background is investigated. Average enhancements of the local with respect to regional AOD of 57%, 55%, 39% and 32% are found for Barcelona, Lisbon, Paris and Athens respectively, suggesting a non-negligible enhancement to the aerosol burden through local emissions. However, negative average deviations of -17% and -6% are also found for Amsterdam and Brussels respectively. Negative statistically significant AOD trends for the entire European continent are observed. A stronger decrease rate at the regional scale with respect to the local one occurs for most of the cities under investigation.

Keywords: aerosol, optical depth, climatology, local, regional

References

Lyapustin, A., Wang, Y., Korkin, S., and Huang, D.: MODIS Collection 6 MAIAC algorithm, Atmospheric Meas. Tech., 11, 5741–5765, https://doi.org/10.5194/amt-11-5741-2018, 2018.