SPATIAL DISTRIBUTION ANALYSIS of the TROPOMI AEROSOL LAYER HEIGHT: A PIXEL-by-PIXEL COMPARISON to EARLINET and CALIOP OBSERVATIONS

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The aim of this study is to report on a detailed validation of the aerosol layer height (ALH) satellite product derived from the TROPOMI/S5P instrument, using as reference spatially and temporally co-located measurements from the well-established EARLINET (Pappalardo et al., 2014) lidars and CALIOP/CALIPSO (Winker et al., 2009) observations over Europe. The time period from 2018 to 2022 is selected for the validation analysis. The TROPOMI Level-2 ALH is an operational product (Nanda et al., 2020) since 2019, and focuses on the retrieval of vertically localized aerosol layers in the free troposphere (desert dust, biomass burning aerosol and volcanic ash plumes) for cloud-free cases. Knowledge of the ALH is essential for understanding the impact of aerosols on the climate system. Lidar instruments are a good source for validating retrieved ALHs from passive satellite sensors since they provide aerosol profile information, such as the backscatter and extinction coefficients, at different wavelengths with a vertical resolution of a few meters. Due to its well-spread spatial coverage of the European continent, EARLINET has actively participated in the calibration and validation of satellite mission measurements (Michailidis et al., 2021). In this study, TROPOMI ALH retrievals are compared with collocated CALIOP and EARLINET products within a distance of 100–150 km. Target pixels were selected according criteria flags for spatio-temporal collocation with lidar measurement, cloud-free conditions and high values of UV Aerosol Index. This leads to a reduced number of valid TROPOMI ground pixels close to the lidar site and CALIOP track. A case-by-case analysis is first presented, followed by a statistical analysis for all co-located cases. The majority of study scenes are distributed across the Mediterranean and the first results showing that ALHs retrieved from TROPOMI are lower, approximately 2 km, than CALIOP and EARLINET aerosol heights. This work also discusses the main key features of the product and its limitations revealed from the validation findings and suggests a future outlook of the evolution of the TROPOMI ALH algorithm.

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