EMS Annual Meeting Abstracts
Vol. 18, EMS2021-114, 2021, updated on 26 May 2022
https://doi.org/10.5194/ems2021-114
EMS Annual Meeting 2021

Day and nighttime observations of water vapor and aerosol optical profiles in the boundary layer observed by Caeli Raman lidar during the TROpomi vaLIdation eXperiment (TROLIX'19)

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To foster our understanding of the role that the vertical distribution of atmospheric aerosols and water vapor plays on the climate system, the Cabauw Experimental Site for Atmospheric Research in the Netherlands has been providing measurements with its high performance multi-wavelength Raman lidar (Caeli) on a regular basis and during intensive periods of observations.

From late August to early October, 2019, the Cabauw site was the central point for the active remote sensing activities during the TROpomi vaLIdation eXperiment (TROLIX'19), a campaign which used a combination of in-situ and remote sensing measurements, both ground and air-borne based, for the validation of Sentinel-5p/TROPOMI level 2 products. During this campaign, Raman lidar measurements were performed under a variety of atmospheric conditions.

In this work, we present the Caeli simultaneous measurements of aerosol optical properties and water vapor mixing ratio profiles during the TROLIX'19 campaign. A general clean atmosphere was observed, with eventual occurrence of mid-tropospheric aerosol layers and a persistent stratospheric layer observed for many days. Profiles of extinction and backscatter coefficients have been processed both locally and through the central processing facilities of the European lidar network (ACTRIS-EARLINET). The precision of the day and nighttime water vapor mixing ratio retrievals were accessed, showing that high resolution profiles were possible in the planetary boundary layer (PBL) during daytime and throughout the troposphere during nighttime, allowing the measurement of dry air mixing in the PBL and information for heat flux studies. Time and vertically resolved aerosol and water vapor fields around cloud formation events are explored.