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INTERACT-II campaign:comparison of commercial lidars and ceilometers with advanced multi-wavelength Raman lidars

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Knowledge of aerosol spatio-temporal distribution in troposphere is essential for the study of climate and air quality. For this purpose, global scale high resolution continuous measurements of tropospheric aerosols are needed. Global coverage high resolution networks of ground-based low-cost and low-maintenance remote sensing instruments, such as commercial automatic lidars and ceilometers, can strongly contribute to this scientific mission. Therefore, it is very interesting for scientific community to understand to which extent these instruments are able to provide reliable aerosol measurements and fill in the geographical gaps of existing networks of the advanced lidars, like EARLINET (European Aerosol Research LIdar NETwork). The INTERACT-II (INTERcomparison of Aerosol and Cloud Tracking) campaign, carried out at CIAO (CNR-IMAA Atmospheric Observatory) in Tito Scalo, Potenza, Italy (760m a.s.l., 40.60°N, 15.72°E), aims to evaluate the performances of commercial automatic lidars and ceilometers for tropospheric aerosol profiling.
The campaign has been performed in the period from July 2016 to January 2017 in the framework of ACTRIS-2 (Aerosol Clouds Trace gases Research InfraStructure) H2020 research infrastructure project. Besides the commercial ceilometers operational at CIAO (VAISALA CT25K and Luftt CHM15k), the performance of a CL51 VAISALA ceilometer, a Campbell CS135 ceilometer and a mini-Micro Pulse Lidar (MPL) have been assessed using the EARLINET multi-wavelengths Raman lidars operative at CIAO as reference.
Following a similar approach used in the first INTERACT campaign (Madonna et al., AMT 2015), attenuated backscatter coefficient profiles and signals obtained from all the instruments have been compared, over a vertical resolution of 60 meters and a temporal integration ranging between 1 and 2 hours, depending on the observed atmospheric scenario. CIAO lidars signals have been processed using the EARLINET Single Calculus Chain (SCC) also with the aim to improve the data consistency and comparability (D'Amico et al., 2016; Mattis et al., 2016).
A first statistical analysis of simultaneous observations performed by all the instruments during the campaign reveals that ceilometers have fairly good performances in aerosol profiling in the lower troposphere, up to an altitude of about 2000 m above the ground, but they are limited at higher altitudes. Among the considered devices, the mini-MPL shows the best performances with discrepancies limited to 10 % throughout the troposphere. Further analysis is ongoing also to assess the stability of the considered lidar technologies with respect to variation of working and environment temperature, aerosol loading, laser operation.