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Ceilometer for aerosol profiling: comparison with the multiwavelength in the frame of INTERACT (INTERcomparison of Aerosol and Cloud Tracking)

Fabio Madonna (1), Joshua Vande Hey (2), Marco Rosoldi (1), Francesco Amato (1), and Gelsomina Pappalardo (1)

(1) (fabio.madonna@imaa.cnr.it), (2) Space Research Centre, University of Leicester, Leicester, LE1 7RH, UK

Observations of cloud base height are important for meteorology, observations of aerosols are important for air quality applications, observations of cloud cover and aerosols address key uncertainties in climate study. To improve parameterization and uncertainties of numerical models, observations provided by high resolution networks of ground-based instruments are needed. In order to achieve broad, high resolution coverage, low-cost instruments are preferable, though it is essential that the sensitivity, stability, biases and uncertainties of these instruments are well-understood.
Despite of their differences from more advanced and more powerful lidars, low construction and operation cost of ceilometer, originally designed for cloud base height monitoring, has fostered their use for the quantitative study of aerosol properties. The large number of ceilometers available worldwide represent a strong motivation to investigate to which extent they can be used to fill the geographical gaps between advanced lidar stations and how their continuous data flow can be linked to existing networks of the advanced lidars, like EARLINET (European Aerosol research LIdar NETwork).
In order to make the best use of existing and future ceilometer deployments, ceilometer must be better characterized. This is the purpose of the INTERACT campaign carried out in the frame of ACTRIS Transnational Access activities at CNR-IMAA Atmospheric Observatory (CIAO - 760 m a.s.l., 40.60 N, 15.72 E).
In this paper, an overview of the results achieved during the campaign is provided. In particular multi-wavelength Raman lidar measurements are used to investigate the capability of ceilometers to provide reliable information about atmospheric aerosol content through the INTERACT (INTERcomparison of Aerosol and Cloud Tracking) campaign carried out at the CNR-IMAA Atmospheric Observatory (760 m a.s.l., 40.60N, 15.72E), in the framework of ACTRIS (Aerosol Clouds Trace gases Research InfraStructure) FP7 project. This work is the first time that three different commercial ceilometers with an advanced Raman lidar are compared over a period of six months. The comparison of the attenuated backscatter profiles from a multi-wavelength Raman lidar and three ceilometers (CHM15k, CS135s, CT25K) reveals differences due to the expected discrepancy in the SNR but also due to effect of changes in the ambient temperature on the short and mid-term stability of ceilometer calibration. A large instability of ceilometers in the incomplete overlap region has also been observed, making the use of a single overlap correction function for the whole duration of the campaign critical. Therefore, technological improvements of ceilometers towards their operational use in the monitoring of the atmospheric aerosol in the low and free troposphere are needed.