EMS Annual Meeting Abstracts
Vol. 18, EMS2021-80, 2021
https://doi.org/10.5194/ems2021-80
EMS Annual Meeting 2021

New profiling capability for operational ceilometer networks

Minttu Tuononen, Raisa Lehtinen, Jukka Kallio, Pekko Tuominen, and Reijo Roininen
Vaisala, Research and Technology, Vantaa, Finland (minttu.tuononen@vaisala.com)

Ceilometers are known to be robust, stand-alone and cost-effective lidar-based remote sensing instruments. Typically, ceilometers are used in aviation to detect cloud base heights. Ceilometers are also used for atmospheric profiling, however, and the applications of profile information are increasing. The focus of this presentation is on potential new developments for operational ceilometer networks, such as the use of depolarization ratio profiles.

High-quality vertical profiles of total attenuated backscatter enable the detailed observation of cloud, boundary-layer, and elevated aerosol layer structures. Further developments in conventional ceilometers, such as the addition of the depolarization ratio profile measurement capability, allow more effective atmospheric sensing and new application areas can be more accurately covered. Depolarization ratio profiles enable the differentiation of hydrometeors – differentiation of liquid droplets, drizzle and raindrops, snow and ice crystals. These are important to a wide range of applications in the fields of aviation, meteorology, and air quality.

In this presentation we demonstrate depolarization ratio profile measurements using a new Vaisala CL61 Lidar Ceilometer with depolarization ratio profiling capability. We show measurements collected with 910.55 nm wavelength in different field campaigns and the comparison results with research grade lidars in varying weather and climate. The results correlate well and the depolarization ratio measurements show the physical characteristics of liquid and ice clouds, as well as the effects of multiple scattering in liquid cloud layers. This new depolarization capability in ceilometers allows multiple applications to be served, and enables the buildup of operational networks that provide improved vertical profiling in all weather conditions.