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Volcanic Ash, Sahara dust, and Biomass Burning plumes over Central Europe: Results from a combined Ceilometer/Lidar network

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Triggered by the eruptions of Eyjafjallajökull/Iceland in spring 2010, European Meteorological and Hydrological Services started to establish a European network for aerosol profiling based on lidars and ceilometers. Current ceilometers, e.g. the Vaisala CL51 and the Lufft CHM15K Nimbus, allow for the detection of aerosol layers in the atmosphere up to the tropopause region. First harmonizing steps on data exchange and aerosol profile retrievals were performed by two recent European COST actions (EG-CLIMET, ES0702; TO-PROF, COST ES1303). Routine operations and further harmonization on data formats and data exchange are performed under the wings of the EUMETNET project E-PROFILE. Moreover, measured attenuated backscatter profiles from the network are routinely used to validate modeled aerosol distributions from the COPERNICUS Atmospheric Monitoring Service (CAMS).
The Deutscher Wetterdienst (DWD) contributes to the European ceilometer/lidar network with currently 50 out of its 150 CHM15K Nimbus instruments (as of April 2019), which are all connected to the Internet. DWD operates furthermore a multi-wavelength Raman Lidar (PollyXT) at the Hohenpeissenberg Meteorological Observatory and a Raymetrics UV-Raman lidar with a depolarization channel, the latter being currently installed at Karlsruhe/Southwest Germany. Another Raman lidar instrument (RAMSES = Raman lidar for atmospheric moisture sensing) at DWD's meteo-rological observatory at Lindenberg near Berlin is dedicated to retrieve water vapor profiles but can also be used for retrieving aerosol parameters in case of emergency, e.g. a volcanic ash event.
Computation of the attenuated backscatter from ceilometer backscatter data requires calibration of such instruments. Two calibration approaches for the CHM15K and both the Vaisala instruments CL31 and CL51, thus covering the majority of instruments in Europe, were jointly developed within TO-PROF mainly by DWD, MeteoSwiss, and the University of Reading/UK. During the development process it turned out that also firmware issues need to be analyzed and taken into account.
All DWD ceilometers provide freely available quick looks of the attenuated backscatter which can be accessed through the „ceilomap“ web site (www.dwd.de/ceilomap) hosted by DWD. A selection of different instruments in Europe is already calibrated and processed within E-PROFILE by a single retrieval algorithm. The related quick looks of again the attenuated backscatter are provided through the E-PROFILE web presence.

We present results from the famous Eyjafjalla volcanic ash event in 2010, Saharan dust episodes and biomass burning plumes from North-American wild fires which were tracked and analyzed in recent years over Europe.