

CEILINEX 2015: Validation of calibration methods during the ceilometer inter-comparison

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In Europe, more than 700 ceilometers are measuring continuously. These instruments can be used for many applications such as detection of cloud base and aerosol layers height, aerosol profiling or for fog now-casting. However, from different manufacturers exist and the results can vary extensively from one type to another.

During the CeiLinEx2015 campaign (Ceilometer Performance Experiment at Lindenberg 2015), 6 types of ceilometers (CL31, CL51, CHM15k, CHM15kx CS135 and LD40) were measuring simultaneously at Lindenberg (Germany) from June to September 2015. Each type was represented by two instruments in order to assess the instrument-to-instrument variability. A companion contribution by Mattis et al. presents an overview of the campaign.

The monitoring of the temporal and spatial evolution of aerosol layers like the volcanic ash, is crucial to compare measurements from different sites. Therefore, all instruments need to be calibrated in order to provide consistent results.

This contribution will focus on the validation and the comparison of state-of-the-art calibration methods. The calibration methods tested were the cloud calibration (O'Connor et al., 2004) and the Rayleigh calibration Method (Wiegner and Geiß, 2012). Both methods can be applied without on-site intervention and are thus suitable for automatic networks. Operational automated algorithms based on these methods were developed in the framework of the TOPROF project (ESSEM COST Action ES1303). The Cloud calibration was found more appropriate for analog instruments with analog signal detection measuring at around 905nm (Vaisala CL51 and CL31 and Campbell Scientific CS135). The Rayleigh was more suitable for photon-counting systems measuring at 1064nm (CHM15k, CHM15kx).

For the first time, these methods were tested simultaneously on different instrument types and compared amongst each other. For a dust event occurred on the 13/08/2015, the attenuated backscatter coefficient difference amongst all instruments was lower than 25% after calibration.

To conclude, these calibration methods can now be trusted and applied to most instruments available, for example on the E-PROFILE European network that will be fully operational in 2017.