The E-PROFILE/TOPROF network of automatic lidars and ceilometers for cloud and aerosol/ash profiling

Maxime Hervo (1), Alexander Haefele (1), Myles Turp (2), Martial Haeffelin (3), Marc-Antoine Druoin (3), Emma Hopkin (4), Simone Kotthaus (3,4), Ina Mattis (5), Frank Wagner (6), Matthias Wiegner (7), Werner Thomas (5), Jean-Luc Lampin (8), Christoph Münkel (9), and Holger Wille (10)

(1) MeteoSwiss, Payerne, Switzerland , (2) Met Office, Exeter, United Kingdom, (3) IPSL, CNRS, Ecole polytechnique, Université Paris-Saclay, Palaiseau, France, (4) University of Reading, Reading, UK, (5) Deutscher Wetterdienst, Meteorological Observatory Hohenpeissenberg, Germany, (6) Karlsruhe Institute of Technology, Karlsruhe, Germany, (7) Ludwig-Maximilians-Universität, Munich, Germany, (8) Météo-France, Toulouse, France, (9) Vaisala GmbH, Hamburg, Germany, (10) Lufft GmbH, Berlin, Germany

It has been shown in various publications that state of the art ceilometers have the capability to do vertical profiling of aerosols including volcanic ash. Hundreds of ALCs with profiling capabilities are operated across Europe and are currently being integrated in the E-PROFILE ALC network. 87 instruments from 12 countries are already operational and several hundreds are expected by the end of 2017. This network will primarily provide vertical profiles of attenuated backscatter coefficient and complement existing networks of high performance research lidars bringing a higher density network of instruments and high data availability. It will significantly enhance the capabilities of the current observing system to detect volcanic ash and provide the basis for new applications in the area of data assimilation, air quality and fog now-casting.

In a tight collaboration between EUMETNET/E-PROFILE, COST/TOPROF and the industry, some of the best known state-of-the-art ALCs have been characterized establishing a good understanding of the instrument output. Correction algorithms and recommendations for instrument operation have been developed to improve data quality and consistency. Finally, calibration methods, relying on backscatter signal in liquid clouds and pure molecular portions of the atmosphere, have been implemented to calibrate ALCs in an automatic and unattended manner. Based on comparisons with research lidars and on Monte Carlo simulations the calibration uncertainty is currently estimated to be 25%.

We will provide a quick overview of COST/TOPROF developments concerning ALCs, and give a detailed description of the network architecture, the calibration algorithms and the envisaged network density and discuss the benefits of the ALC network with focus on volcanic eruption events. First results of assimilation in the atmospheric composition model operated at ECMWF will be shown.