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First evaluation of aerosol profiles forecasted in ECMWF C-IFS model with E-PROFILE ceilometer network

Maxime Hervo and Alexander Haefele
MeteoSwiss, Payerne, Switzerland (maxime.hervo@meteoswiss.ch)

E-PROFILE is a EUMETNET observation programme regrouping measurements of Automatic Lidars and Ceilometers (ALC). Twenty National Weather Services are funding E-PROFILE and more than 10 universities are contributing to the network. At the beginning of 2017, 68 ALCs were sending data operationally. Several hundreds of instruments are expected in the next years. ALCs have a strong potential for models evaluations and assimilation: they measure 24/7 and the high number of instruments can compensate for their limited power.

ALC measurements from 8 countries were compared with ECMWF Composition Integrated Forecasting System (C-IFS) model. To our knowledge, it is the first time that this kind of comparison is realised on a continental scale. Two forward operators were used to convert aerosol concentration in simulated Lidar profile. First, the methodology used by the Copernicus Atmosphere Monitoring Service (CAMS) was used. Secondly, the experimental forward operator implemented at ECMWF was tested.

On a 3-month period, the average difference between ALC measurements and CAMS forward operator was less than 50%, suggesting the good agreement between model and measurements. However, the sea-salt concentration forecasted in central Europe is clearly over-estimated. The concentration of Sulphate aerosol in the free troposphere was also clearly overestimated by the model. Similar results were found with ECMWF experimental forward operator.The comparison between measured and simulated profiles also highlights instrumental limitations like overlap artefacts.

After the evaluation, assimilation tesst will be performed to integrate the E-PROFILE observations in the ECMWF assimilation procedure.

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