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Systematic observations of long-range transport events and climatological backscatter profiles with the DWD ceilometer network

Ina Mattis (1), Gerhard Müller (1), Frank Wagner (1), and Maxime Hervo (2)

(1) Deutscher Wetterdienst, Observatorium Hohenpeißenberg, Hohenpeißenberg, Germany (ina.mattis@dwd.de), (2) MeteoSwiss, Federal office of meteorology and climatology, Payerne, Switzerland (maxime.hervo@meteoswiss.ch)

The German Meteorological Service (DWD) operates a network of about 60 CHM15K-Nimbus ceilometers for cloud base height observations. Those very powerful ceilometers allow for the detection and characterization of aerosol layers. Raw data of all network ceilometers are transferred online to DWD's data analysis center at the Hohenpeißenberg Meteorological Observatory. There, the occurrence of aerosol layers from long-range transport events in the free troposphere is systematically monitored on daily basis for each single station.

If possible, the origin of the aerosol layers is determined manually from the analysis of the meteorological situation and model output. We use backward trajectories as well as the output of the MACC and DREAM models for the decision, whether the observed layer originated in the Sahara region, from forest fires in North America or from another, unknown source. Further, the magnitude of the observed layers is qualitatively estimated taking into account the geometrical layer depth, signal intensity, model output and nearby sun photometer or lidar observations (where available). All observed layers are attributed to one of the categories 'faint', 'weak', 'medium', 'strong', or 'extreme'. We started this kind of analysis in August 2013 and plan to continue this systematic documentation of long-range transport events of aerosol layers to Germany on long-term base in the framework of our GAW activities.

Most of the observed aerosol layers have been advected from the Sahara region to Germany. In the 15 months between August 2013 and November 2014 we observed on average 46 days with Sahara dust layers per station, but only 16 days with aerosol layers from forest fires. The occurrence of Sahara dust layers vary with latitude. We observed only 28 dusty days in the north, close to the coasts of North Sea and Baltic Sea. In contrast, in southern Germany, in Bavarian Pre-Alps and in the Black Forest mountains, we observed up to 59 days with dust. At about 6 days per station, the optical depth of the dust particles was estimated to be larger than 0.4. Those events are classified as 'strong'. 'Faint', 'weak', and 'medium' events were detected at 13, 15, and 12 days per station, respectively. Almost all of the forest fire events have been classified as 'faint' and 'weak' with optical depths below 0.15.

Beside this qualitative investigations on transport events, we started to obtain calibration constants for all individual ceilometers in our network within the framework of the European projects E-PROFILE and TOPROF. We are currently producing a data set of 1-hour-mean particle backscatter profiles at 1064 nm at all ceilometer stations in Germany for the period between summer 2013 and winter 2014.

We will present an overview on the used methodologies of analysis of long-range transport events and of the calibration procedures. More detailed results of the event analysis, e.g. on seasonal behaviour will be presented as well. Further we will show results of a first statistical analysis of our 18-months data set of backscatter profiles over Germany.