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Aircraft measurements compared with ceilometer measurements during a sahara dust period in Germany

Konradin Weber (1), Christian Fischer (1), Martin Lange (1), Tobias Pohl (1), Christoph Boehlke (1), Frank Wagner (2), Ina Mattis (2), Harald Flentje (2), Klaus Sturm (2), Joachim Barth (2), Thomas Steinkopff (2), and Andreas Vogel (3)

(1) University of Applied Sciences, Duesseldorf, Germany, (2) German Weather Service, Offenbach, Germany, (3) NILU, Kjeller, Norway

A significant Sahara dust event took place at the beginning of April 2014 over large areas of Germany and Europe. The German Weather Service (DWD) detected and monitored the expansion and propagation of this dust cloud with a ceilometer network of more than 50 ceilometers. Moreover, these ceilometers were also able to track the altitude of the dust cloud at the positions of the ceilometers.
Additionally, aircraft measurements over Germany and France were performed with two aircraft by the Duesseldorf University of Applied Sciences. These aircraft were equipped with optical particle counters (OPC) and were able to measure the particle size distribution within the Sahara dust cloud and as a result of this to calculate the particle mass concentration of the dust. The ceilometer measurements and the aircraft measurements complemented each other: whereas the ceilometers gave continuous information about the Sahara dust cloud at the ceilometer positions, the aircraft measurements delivered interpolating results between the ceilometer positions.
Moreover, at several ceilometer positions intercomparison flights were performed by spiraling with the aircraft up or down around the ceilometer laser beam. This gave the unique possibility for comparing the remote sensing results of the ceilometers with the in-situ measurements of the aircraft.
This study shows that a significant high amount of Saharan dust particles was transported over Germany during a several days long episode. Furthermore, the intercomparison study between the German ceilometer network and aircraft measurements results shows a good agreement. A combination of these techniques could help to detect the vertical and horizontal distribution of the dust cloud and additionally the particle mass concentration.