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Urban new aerosol particle formation, its relation to local meteorology and profile measurements in the lower PBL

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Aerosol particles play an important role in the radiation balance of the Earth. They are mostly generated by new particle formation (NPF) and growth events. The process can be studied by measuring particle number size distributions on long run. Studies on urban NPF and growth in Budapest have been performed by a Differential Mobility Particle Sizer (DMPS) in the diameter range of 6–1000 nm with a time resolution of ca. 8 min at the Budapest platform for Aerosol Research and Training (BpART http://salma.web.elte.hu/BpArt/) research facility from 2008 (Salma et al., 2016). The mean occurrence frequency of NPF is the highest in spring (up to 60%). Nucleation phenomenon extends horizontally up to several hundreds of kilometres, while its vertical dimensions are not known.

Hexa-copter based profile measurements in the bottom 300 m portion of the Planetary Boundary Layer (PBL) have recently been added to previous surface observations, as further contribution to the environmental factors of nucleation. In spring 2019, temperature and relative humidity profiles were measured by a modified GRAW radiosonde at 1 Hz frequency, while particle number concentration profiles were measured by a TSI 8525 portable condensation particle counter in a diameter range of 10–1000 nm, with 5-second averaging time. Meteorological data of the GRAW radiosonde were compared to the data of a self-modified OGN Tracker, which has also been carried by the drone platform. Bosch BME-280 (pressure, temperature and humidity) sensor was installed to the OGN Tracker, which is able to transmit meteorological information in addition to location telemetry to the ground receiver. Packets of meteorological profiles are feed to APRS servers, usable by data assimilation cycles of regional forecast models in support of an aviation support system which is under current development.

The hexa-copter performed measurements in 50-meter thick vertical slices, carrying out nearly 20-sec constant level observation at each level on multiple days both with and without observed nucleation. The preliminary results indicate changes in aerosol profile and larger concentrations at certain heights during NPF events. The observations have been going on to reveal qualitative relationships.

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Reference

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