

Horizontal and vertical variation of particle concentration over Southern Finland

R. Väänänen¹, R. Krejci^{2,1}, H.E. Manninen¹, A. Manninen¹, J. Lampilahti¹, S.B. Mazon¹, T. Nieminen³,
T. Yli-Juuti³, J. Kontkanen¹, A. Asmi¹, P.P. Aalto¹, P. Keronen¹, T. Pohja¹, T. Petäjä¹, M. Kulmala¹

¹Department of Physics, University of Helsinki, Helsinki, Finland

²Department of Environmental Science and Analytical Chemistry (ACES)
Atmospheric Science Unit, Stockholm University, Stockholm, Sweden

³Department of Applied Physics, University of Eastern Finland, Kuopio, Finland

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Presenting author email: riikka.vaananen@helsinki.fi

University of Helsinki has performed research flight campaigns by a light aircraft since 2009 (Schobesberger *et al*, 2013) to extend the aerosol measurements into the boundary layer and lower troposphere. They complement the extensive on-ground measurements conducted at the SMEAR II station (see eg. Petäjä *et al*, 2016). Aims of the campaigns have been to investigate the representativeness of the SMEAR II measurements, the new particle formation (NPF), and the evolution of the planetary boundary layer.

In this study, we compared the airborne results to the on-ground measurements at the SMEAR II station. We present the horizontal and vertical variation of the aerosol concentration and the size distribution. The extend of our measurement was vertically 3.8 km and horizontally 30 km in the vicinity of the SMEAR station. Within this, we present statistical values of these quantities. Also interesting case study flights on NPF days are shown.

Our study concentrates on two flight measurements campaigns. The first one took place on May–June 2013, and the second one on March–April 2014. The instrumentation setups were similar. A Cessna 172 aircraft was used as a measurement platform. The measured quantities included the particle number concentration (cut-off size of 3 nm) and the particle number size distribution (size range of 10–400 nm). The flight data used in this analysis equals 111 hours. The seasonal and meteorological differences between the campaigns resulted in differences in the aerosol properties. Fig. 1 shows the vertical profiles of the nucleation mode and the CCN sized particles during the campaigns. The airborne concentrations fit well with the on-ground measurements. The differences between the campaigns arise from different NPF frequencies but also from the different air mass origins and average heights of the planetary boundary layer. The fraction of NPF event days of all flight days during 2013 was 57 %, while during 2014 it was 93%.

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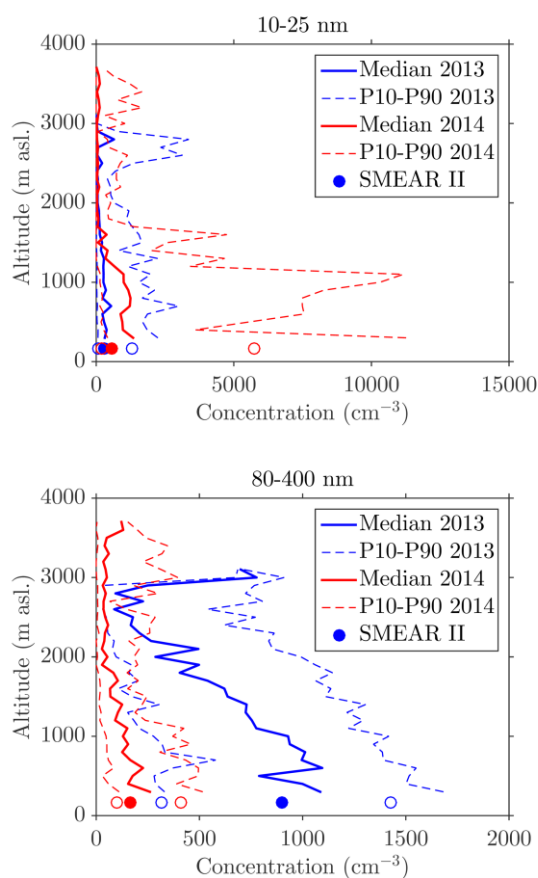


Figure 1. Statistics of the vertical particle number concentration profiles of the late spring flights 2013 (blue), and the early spring flights 2014 (red). Median values, as well as 10th and 90th percentiles of the size bins 10–25 nm and 80–400 nm presented. Circles show the simultaneous SMEAR II concentration data.

Schobesberger, S., *et al.* (2013), *Boreal Env. Res.*, 18, 145–163.

Petäjä, T., *et al.* (2016), *Bull. Am. Meteorol. Soc.*
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