

Publication

Fine and ultrafine particles in the Zürich (Switzerland) area measured with a mobile laboratory: an assessment of the seasonal and regional variation throughout a year

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On occasion of the project YOGAM (year of gas phase and aerosol measurements), the spatial and temporal variation of selected aerosol and gas phase parameters was assessed for the Zurich (Switzerland) area with a new mobile pollutant measurement laboratory. This assessment based on on-road measurements along a specified route on selected days during different seasons in 2001/2002, covering urban, suburban and rural regions. Special focus was put on the investigation and characterization of particles in the fine (particle diameter $D < 2.5 \mu\text{m}$) and ultrafine ($D < 100 \text{ nm}$) size ranges. Analysis of Variance (ANOVA) showed that the variance of all considered fine and ultrafine aerosol parameters (i.e. particle background and total number concentration for particles larger than 3 nm, number concentrations in the size ranges 7-30 nm and 80-140 nm, as well as the active surface area concentration) was significantly larger for day-to-day than for spatial variation. However, Principal Component Analysis (PCA) found a similar regional pollution pattern within every single measuring day. Lowest particle background levels ($D > 3 \text{ nm}$) were found in rural areas at higher elevation (15 000 cm(-3)), while corresponding mean background values for urban and freeway-influenced areas were typically 35 000 cm(-3) and >80 000 cm(-3), respectively. Meteorology, i.e. prevailing weather conditions not only governed the day-to-day concentration variations in the selected area, but also influenced the formation of primary (directly traffic-related) and in few cases secondary (biogenic or anthropogenic) ultrafine particles. Overall, low temperatures regularly enhanced primary ultrafine particle formation in urban areas. There was a possible indication for relatively low number concentrations of secondary ultrafine particles during a few warm and sunny spring days. Mobile measurements as they were performed in this study have been shown to be suitable for pollutant assessments to obtain good information on spatial and day-to-day variability. For experimental studies concerning spatial resolution on a relatively short time scale (<1 day), a mobile measurement design may even be more appropriate than a network of stationary measuring sites.

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