A mobile pollutant measurement laboratory-measuring gas phase and aerosol ambient concentrations with high spatial and temporal resolution

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A mobile pollutant measurement laboratory was designed and built at the Paul Scherrer Institute (Switzerland) for the measurement of on-road ambient concentrations of a large set of trace gases and aerosol parameters with high time resolution (<15 s for most instruments), along with geographical and meteorological information. This approach allowed for pollutant level measurements both near traffic (e.g. in urban areas or on freeways/main roads) and at rural locations far away from traffic, within short periods of time and at different times of day and year. Such measurements were performed on a regular base during the project year of gas phase and aerosol measurements (YOGAM). This paper presents data measured in the Zurich (Switzerland) area on a late autumn day (6 November) in 2001. The local urban particle background easily reached 50 000 cm(-3), with additional peak particle number concentrations of up to 400 000 cm(-3). The regional background of the total particle number concentration was not found to significantly correlate with the distance to traffic and anthropogenic emissions of carbon monoxide and nitrogen oxides. On the other hand, this correlation was significant for the number concentration of particles in the size range 50-150 nm, indicating that the particle number concentration in this size range is a better traffic indicator than the total number concentration. Particle number size distribution measurements showed that daytime urban ambient air is dominated by high number concentrations of ultrafine particles (nanoparticles) with diameters <50nm, which are immediately formed by traffic exhaust and thus belong to the primary emissions. However, significant variation of the nanoparticle mode was also observed in number size distributions measured in rural areas both at daytime and nighttime, suggesting that nanoparticles are not exclusively formed by primary traffic emissions. While urban daytime total number concentrations were increased by a factor of 10 compared to the nighttime background, corresponding factors for total surface area and total volume concentrations were 2 and 1.5, respectively.

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