Locating urban hot-spots with mobile on-line size-resolved nanoparticle measurement

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Background
• Internal combustion engines are often a dominant source of fine particles in urban air, which cause an order of magnitude more premature deaths than traffic accidents. Particles are very small, are emitted in the immediate vicinity of people.
• Nanoparticles concentrate along roads and their spatial distribution of nanoparticles is highly non-uniform.
• Emissions of nanoparticles from internal combustion engines are strongly dependent on current and prior engine operating conditions and their distribution is therefore highly non-uniform.

Goal: Compact, mobile, size-resolved measurement of nanoparticles in ambient air near roadways.

Approach
• Fast mobility spectrometer (Engine Exhaust Particle Sizer, TSI Inc.), condensation counter (P-trak, TSI Inc.), notebook, GPS, batteries mounted on a two-wheel hand cart.

Size: Large peaks found around 10 nm -- can be missed if measurements start around 15-20 nm (UFP studies) or 23 nm (PMP)
Size distribution corresponds to, i.e., diesel exhaust after thermodenuder (Rönkkö et al., Environ. Sci. Technol., 2013, 47, 11882-11889)

Conclusions
• Local concentration of ultrafine particles and nanoparticle hotspots were assessed by walking around the neighborhood with local citizens with a mobile fast particle electric mobility classifier.
• Concentrations above and near roadways exceed “urban background” (7000 #/cm² in Prague) by order(s) of magnitude.
• Local hotspot found where trucks accelerate out of congested area.
• Engines are not “black boxes producing emissions” evenly along the way; operating conditions and their history are important and should be considered.

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