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Quantifying size-resolved urban particle number fluxes in Berlin (Germany) using eddy covariance

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Cities are characterized by high particle number concentrations, which are emitted from different sources, e.g. traffic exhaust, industrial combustions, road dust or domestic emission from cooking and heating. However, only few studies focused on turbulent exchange of particles between the urban area and atmosphere, yet. In particular, little is known about size-resolved particle number fluxes in the ultrafine size range ($<$ 100 nm diameter).

Within the project "Urban Climate Under Change ([UC]^2)", eddy covariance measurements of vertical aerosol transport are conducted at a dense urban site in Berlin (population $\sim$ 3.6 million). Particles in the size range 10 nm $<$ D_P $<$ 200 nm (21 size bins) are sampled on a rooftop at a height of 57 m above ground. The measurement system, which consists of an Engine Exhaust Particle Sizer Spectrometer (EEPS 3090; TSI Inc., USA) and a 3D ultrasonic anemometer (USA-1; METEK GmbH, Germany), records data since March 2017.

For the present analysis, one year of data from March 2017 to March 2018 is used. Initial results of total number fluxes for 1.5 months (March – April 2017) show that Berlin acts as a source of particles with a mean flux of 1.27*10^8 particles m^{-2} s^{-1}. These findings are in the order of magnitude in comparison to other European cities such as Münster (Germany), Helsinki (Finland) or Lecce (Italy). Furthermore, analysis of the mean diurnal cycle shows that fluxes seem to be correlated to traffic activity and stability of the urban boundary layer.

In the presentation, we would like to give an overview of the particle number fluxes measured in Berlin, the mean diurnal cycle of size-resolved particle number fluxes, the incidence of simultaneous bidirectional fluxes for different particle diameters, and differences with regard to meteorological seasons.