

INTRODUCTION

Work package 1 of Joaquin aimed at a better understanding of UFP in urban environments by evaluating the spatiotemporal variation of UFP number concentration and size distribution in four NW European cities (Amsterdam, Antwerp, Leicester and London). Moreover, relations of UFP with more commonly monitored pollutants such as nitrogen oxides (NO_x), particulate matter (PM₁₀, PM_{2.5}) and black carbon (BC) were evaluated.

Objective

To obtain a better understanding of the spatiotemporal variation of UFP in NW European urban environments

METHODS

- Continuous measurements of UFP, black carbon (BC), PM and NO_x between April 2013 and March 2015 in Amsterdam (NL), Antwerp (BE), Leicester (UK) and London (UK).
- Total UFP number concentrations were measured with a condensation particle counter (TSI EPC-3783, 7-1000 nm) and BC with a MAAP (Thermo-5012).
- Size-resolved UFP number concentrations were obtained by a Grimm-5420/L-DMA (10-1000 nm) in Amsterdam and Antwerp and a TSI UFP-3031 in Leicester and London* (20-200 nm).
- An initial campaign was conducted to compare the UFP instruments (January, 2013)

* Anomalous results were obtained for the size-resolved particle numbers in London. The instrument is currently revised by TSI for correction factors.

RESULTS

- Total UFP number concentrations (TNC) show a traffic-related diurnal variation with distinct morning and evening peaks, higher concentrations on working days and in the winter period.

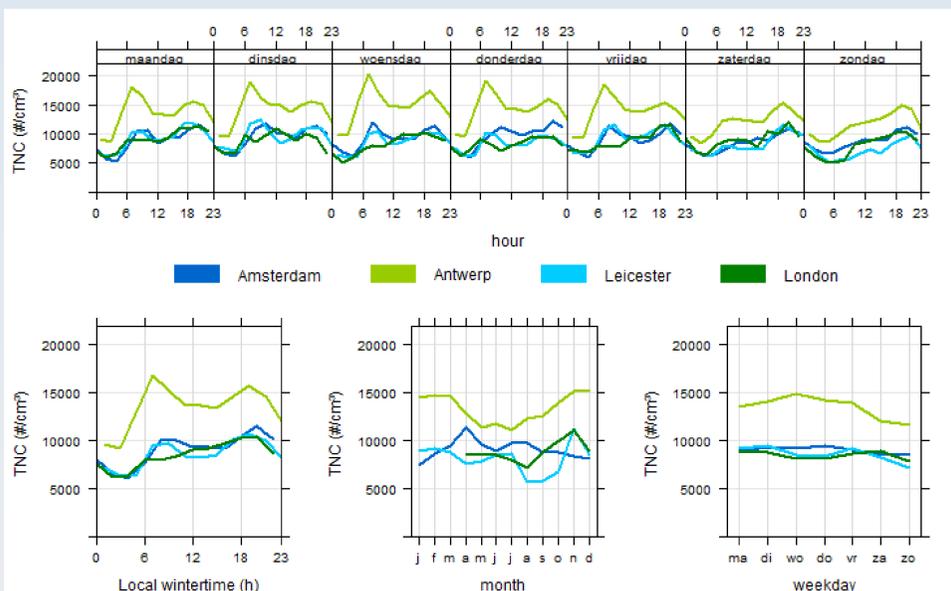


Figure: Daily, weekly and monthly variation of total UFP number concentrations in Amsterdam, Antwerp, Leicester and London

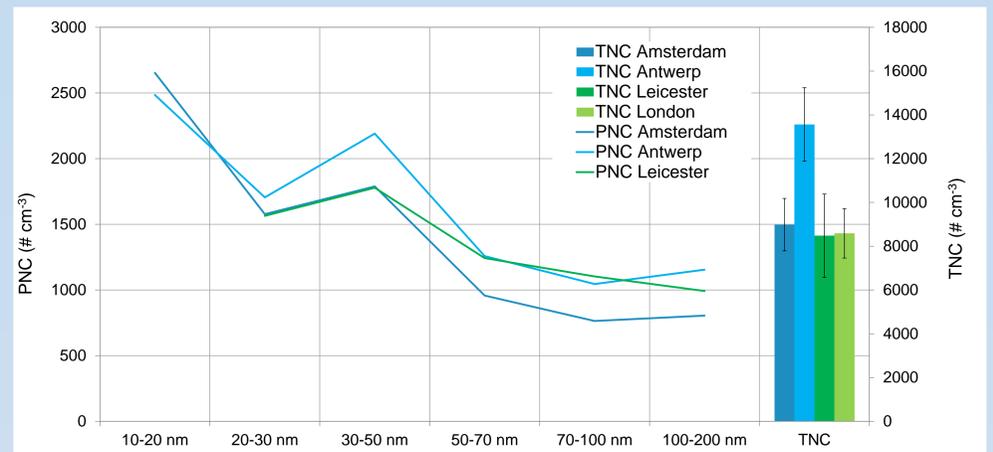


Figure: Average size-resolved (PNC) and total particle number (TNC) concentrations for Amsterdam, Antwerp, Leicester and London

- Average UFP size distributions are relatively similar between the considered sites. Nevertheless, Antwerp and Amsterdam show a higher contribution of 30-50 and 10-20 nm particles, respectively.
- Amsterdam, Antwerp and London show significant TNC variation depending on the experienced wind fields, with Schiphol airport being an important source of 10-20 nm-sized particles. This was reported before by a study of Keuken et al. (2015).

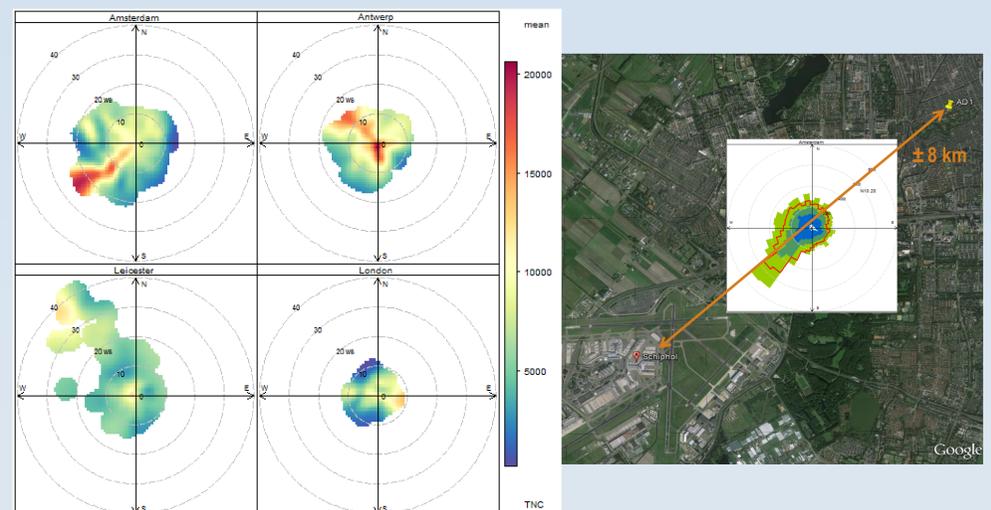


Figure: Polar plot of wind field averaged total particle number concentration (#/cm³) for the considered monitoring sites (left) and location of the Amsterdam monitoring site at 8 km from Schiphol airport and wind direction averaged (red line) 10-20 nm particles (right)

CONCLUSIONS

- Continuous size-resolved UFP monitoring in urban environments is challenging but feasible.
- Urban UFP size distributions are relatively comparable, but have shown to be influenced by site-specific UFP sources.
- Relations between UFP and other pollutants (e.g. BC, NO₂) are site-dependent.

Can monitoring sites which are influenced by local sources (e.g. Amsterdam and Antwerp) be considered as good urban background stations?