Particle number concentrations and size distributions in Po Valley (Northern Italy).

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The densely populated and heavily industrialized area of the Po Valley is a well known hot-spot for PM pollution, especially in the cold season, due to the frequent inversion and stagnation meteorological conditions. However, knowledge on particle number concentration (PNC) and related size distribution (PNSD) in this area is still rather scarce.

Within the experimental Poair project, an intensive multi-site field campaign was conducted during February 2014, aiming to the investigation of the temporal and spatial variations of PNC levels and PNSD. Measurements were taken at four sites (Fig.1): three urban background sites, Milano (MI-UB), Bologna (BO-UB), Padova (PD-UB), and one rural site, Molinella (SPC-R). Data have been collected by means of an Ultrafine Particle Monitor (UPM, TSI 3031) at MI-UB, a Fast Mobility Particle Sizer (FMPS, TSI 3091) at PD-UB and BO-UB and a twin-DMPS at SPC-R. The measured particle size ranges were 3-600 nm for both FMPS and twin-DMPS and 20-1000 nm for UPM in Milano.

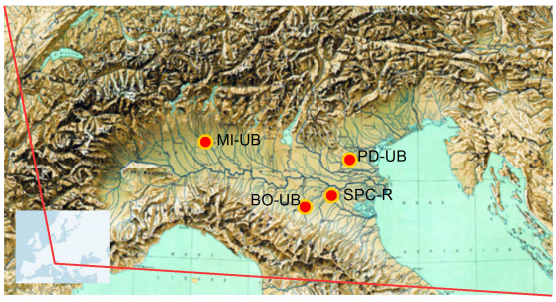

Figure 1. Monitoring sites location.

Compared with the typical winter conditions in this area, February 2014 was warmer, more unstable and more rainy: thus, particulate matter mass concentration levels were quite low.

At UB sites TNC showed similar daily time patterns, with two typical peaks in correspondence with the traffic rush hours; conversely, the SPC-R rural site showed a pattern mainly driven by the boundary layer evolution and much less affected by emission activity.

The contribution of ultrafine particles (UFP, 20-100nm) to TNC levels were between 74-76% at urban sites, in agreement with data reported for other similar urban areas (Bigi et al., 2011); a lower UFP contribution (62%) was observed at the rural site SPC-R.

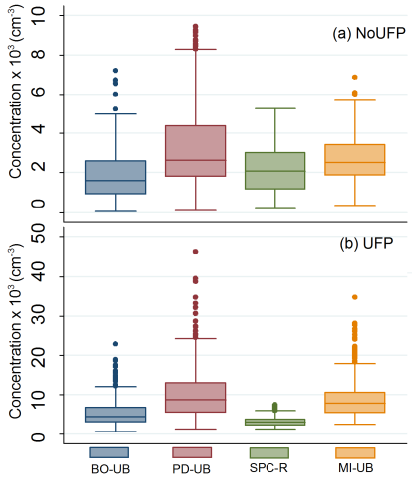

Figure 2. Box-plots of 1-h average NoUFP (a) and UFP (b).

Data comparison (fig. 2) highlighted a much larger variability for UFP concentrations at the urban sites than at the rural site, likely as a consequence of primary emissions from urban sources, namely traffic (Moore et al. 2012). Conversely, with the exception of PD-UB site, NoUFP (>100nm) displayed a less relevant spatial variability, apparently deriving from a diffused regional background. This behaviour was partially confirmed by the time series analysis: site correlations for NoUFP number concentrations were comparable to those observed for PM2.5, whereas correlations for UFP, mainly influenced by local emission, were noticeably lower.

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