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Spatial variation in particle number size distributions in a large metropolitan area

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Abstract. Air quality studies have indicated that particle number size distribution (NSD) is unevenly spread in urban air. To date, these studies have focussed on differences in concentration levels between sampling locations rather than differences in the underlying geometries of the distributions. As a result, the existing information on the spatial variation of the NSD in urban areas remains incomplete. To investigate this variation in a large metropolitan area in the southern hemisphere, NSD data collected at nine different locations during different campaigns of varying duration were compared using statistical methods. The spectra were analysed in terms of their modal structures (the graphical representation of the number size distribution function), cumulative distribution and number median diameter (NMD). The study found that with the exception of one site all distributions were bimodal or suggestive of bimodality. In general, peak concentrations were below 30 nm and NMDs below 50 nm, except at a site dominated by diesel trucks, where it shifted to around 50 and 60 nm respectively. Ultrafine particles (UFPs (<100 nm)) contributed to 82–90% of the particle number, nanoparticles (<50 nm) to around 60–70%, except at the diesel traffic site, where their contribution dropped to 50%. Statistical analyses found that the modal structures heterogeneously distributed throughout Brisbane whereas it was not always the case for the NMD. The discussion led to the following site classification: (1) urban sites dominated by petrol traffic, (2) urban sites affected by the proximity to the road and (3) an isolated site dominated by diesel traffic. Comparisons of weekday and weekend data indicated that, the distributions were not statistically different. The only exception occurred at one site, where there is a significant drop in the number of diesel buses on the weekend. The differences in sampling period between sites did not affect the results. The statistics instead suggested variations in traffic composition. However, the relative contribution of petrol vehicle emissions at each site could not be assessed due to the limited traffic information available.

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