



Implications of atmospheric boundary layer dynamics for urban air quality: case studies from London and Beijing

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The cities of London, UK, and Beijing, China, are currently receiving significant attention due to frequent air pollution episodes. Hence, great effort is being directed towards monitoring pollutant concentrations and emission fluxes to support the regulation and forecasting of air quality in these dense urban settings. Given that the depth (DML) of the mixed layer (ML) determines the volume over which aerosols and moisture emitted at the surface are diluted, interpretation of near-surface observations requires insights on atmospheric boundary layer (ABL) dynamics.

DML is determined from ceilometer profile observations at sites in the city centre of London and Beijing, coinciding with detailed atmospheric chemistry observations both at surface monitoring stations and at elevated heights on a tall measurement tower. Based on long-term observations (multiple years in London, multiple months in Beijing), seasonal differences in ML height are put into context using surface energy balance fluxes of radiation and sensible heat to evaluate the role of atmospheric stability conditions. Taking into account the synoptic background, it is analysed under which conditions atmospheric stratification affects particle and gaseous concentrations near the surface. Case studies of locally-driven dynamics reveal that the depth of the mixed layer can explain both temporal and spatial (i.e. vertical gradients) variations of pollutant concentrations in relation to surface emission fluxes.