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Scintillometer measurements above the urban area of London

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The spatial heterogeneity of urban surfaces presents a particular challenge to the measurement of turbulent fluxes. This is particularly true close to the urban surface (in the roughness sub-layer (RSL)) where the mosaic of roof top and street canyon surfaces present a complex three dimensional source area. Scintillometery, which offers the ability to make path-averaged measurements of turbulent fluxes of heat and momentum, provides an alternative approach to obtaining more spatially representative data sets in the RSL.

In this study three Scintec small aperture scintillometers (SLS 20) were used to measure the sensible heat flux (Q_H) at a densely built up site at Strand Campus, King's College London, UK. Two different surfaces (courtyard and rooftop) characteristic of the urban environment were investigated simultaneously. One of the SLS was aligned just atop a courtyard (z/z_H= 0.9), while the other two were set up in two different heights (z/z_H= 1 and z/z_H= 1.25) above a rooftop line. Where z_H is the mean building height and z is the measurement height above ground level. Special consideration was given to the estimation of the displacement height and the influence of the Monin-Obukov function used for the analysis. To estimate the contribution of the different surface types to the observed fluxes a footprint analysis was carried out for the two rooftop SLS and the eddy covariance system.

Fluxes from the two SLS above the rooftop generally agreed well with each other and exhibited a pronounced diurnal cycle. They also showed similar patterns and magnitudes as those measured by an eddy covariance system located close by. In contrast, diurnal flux patterns derived from the measurements atop the courtyard showed marked differences, especially during day time when fluxes often remained smaller.