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An intercomparison of urban and rural boundary layer turbulent characteristics based on 2 years of Doppler lidar observations in London, UK

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The turbulent characteristics of the Urban Boundary Layer (UBL) are important because they determine the dispersion of pollutants close to their sources. Due to the differences in surface energy balance between urban and rural areas, significant differences in fluxes, boundary layer depth and their diurnal cycle are expected to arise. However there is a general lack of long term observations of fluxes and boundary layer depth at both urban and rural sites to characterise the differences. In this study we examine the turbulent characteristics of the UBL over the full diurnal cycle, using over 2 years of measurements conducted through the ACTUAL (Advanced Climate Technology Urban Atmospheric Laboratory) and Clearflo projects in central London, UK. The UBL characteristics are contrasted with measurements at a nearby rural site.

Two Doppler lidars were sited in central London and at a rural site (Chilbolton Observatory) and run from spring 2010 to autumn 2012. Eddy covariance systems measuring radiative, sensible heat and latent heat fluxes were located at a height of 5m at the rural site, and at 17m (on a roof-top) and at 190m (on a telecommunications tower, the BT Tower) at the ACTUAL project sites in London. Extensive pollutant measurements were co-located with the BT Tower observations and at additional sites through central London as part of the Clearflo project. Results will be presented showing the mean diurnal variation of boundary layer depth and fluxes and its seasonal and monthly variation across the whole observation period. Differences in boundary layer depth between the urban and rural stations will be analysed in terms of stability and atmospheric temperature structure, using additional radiosonde and aircraft meteorological data relay (AMDAR) data. Implications for urban pollutant concentrations and dispersion will be discussed.