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Forecasting the weather
- ensemble techniques
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Boundary layer dynamics over London, UK, as observed using doppler lidar and scintillometers

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The varying surface types within a city can cause the formation of internal layers of differing turbulence regimes. These layers can affect vertical mixing throughout the lower atmosphere. Over more homogeneous (e.g. rural) terrain, there are well-developed formulations for boundary-layer turbulence profiles; but can these formulations be applied over complex (e.g. urban) surfaces? Doppler lidars are ideal for examining the structure of the boundary layer over cities, since they provide both aerosol backscatter and turbulence statistics.

During 2010, a HALO Photonics Streamline doppler lidar has been installed in London as part of the ACTUAL project (www.actual.ac.uk). Vertical profiles of backscatter and vertical velocity variance are retrieved and used to derive aerosol-layer and mixing heights, respectively. In convective cases, profiles agreed well with established formulations. During clear nighttime skies, distinct layers of aerosol and turbulence were observed suggesting that stable layers aloft—decoupling air from the warm urban surface—can exist at night. These results have implications for pollutant transport, as well as further understanding of the boundary layer over urban areas.

We also have begun to compare the doppler-lidar results with measurements using different models of scintillometer at different scales. The lidar was used to scan along and across the scintillometer paths to allow a comparison of turbulence measurements derived from these two remote-sensing techniques. A Large Aperture Scintillometer (LAS) was setup along a 4.1 km path with a mean beam height of 135 m above the ground (a Kipp and Zonen LAS 150). A second LAS (a Scintec dual beam BLS900) was setup with a path length of 0.8 km over the River Thames.