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Measuring aerosol distribution and transport in London using a high density solar radiation measurement network

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Urban aerosols are important to human health and also cause a local direct radiative effect at the surface and the TOA. Regions surrounding urban areas are also sensitive to these effects through the aerosol transportation within the planetary boundary layer.

We present a novel technique for studying the distribution of aerosols within and out of London. The technique uses a new high density network of continuous solar radiation measurements across London which form part of the OPAL (Open Air Laboratories) weather station network. We perform Langley extrapolations on the measured irradiance to infer the columnar amount of aerosol, and hence aerosol optical depth. This allows a map of aerosol optical depth across greater London to be produced.

We evaluate results from this method by comparing results to measurements from the EM25 field campaign which took place during June 2009. During EM25 measurements of aerosols were made firstly by the UK FAAM (Facility for Airborne Atmospheric Measurements) BAe-146 aircraft, performing in-situ measurements, and secondly by a truck that was driven around London and equipped with a 355nm wavelength backscatter lidar, showing the vertical distribution of aerosol. The solar radiation measurements are also compared to data from London's PM2.5 and PM10 ground-based network, and to satellite aerosol optical depth data from MODIS at 550nm.

The solar radiation network results show aerosol being transported to the southwest of London under the effect of a north-easterly prevailing wind. This shows good agreement with data from MODIS, PM2.5 and the EM25 field campaign measurements. This novel technique of using a high density network of solar radiation measurements is therefore able to monitor the distribution of aerosol across and out of London, and is presented as a useful way to infer aerosol distribution across urban areas.