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A Portable Low-Cost High Density Sensor Network for Air Quality at London Heathrow Airport

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Outdoor air quality and its impact on human health and the environment have been well studied and it has been projected that poor air quality will surpass poor sanitation as the major course of environmental premature mortality by 2050 (IGAC / IGBP, release statement, 2012). Transport-related pollution has been regulated at various levels by enactment of legislations at local, national, regional and global stages. As part of the mitigation measures, routine measurements of atmospheric pollutants such as carbon monoxide (CO), nitric oxide (NO) and nitrogen dioxide (NO_2) have to be established in areas where air quality problems are identified. In addition, emission inventories are also generated for different atmospheric environments including urban areas and airport environments required for air quality models.

Whilst recognising that most of the existing sparse monitoring networks provide high temporal measurements, spatial data of these highly variable pollutants are not captured, making it difficult to adequately characterise the highly heterogeneous air quality. Spatial information is often obtained from model data which can only be constrained using measurements from the sparse monitoring networks.

The work presented here shows the application of low-cost sensor networks aimed at addressing this missing spatial information. We have shown in previous studies the application of low-cost electrochemical sensor network instruments in monitoring road transport pollutants including CO, NO and NO_2 in an urban environment (Mead et. al. 2012, accepted Atmospheric Environment). Modified versions of these instruments which include additional species such as O_3, SO_2, VOCs and CO_2 are currently deployed at London Heathrow Airport (LHR) as part of the Sensor Network for Air Quality (SNAQ) project. Meteorology data such as temperature, relative humidity, wind speed and direction are also measured as well as size-speciated particulates (0.38 to 17.4 μm).

A network of 50 sensor nodes is being deployed in and around the airport perimeter. We present here some of the early results from the deployment showing some regional pollution episodes influenced by meteorology, as well as localised pollution effects related to aircraft taxiing, take-off and landing at the airport. We show how SNAQ can provide measurement data useful for validation of air quality models currently used for LHR, the generation of emission inventories for the airport as well as pollution source attribution within and around LHR.