Across-scale processes in urban environments: the ASSURE project

Janet F. Barlow[1], Sue Grimmond[1], Andreas Christen[2], Dudley Shallcross[3], Zheng-tong Xie[4], Marco Placidi[5], Matteo Carpentieri[5], Alan Robins[5], Omduth Coceal[1], Maarten van Reeuwijk[6], Stefan Smith[1], Jeremy Price[7], James McGregor[7], and Phil Rosenberg[8]

[1]*Department of Meteorology, University of Reading*
[2]*Environmental Meteorology, University of Freiburg*
[3]*School of Chemistry, University of Bristol*
[4]*Faculty of Engineering and the Environment, University of Southampton*
[5]*Mechanical Engineering Sciences, University of Surrey*
[6]*Civil and Environmental Engineering, Imperial College London*
[7]*Observation Based Research, Cardington, Met Office*
[8]*Atmospheric Measurement and Observation Facility, NCAS*

Local and global consequences of climate change affect most of the world's urban population, but only recently have cities been represented, albeit crudely, in weather forecast models. To manage and develop sustainable, resilient, and healthy cities requires improved forecasting and observations that cross neighbourhood-influenced scales O(1km) which the next generation weather forecast models need to resolve. ASSURE addresses the critical issue of which processes need to be parameterised, and which resolved, to capture urban heterogeneity in space and time. An important part of that heterogeneity is the impact on the atmosphere of anthropogenic activities, e.g., heat release from combustion, that can have a significant effect on the urban boundary layer.

The ASSURE Project aims to advance understanding in developing new approaches and parameterisations for larger-scale urban meteorological and dispersion models by combining the results of field observations, high-resolution numerical simulations, and wind tunnel experiments. Field work and modelling focuses on Bristol, as its physical geography provides suitably high levels of complexity and yet is compact enough to allow whole-city approaches. With mid-sized cities being large sources of greenhouse gases, and where large numbers of people live, it is critical that agencies can provide predictions of weather and climate variability across cities of this scale as they need this information to manage and provide their services.

This talk will review scientific issues that motivated the work and introduce different components of the project and the interaction with project partners. Theoretical and numerical weather prediction modelling work will be introduced. Fieldwork is planned for one year from May 2024: the fieldwork will be outlined and early results will be described. Meteorological equipment includes a 40+ network of automatic weather stations, 5 Doppler Wind Lidars, 5 Ceilometers, and radiation instrumentation that span the whole city. Full-scale tracer gas release experiments will be conducted and modelled in the wind tunnel and with Large Eddy Simulation.