Air Quality and Health: exploring the linkages and developing a predictive capability

Supervisors: Prof**.** Gordon McFiggans, Prof. David Schultz, Dr David Topping (UoM, SEAES), Prof. Andrew Brass (UoM, Computer Sciences), Dr Sheena Cruickshank (UoM Life Sciences).

Primary Contact Name and Email: Gordon McFiggans, g.mcfiggans@manchester.ac.uk

Is this a CASE studentship? YES

Intended CASE partner: Cisco

Introduction:

Regional air quality is a major area of research focus with direct implications for both local and national policy and pollution control strategy. Poor air quality is now the single biggest environmental risk factor to life expectancy in the UK and globally, estimated to cause an average UK life expectancy reduction of around 6 months and cause 29,000 annual premature deaths. Particulate Matter (PM) is the most damaging of regional pollutants with an estimated cost in the UK of €15K - €40K / tonne in terms of mortality with further substantial effects on morbidity. Complex interactions between meteorology, emissions and physico-chemical transformations make reliable "chemical weather" predictions challenging. Within the Centre for Atmospheric Sciences we complement our expertise in process modelling and measurement of trace gas and particulate pollutants with regional-scale modelling to interpret field measurements in all parts of the planet and understand the impacts of chemical processes. Our ManUniCast website and iPad and iPhone app show our real-time air-quality and weather forecasts (http://manunicast.seaes.manchester.ac.uk). The project co-supervisors in the Manchester Immunology Group and BioInformatics have developed an app through the #britainbreathing project that will be used to collate data on seasonal allergy symptoms in the UK (asthma and hayfever). In the UK alone, approximately one in four people have asthma and allergies and the incidence has increased over the last hundred years. The reasons for this are unclear but pollutants are thought to be a factor. Thus, combining the expertise of both teams will enable investigation of the links between air quality and health.

Project Summary:

This multidisciplinary PhD offers the opportunity for research linking the causes of air quality degradation to their health outcomes, with particular emphasis on improving our understanding the effects of fine particles and gaseous pollutants on breathing. The student will have the opportunity to develop skills in computational modelling, data analysis and interpretation of measurements as the project dictates and as the interests and aptitude of the student allows. The development and use of the model as an operational predictive tool for understanding Defra network observation data will be a main focus of the work. Comparing the location, timing and symptom reporting (as broad categories) from the #britainbreathing app with predicted and measured pollution data (as well as pollen/weather), the student will look for relationships with air quality factors that influence allergy flare / symptoms

References:

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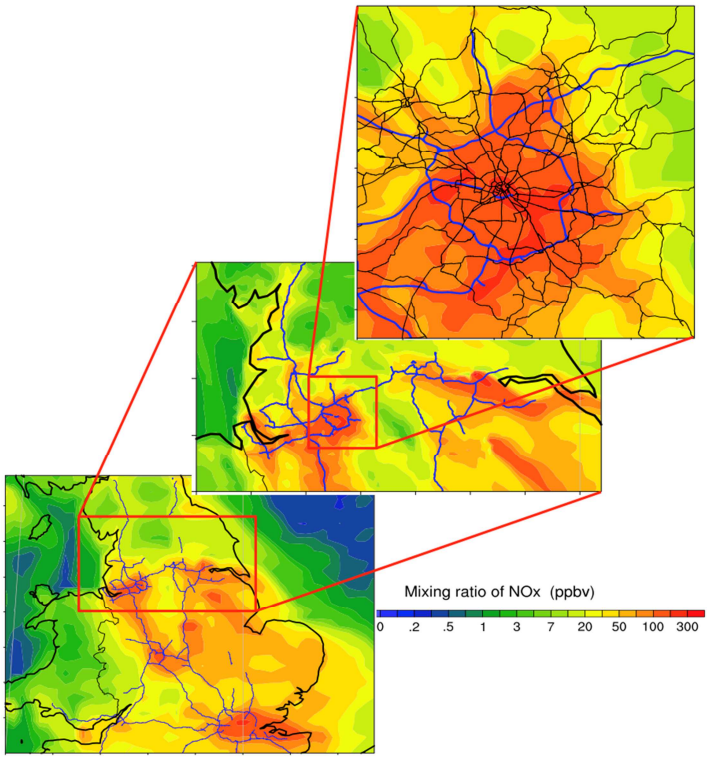
2. Grell G. et al., Chapter on "On-line Chemistry within WRF: Description and Evaluation of a State-of-the-Art Multiscale Air Quality and Weather Prediction Model" in Integrated Systems of Meso-Meteorological and Chemical Transport Models. Springer, ISBN: 978-3-642-13979-6, 2011.
3. Monks, P. S. et al., Atmospheric Composition Change–Global and Regional Air Quality, Atmospheric Environment, 43, 33, 5268-5350, doi:10.1016.jatmosenv.2009.08.021, 2009.



Simulated NOx down to 1 km x 1 km grid spacing over Manchester.