UNIVERSITY OF BIRMINGHAM | WM-AIR

WM-AIR ANNURAL MEETING

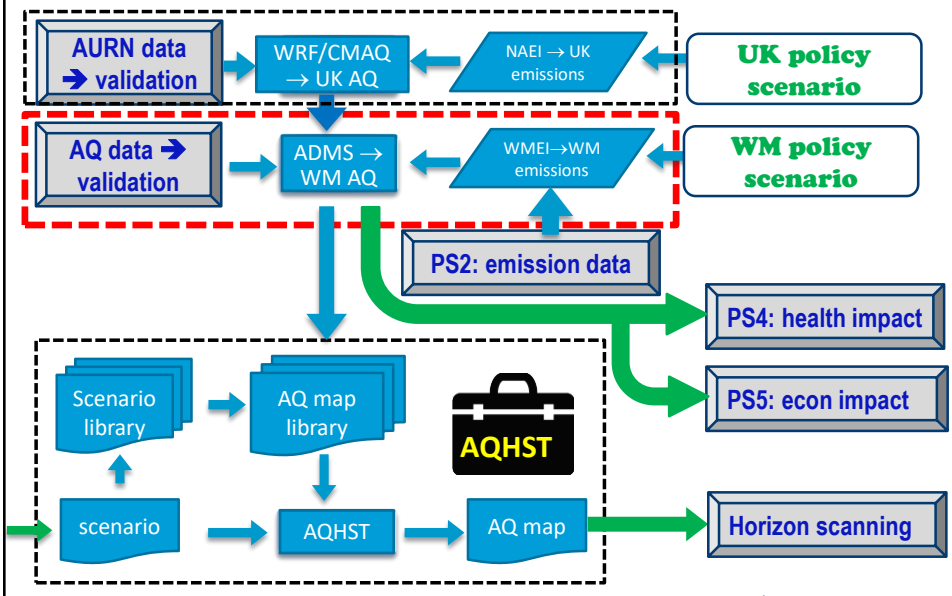
Ambient AQ Modelling

Presented by

XIAOMING CAI

WM-Air Annual Meeting, 29 Oct 2019

WM-Air Strand 3: Air Quality Modelling



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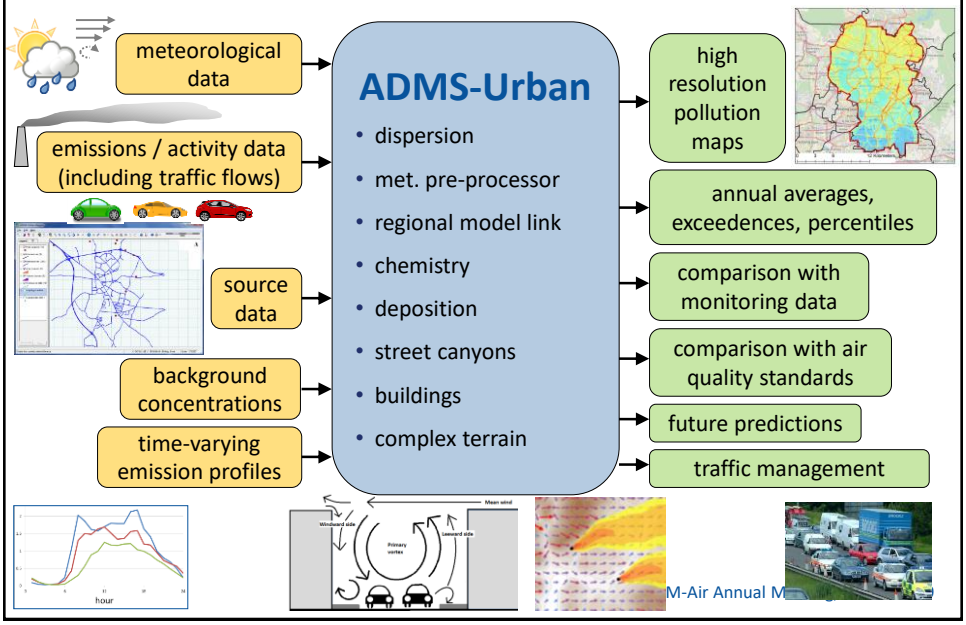
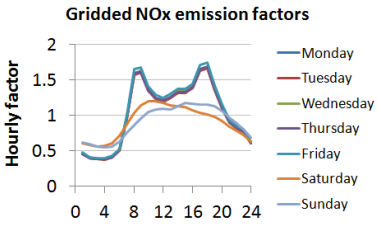
Modelling approach overview

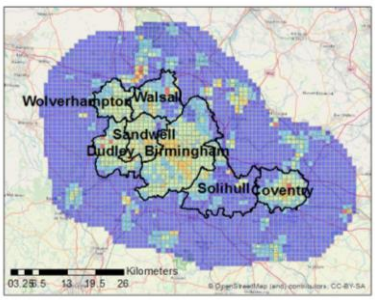
Air quality modelling using ADMS-Urban

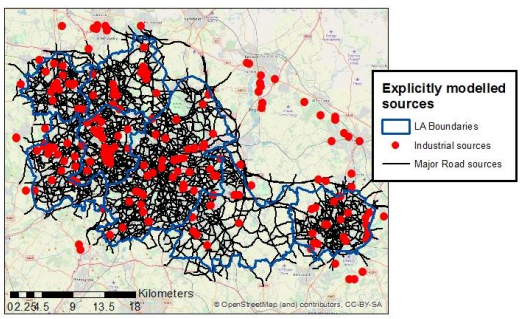


Model inputs for baseline year 2016

- **Emissions:**
  - **"National Atmospheric Emissions Inventory" data (all sectors)**
  - **Road traffic emissions**
  - **Industrial emissions**
  - **Time variation**
- Meteorological data
- Background pollutant data





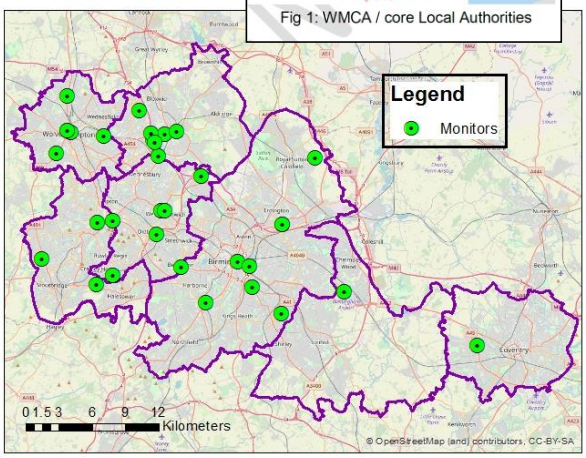


Model outputs

Verification - Monitoring data

- Types:
  - 19 roadside
  - 12 urban background
  - 1 airport
- Temporal data capture:
  - Mostly hourly
  - Some daily (PM)
  - Poor data capture at some sites (6 sites less than 50%)
- No monitors in Solihull (apart from airport)

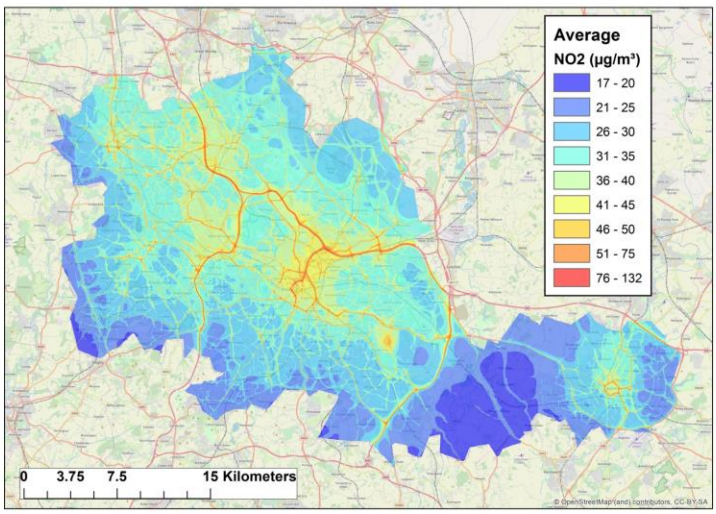
Fig 1: WMCA / core Local Authorities



Model outputs

Contour plots

- 1 week contour plot of WM (NO_2)



Model output and its use

- **Hourly** air pollutant concentrations of NO_x, NO_2, O_3, PM_{10} and $PM_{2.5}$ (and other pollutants, if emissions data are available)
- Variable spatial resolution (~ 10 m for reasonable file sizes)
- Standard air quality metrics (e.g. relating to air quality limit values)
- Metrics relating to exposure to be calculated e.g.
  - average concentrations for the school days, Christmas period, heatwave scenarios
  - rush hour concentrations.
- To generate spatially averaged data and to allow spatial analysis in relation to other datasets, for example, hospital admission data.

Model output and its use

- **Impact on health in the past, present and future**
- **Integrating Air Quality with economic metrics to enable better investment decisions**
- **Air quality impact of a given change – in policy, traffic, fleet composition (e.g. fleet evolution to electric vehicles)?**
- **Potential interventions needed (e.g. replacing diesel cars with EVs) to achieve a given AQ goal?**
- **Benefit of a policy (e.g. modal shift from cars to bicycles, fleet replacement etc.)**

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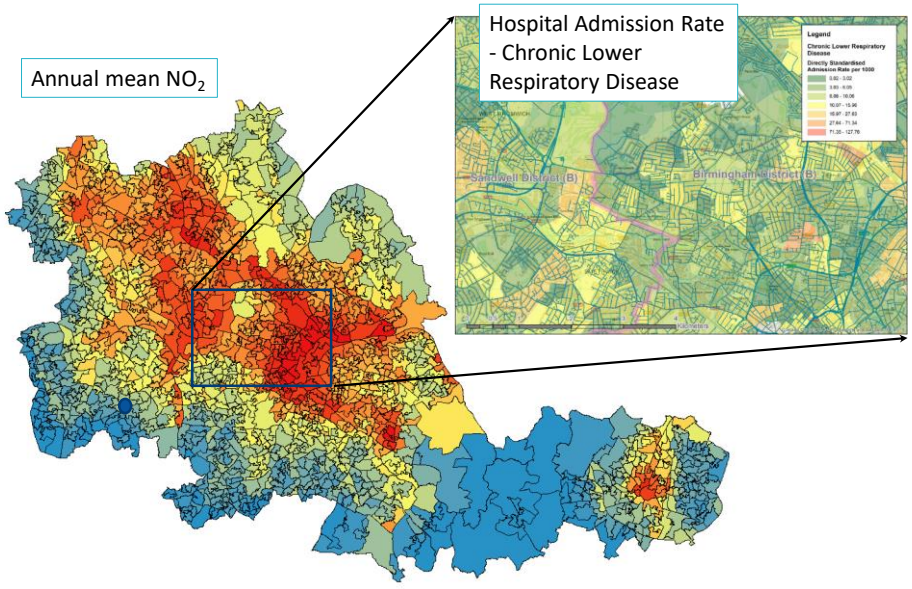
Air Quality calculated for the LSOA level



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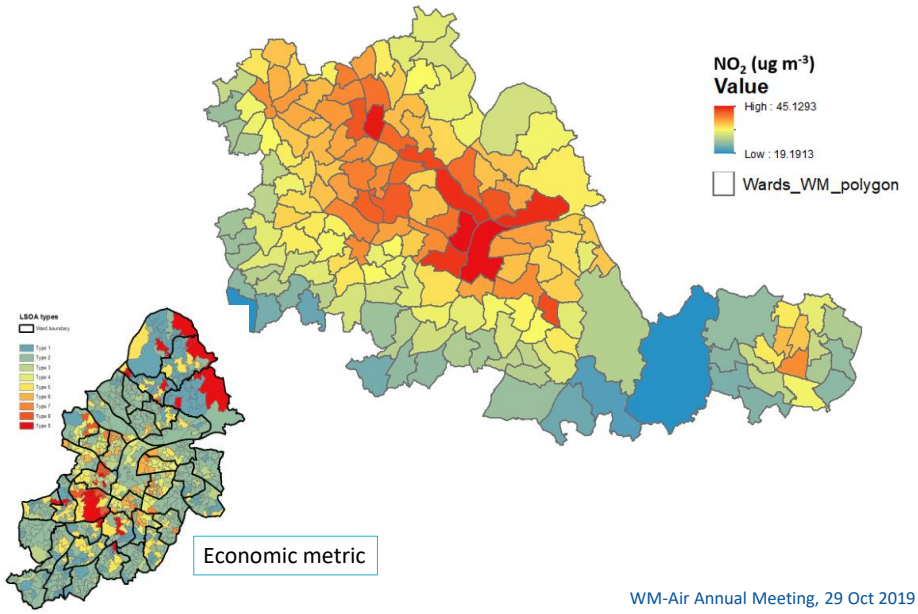
Air Quality calculated for the Ward level



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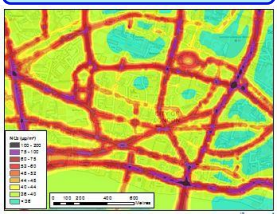
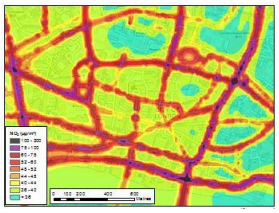
Local management scenario

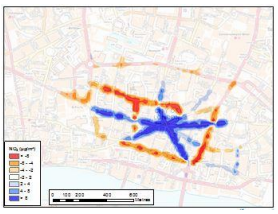
Before



After



Reduction



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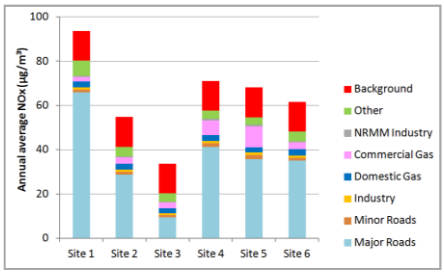
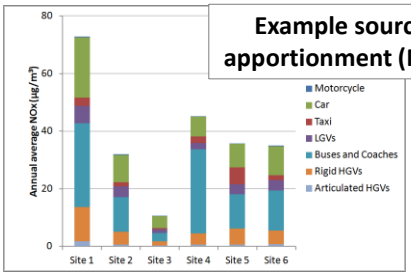
Model output and its use

- Source apportionment calculations are straightforward (NO_x, PM)…

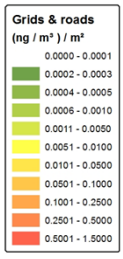


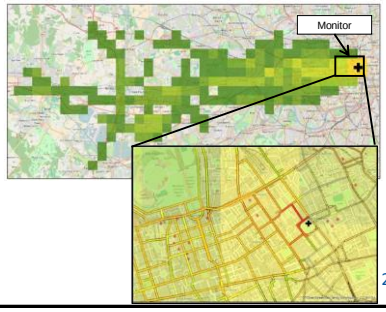


Example source apportionment (NO_x)

- …and also 'footprint' (concentration contribution per source) modelling

Example footprint modelling (NO_x)





2019

Next steps

- To **improve quality of input data** (mainly traffic data and industrial sources)
- To run the ADMS-Urban for the baseline year for **Strand 4 (Health) and Strand 5 (Economics)**
- To set up and to evaluate the **regional AQ model** for a better knowledge of the background concentrations
- To set up and to evaluate the **regional-local coupled modelling** system
- To **develop a tool** for scanning and analysis

Contributions from

- Mark Wolstencroft, Peter Porter, Laura Li, Peter Bethell (BCC)
- John Grant, Curtis Dean (WBC)
- Jake Thrush, Helen Ursell (TfWM)
- Nadia Inglis, Neil Chaplin (CCC)
- Jian Zhong, Andrea Mazzeo (UoB)
- Christina Hook, Jenny Stocker, Kate Johnson (CERC)