

WM Air Quality Modelling

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CERC

WM-AIR
CLEAN AIR SCIENCE FOR
THE WEST MIDLANDS



WM-Air AQ model development

- State-of-the-art modelling technologies
 - The ADMS models (hundreds of ADMS licences worldwide)
 - CMAQ regional model – a US EPA model; UK Defra commissioned an assessment of its performance
- CERC Expertise (Cambridge Environmental Research Consultants, a leading air quality model developer and consultancy)
- Best approach adopted to set up the models, to evaluate the model output, and to run scenarios
- Best support from WMCA and LAs with comprehensive local knowledge and experience (TfWM, WBC, BCC, CCC, et al.)
- Best datasets used to develop the baseline year model
 - Traffic and non-traffic: PRISM (TfWM) + Saturn (BCC); traffic counts (TfWM, DfT); NAEI
 - Air quality: LAs + AURN

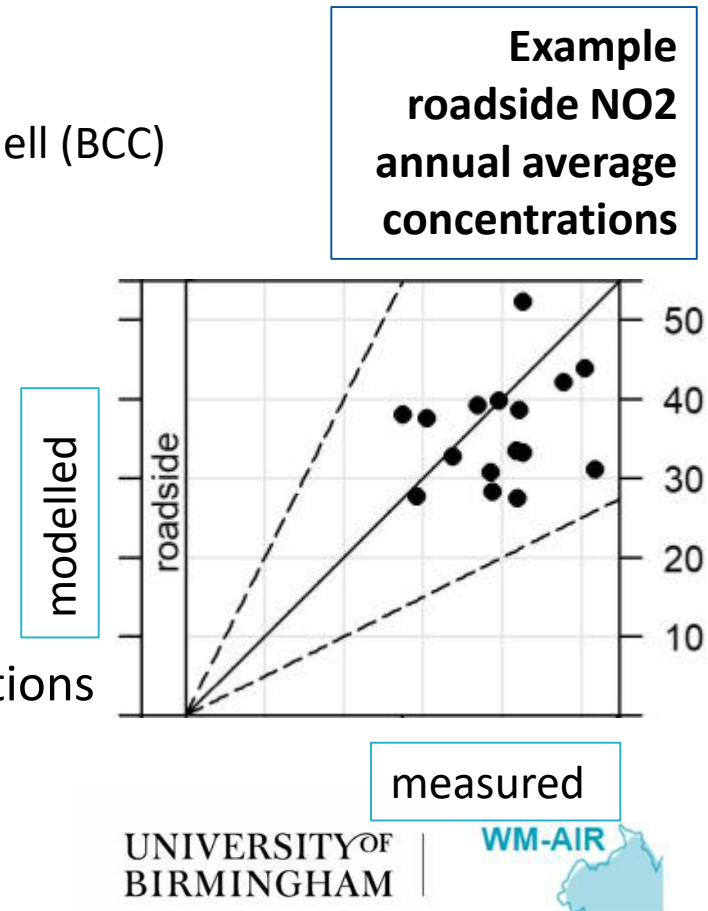
Expertise, model configuration and evaluation

Expertise involved in model configuration

- CERC: Jenny Stocker, Christina Hood, Kate Johnson, Steve Smith, ...
- WMCA and LAs:
 - Jake Thrush, Helen Ursell (TfWM)
 - John Grant, Curtis Dean (WBC)
 - Mark Wolstencroft, Laura Li, Peter Porter, Peter Bethell (BCC)
 - Nadia Inglis, Neil Chaplin, Steve Dewar (CCC)
 - Paul Fisher, Nick Taylor (Sandwell)
 - Beverley Hill, Amanda Clover (Solihull)
 - Tim Glews, Ian Grove (Dudley)
 - Dean Gooch (Wolverhampton)
 - ...

Evaluation of model performance

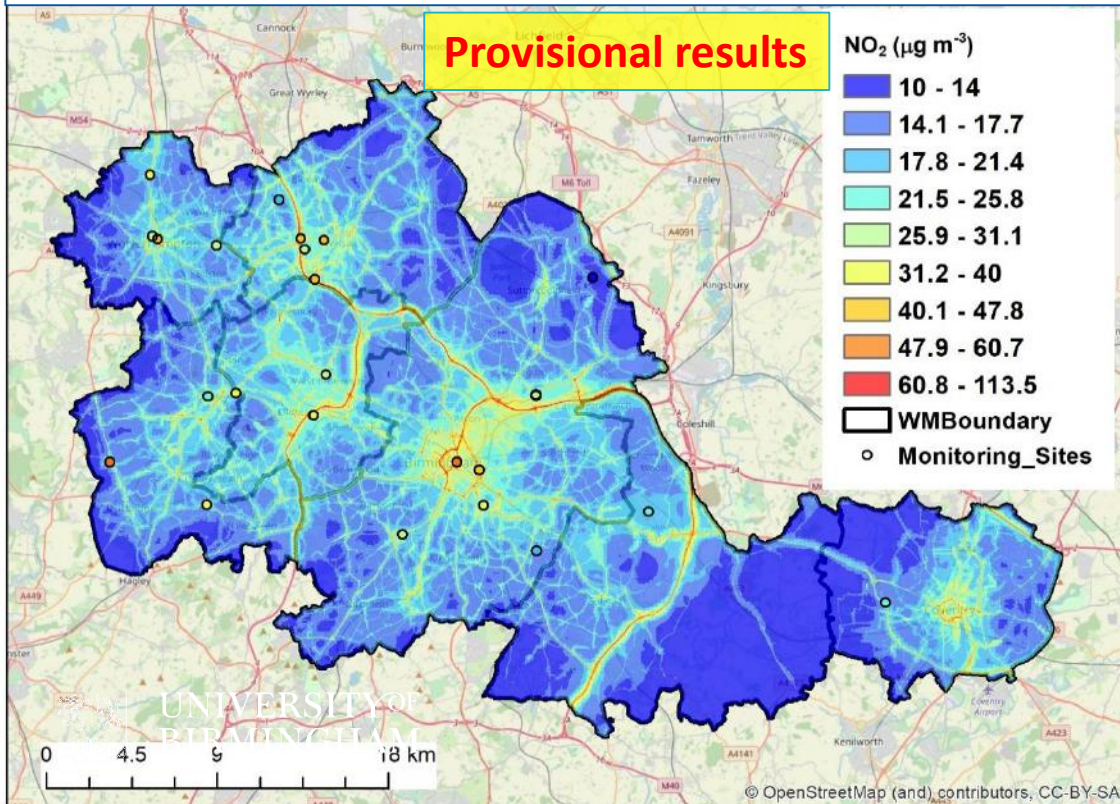
- Comparison of modelled and measured concentrations (statistics, graphs; one example shown here)
- Analysis of emissions and other model inputs



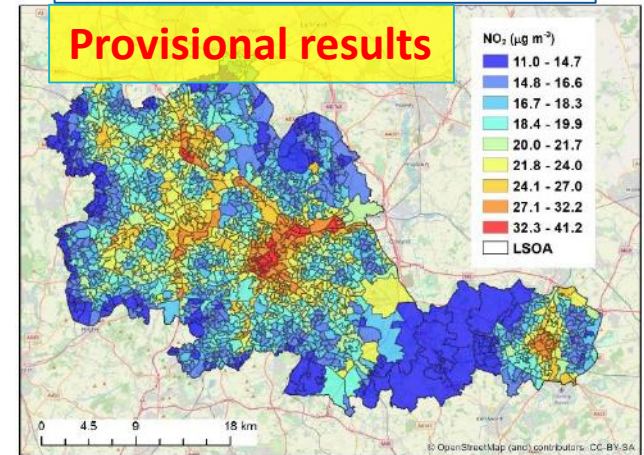
Capability of the model (1)

- Annual mean NO₂ [figure below], PM₁₀, PM_{2.5} etc across the WM
- AQ maps for the LSOA levels [figure on the right side]

At 10 m x 10 m resolution; roadside with a few metres



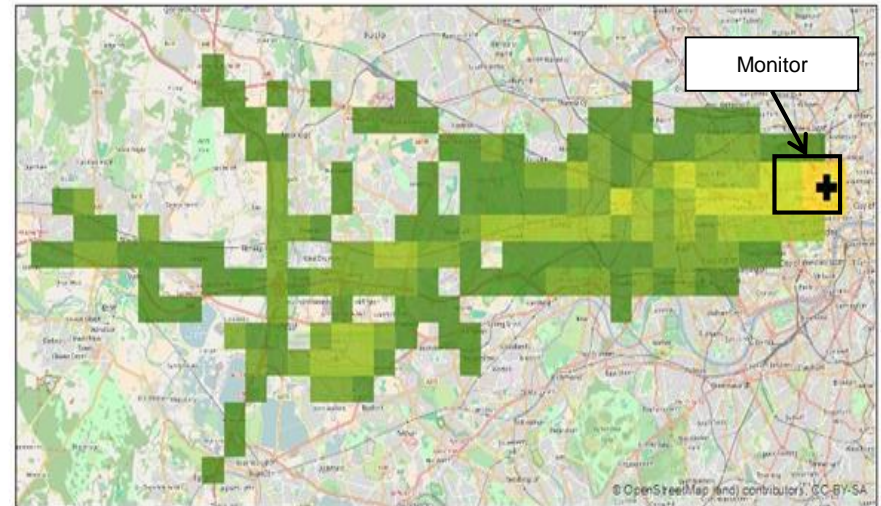
Averages over LSOA level



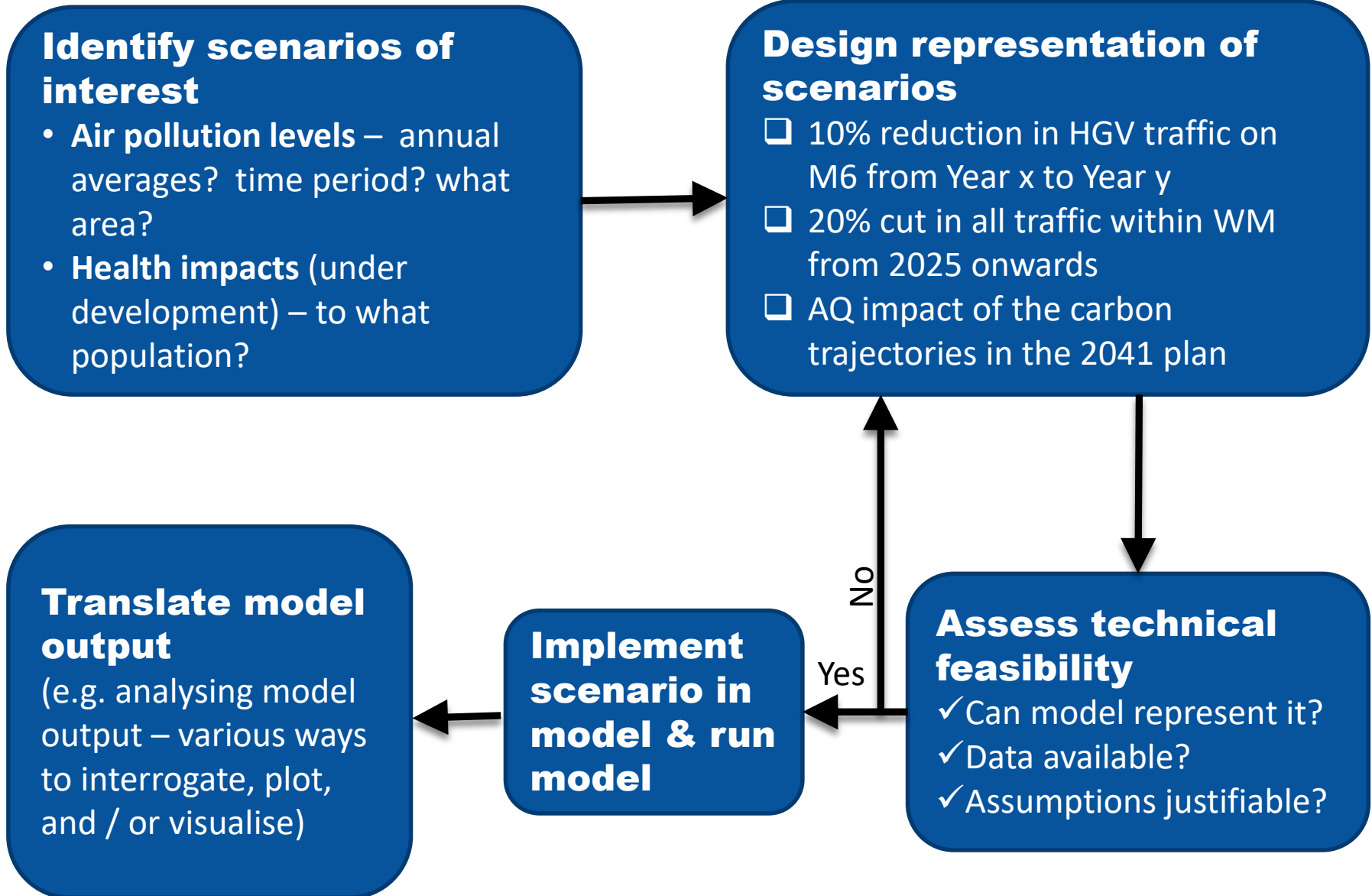
Capability of the model (2)

- Street-scale resolution, hourly air quality values at all locations (maps, time series) for many applications, e.g.:
 - concentrations or number of exceedances at given sites
 - evaluation of local air quality management
 - assessment of health impact
 - ...

- [figure on the right side]
Identify locations and contributions of sources (footprint) for a hotspot
- Identify sector contributions for a AQ site
- ...



Scenario modelling (1): the approach

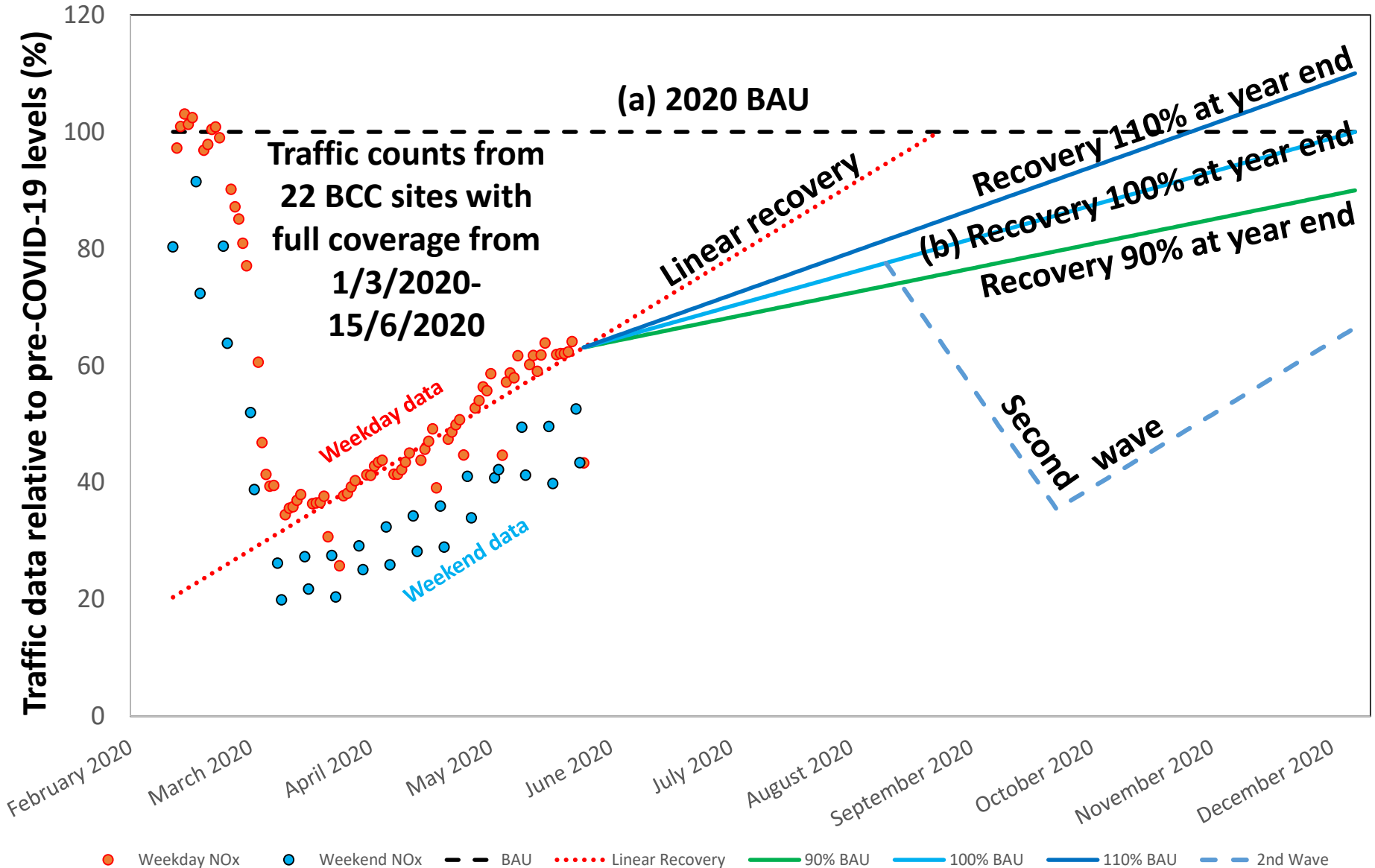


Scenario modelling (2): Tested scenarios

Scenario	Feature	Description
1. Impacts of <u>Covid-19 Lockdown</u> in 2020	Short-term temporally varying emissions	A natural experiment to assess impacts of behaviour change upon air quality and health, with lessons for future policy choices.
2. Impact of <u>30% traffic activity drop</u>	Long-term projection scenarios	Change of emissions is spatially uniform across the whole West Midlands area. Many future scenarios fit this type.
3. Impact of a) <u>'removing' A38</u> in CAZ b) <u>'removing' A45</u> in Tyseley; c) <u>reducing speed limit</u> for motorway	Spatially varying emissions	a) & b) Assumes 'no through-traffic' along A38 in CAZ or A45 in Tyseley whilst others are unchanged. c) Assumes the speed limit between J6 and J7 of M6 is reduced from 70 mph to 60 mph

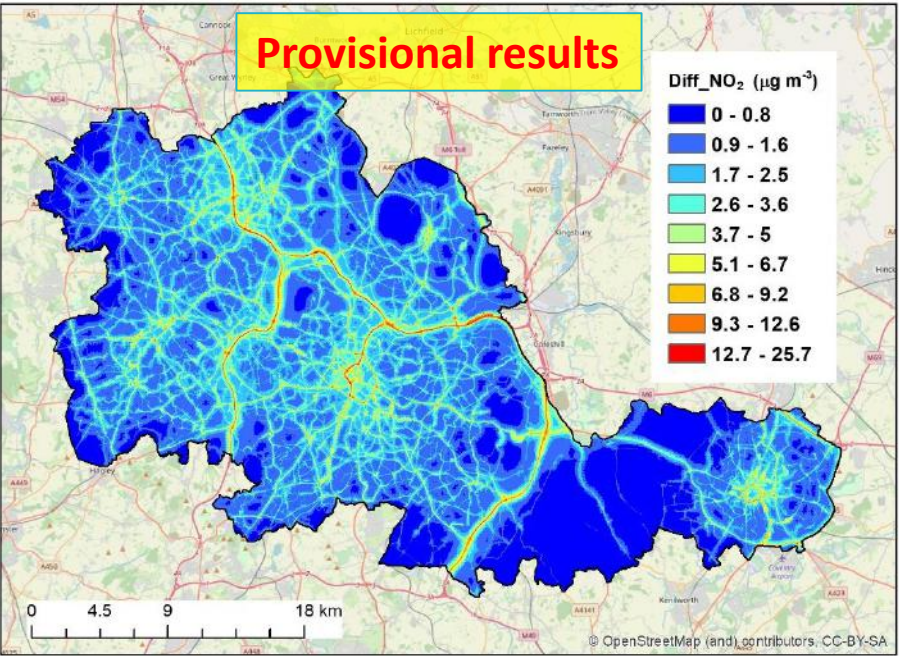
Scenario 1: Impacts of Covid-19 Lockdown in 2020

Real world vehicle NOx emissions from fleet-weighted traffic data and assumed Recovery Trajectories

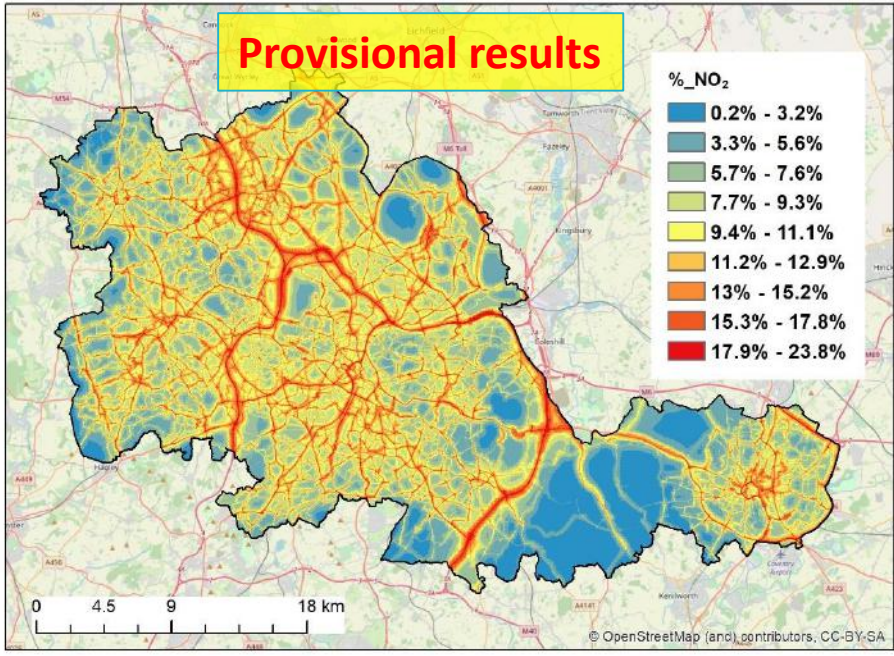


Scenario 2: Impact of 30% traffic activity reduction

(a) Drop in annual NO₂ map

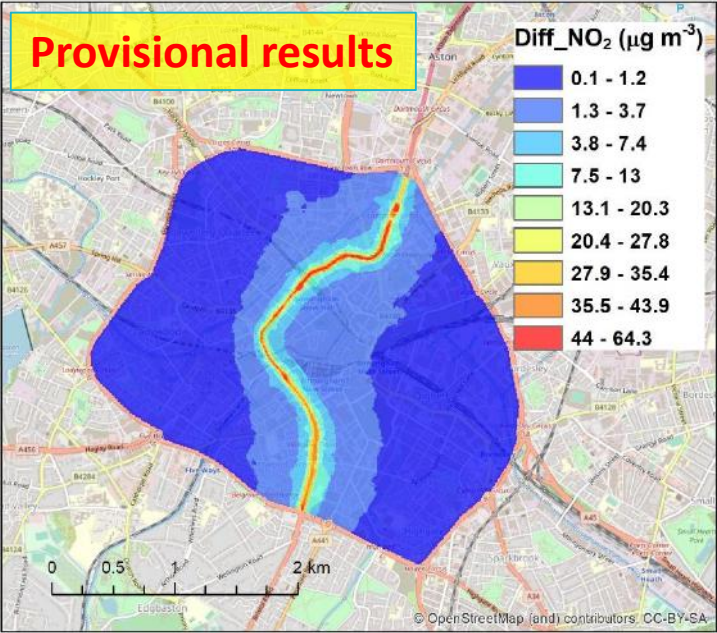


(b) Relative drop (%) in annual NO₂ map

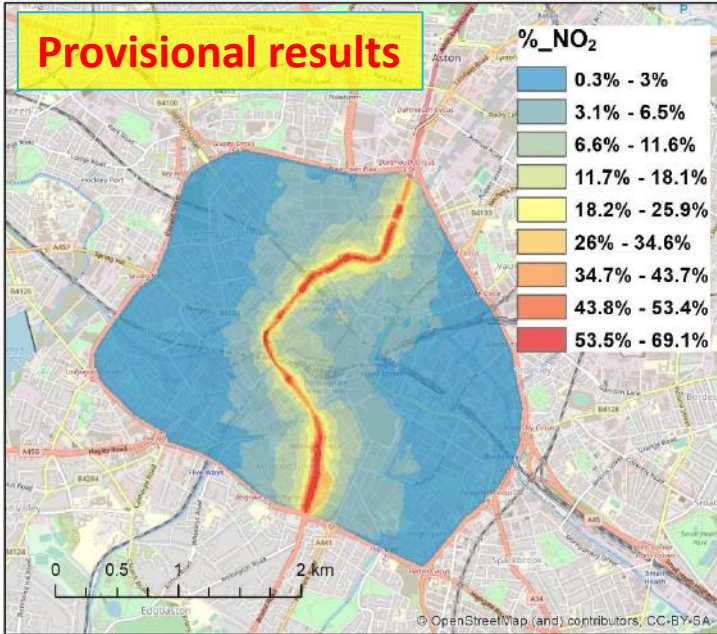


Scenario 3a: Impact of removing A38 in CAZ

(a) Drop in annual NO₂ map



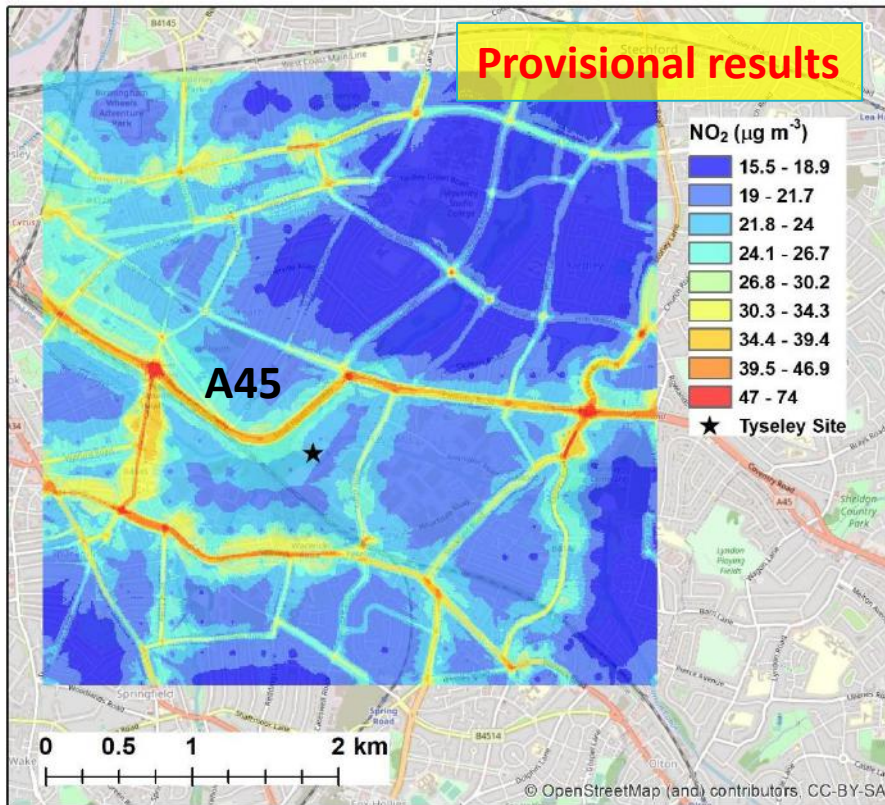
(b) Relative drop (%) in annual NO₂ map



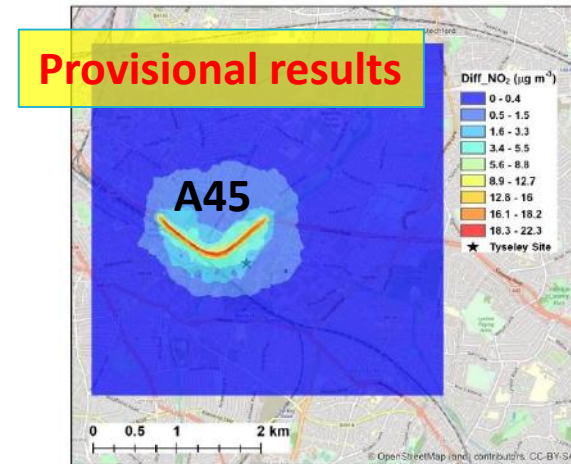
Note: re-routing of traffic is NOT considered.

Scenario 3b: Impact of removing A45 in Tyseley

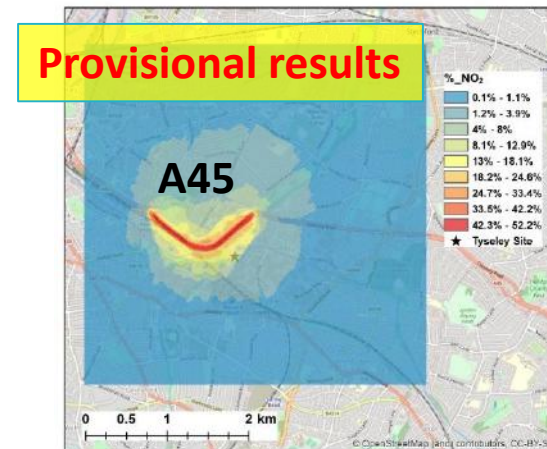
(a) Annual NO₂ map for 2016 BAU case



(b) Drop in annual NO₂ map



(c) Relative drop (%) in annual NO₂ map

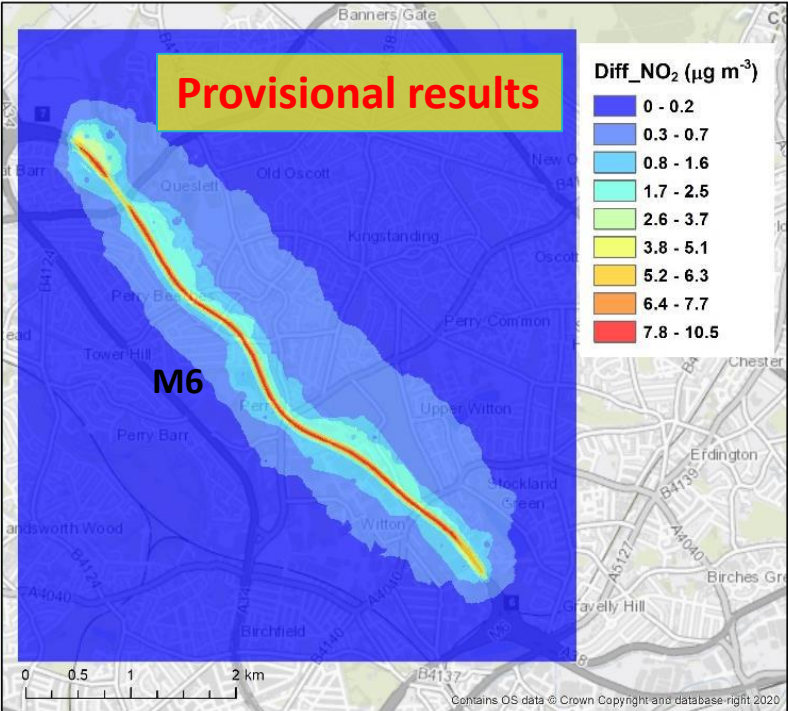


Note: re-routing of traffic is NOT considered.

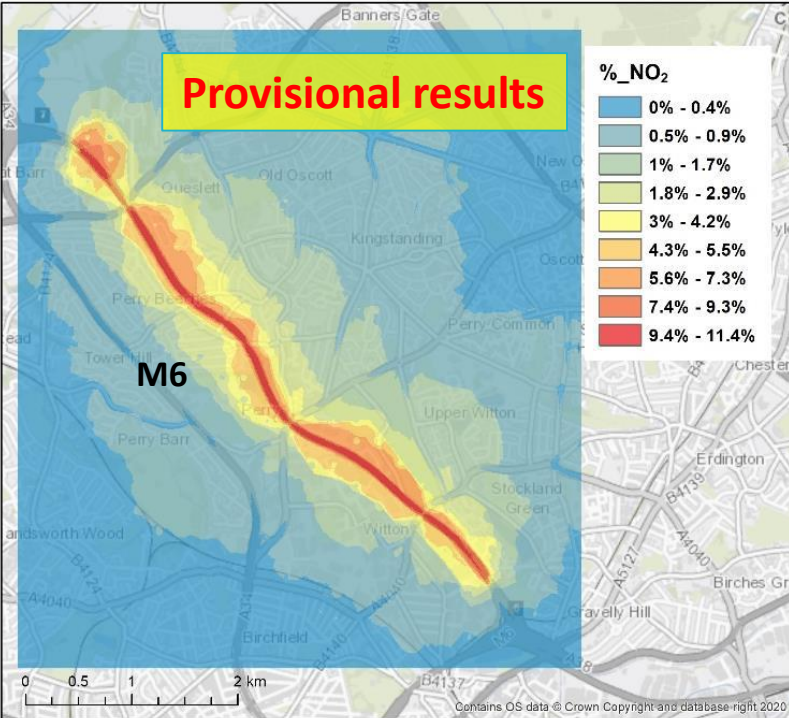
Scenario 3c: Impact of speed limit change for motorway

M6 (J6-J7): Speed limit is changed from 70 mph to 60 mph

(a) Drop in annual NO₂ map

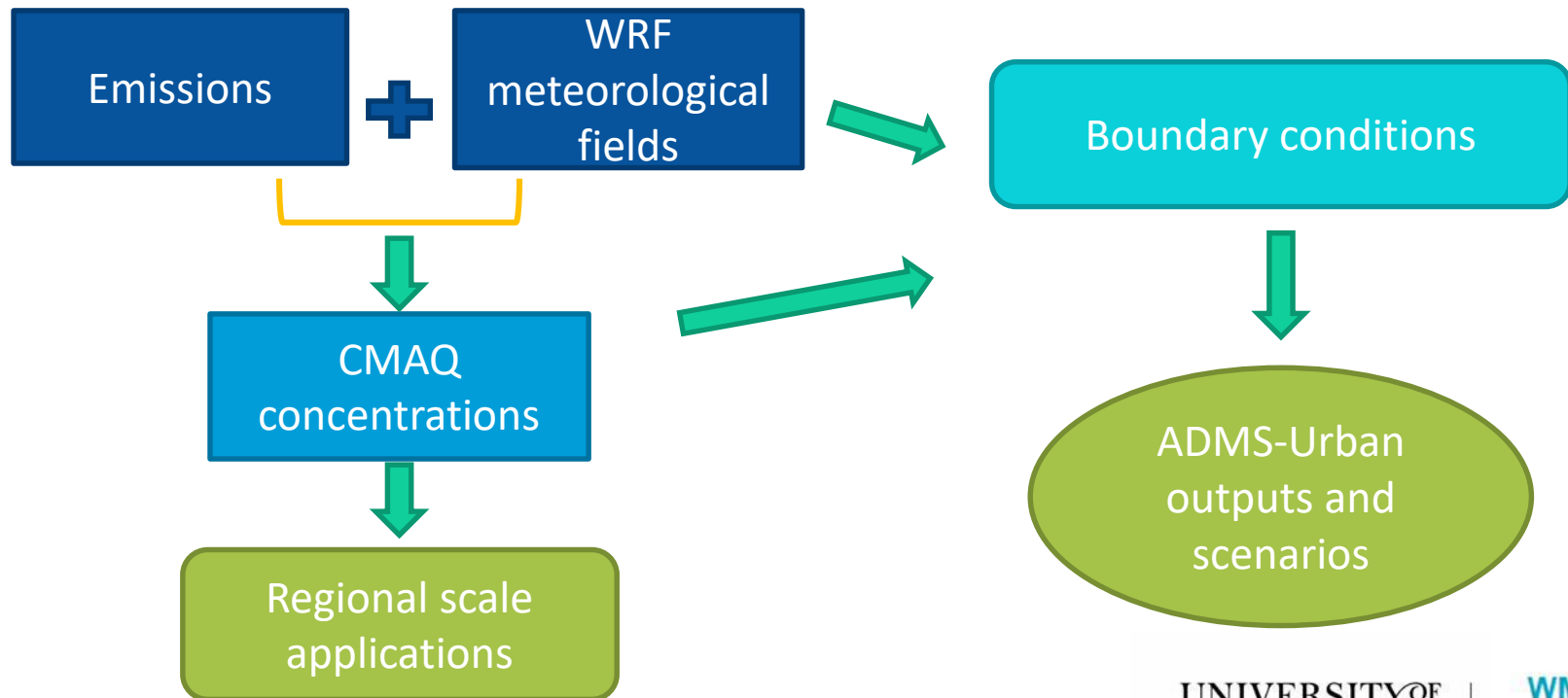


(b) Relative drop (%) in annual NO₂ map



Ongoing: set up and evaluate the regional AQ model

- To set up and to evaluate the regional AQ model, CMAQ
- To set up the ADMS-Urban RML (Regional Model Link)
- The outputs obtained from the validated regional modelling in CMAQ will be used to provide boundary conditions for the local modelling made with ADMS-Urban.
- Aims to improve the predictive capability, particularly for PM_{10} and $PM_{2.5}$.



Opportunities: to contact WM-Air

Scenario	Feature	Opportunities?
1. Impacts of <u>Covid-19 Lockdown</u> in 2020	Short-term temporally varying emissions	School vacation periods, public holiday periods etc.
2. Impact of <u>30% traffic activity drop</u>	Long-term projection scenarios	The WM2041 climate plan, post-EV world etc.
3. Impact of a) ' <u>removing</u> ' A38 in CAZ b) ' <u>removing</u> ' A45 in Tyseley; c) <u>reducing speed limit</u> for motorway	Spatially varying emissions	Clean Air Strategy 2019, local-scale planning, etc.
4. ...		
5. ...		

END

Thank you!