Comments on proposal to enhance the MQO by including additional metrics and QA/QC protocol

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FAIRMODE
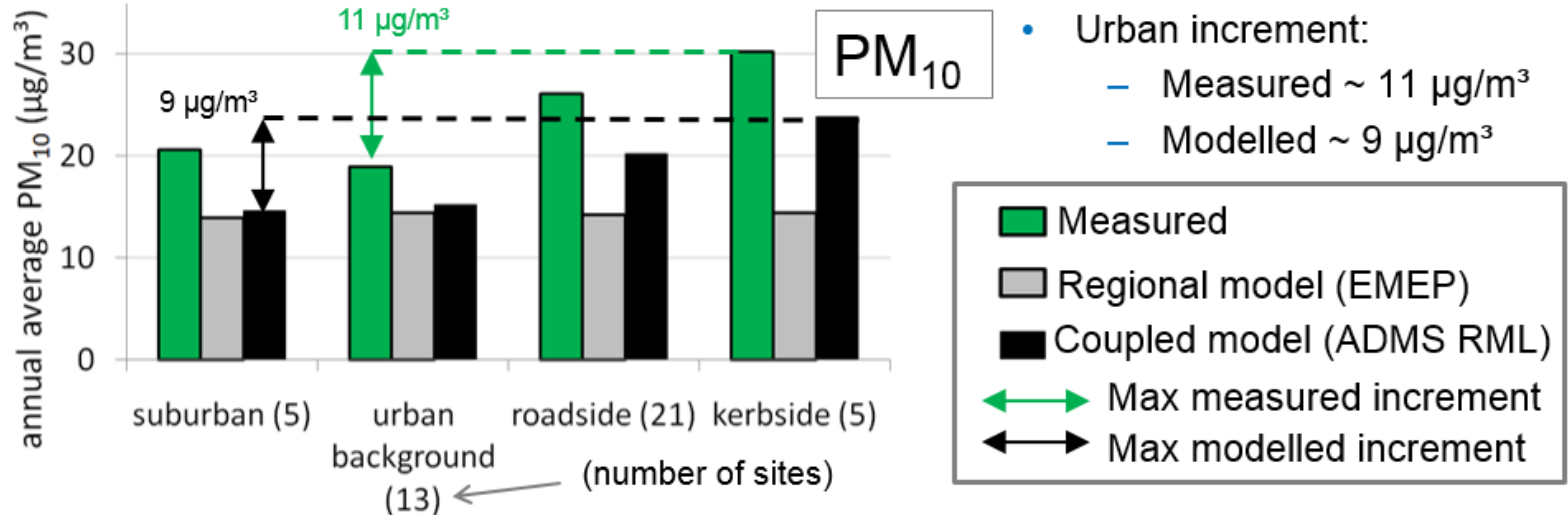
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Online

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A few have been proposed, e.g:

- 'Urban increment' and 'Traffic increment'

   - These can be interesting to separate the local and regional influences on urban concentrations

    - Sufficient sites are required to make a robust analysis

    - And: for large cities 'urban background' NO2 concentrations can be > than 'roadside', due to the spatial variation of 'background' concentrations – so important to be careful with site categorisations

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London study using ADMS-Urban, CERC team and R. Doherty's team at the School of Geosciences, University of Edinburgh

Additional metrics

- 'Day/Night'

  - Relatively complicated to implement, requiring solar elevation information, but could be interesting e.g. looking at maximum and minimum hourly values. We repeatedly look at average diurnal variation graphs during ADMS-Urban model evaluation....

**NO_x average diurnal variation from one site (Kuala Lumpur study)**
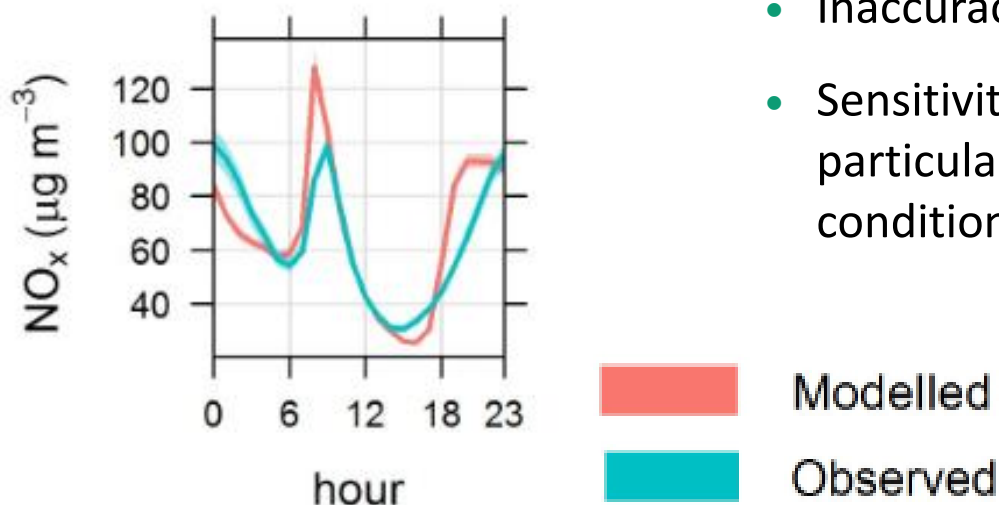
  - It is often difficult to distinguish the error in the model due to:

    - Inaccuracies in temporal emissions inputs and

    - Sensitivity of modelled concentrations to particular meteorological conditions e.g. stable conditions at night

Additional metrics

- ‘Seasonal variation’

  ▪ This would be a useful indicator, because it separates out the sensitivity of results to meteorology (although the influence of seasonal emissions may still influence model predictions e.g. summer holidays)

**NO$_2$ seasonal average diurnal variations**

Measured · Hour of the day

Measured

ADMS-Urban · Hour of the day

Modelled
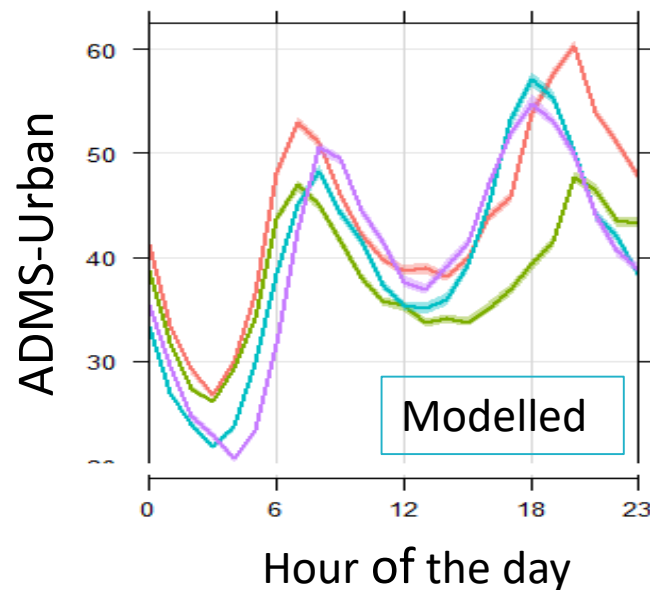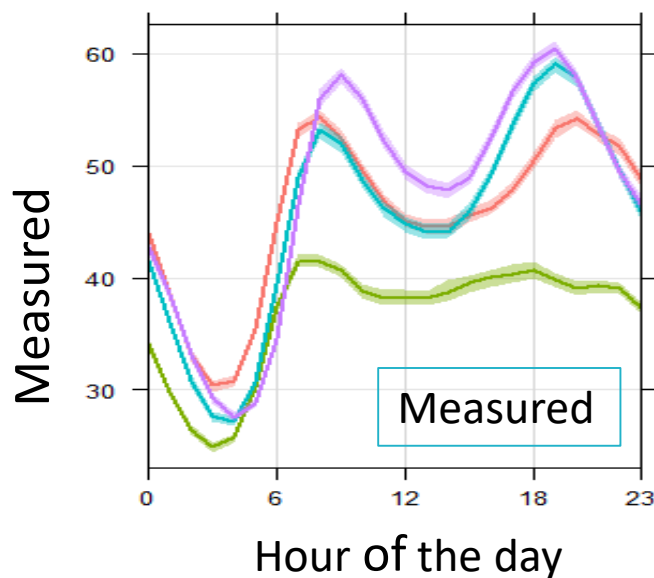
spring (MAM)   summer (JJA)   autumn (SON)   winter (DJF)

  ▪ Could you go further and find metrics to link model performance more directly to meteorology…?

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Additional metrics

- **'Meteorological variation'**

  ▪ Concentrations are approximately inversely proportional to wind speed, so *if* modelled meteorological data are unrepresentative *then* modelled concentrations may be inaccurate.

  ▪ This is particularly noticeable for low wind speed cases, which lead to pollution episodes during wintertime (meteorological models need, for example, to be able to represent wind speed variation in the urban canopy layer)

  ▪ Inaccuracies in concentration predictions may be difficult to detect unless concentration data are analysed alongside meteorological data

  ▪ Not easy to 'co-locate' met and concentration values

Measured hourly NO_x concentrations (roadside site)

Large change in concentrations

Small change in wind speed
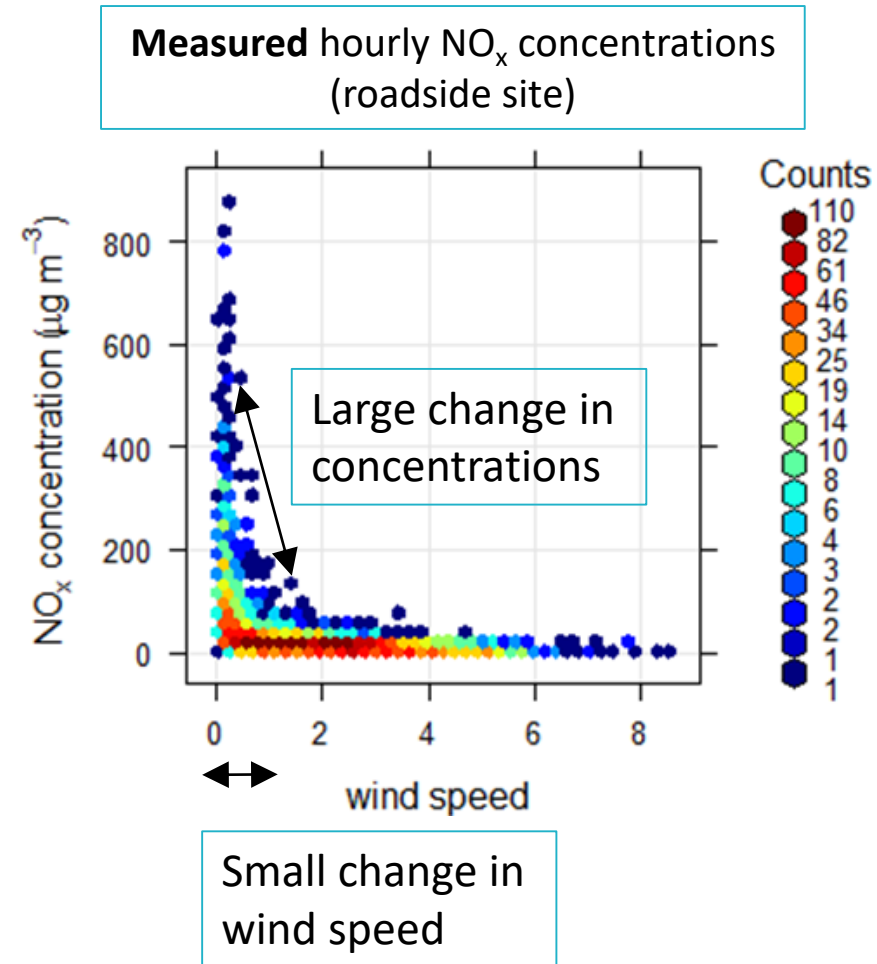
Useful metrics: Concentration bias compared to wind speed bias defined by: $(U_m - U_0)/\max(U_0, 0.3)$
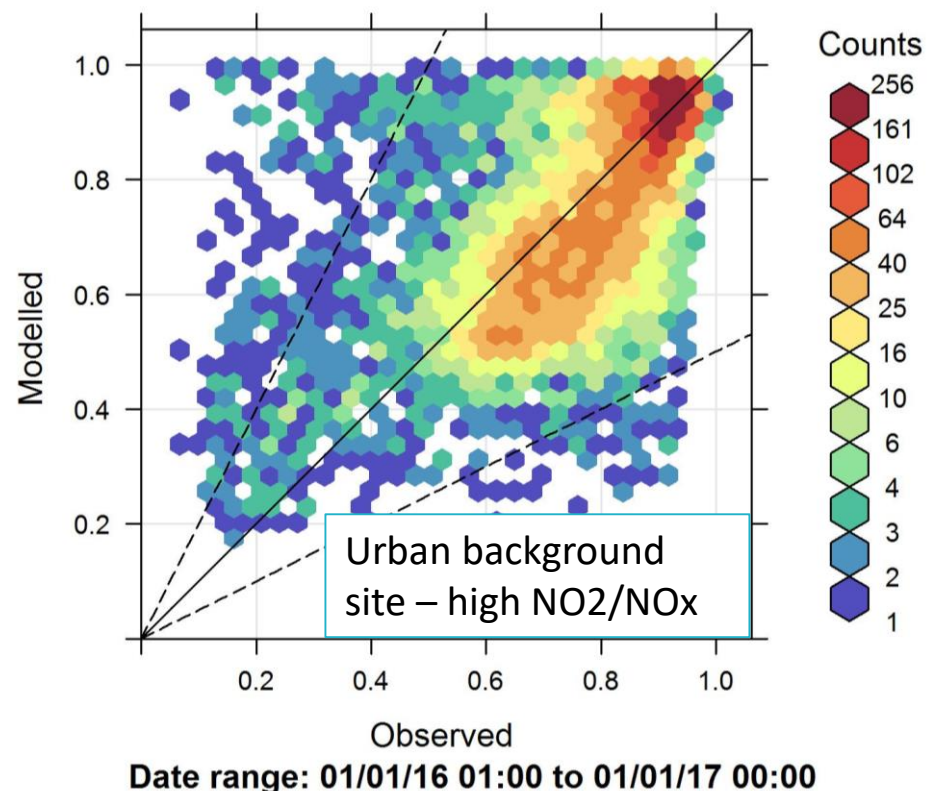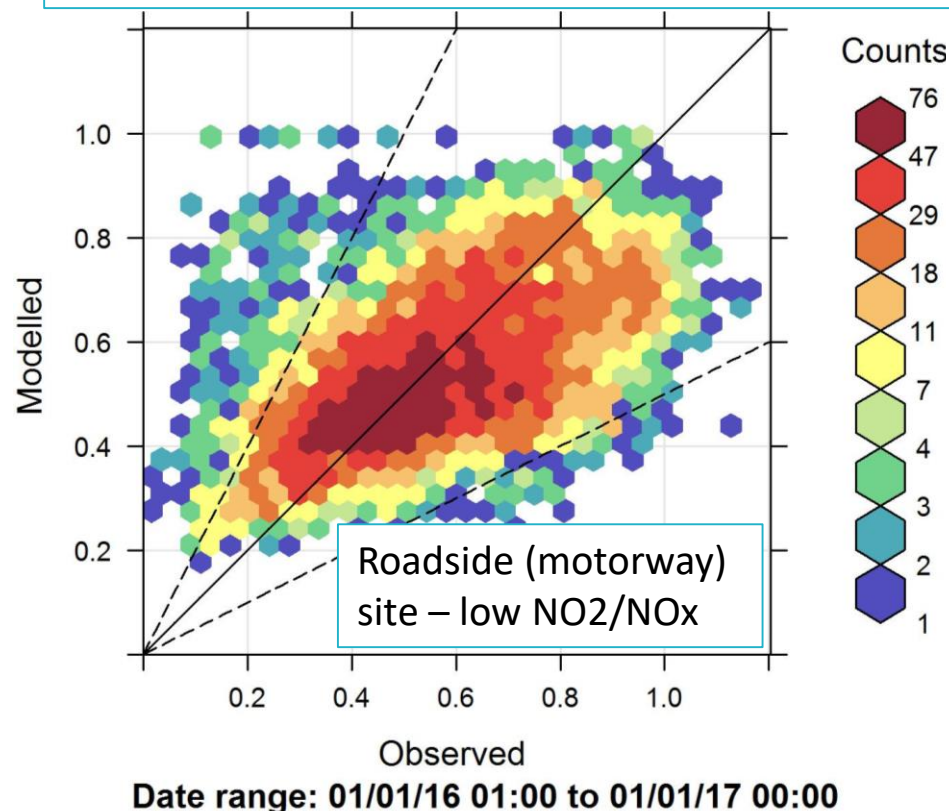
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Multi pollutants checks (NO2/NOx, PM2.5/PM10)

- ## NO2/NOx is particularly interesting for a local model

  - Are the traffic NO2/NOx emissions accurately represented?

  - Is the model correctly accounting for near-field chemistry?

CERC & University of Birmingham team, School of Geography, Earth and Environmental Science

Modelled (ADMS-Urban) against measured NO2/NOx (frequency scatter plots)

Roadside (motorway) site – low NO2/NOx

Date range: 01/01/16 01:00 to 01/01/17 00:00

Urban background site – high NO2/NOx

Date range: 01/01/16 01:00 to 01/01/17 00:00

Model QA/QC protocol: documentation

Proposal is to enhance current IPR Decision documentation, e.g. looking at:

- Model Documentation System (MDS)*

- French AASQA audit looks very detailed!

* MDS appears to be based on Eulerian grid models. We need to make any 'tick box' approach to model documentation allow for all types of model and systems. **This isn't easy (Eulerian, Gaussian, Lagrangian, land-use regression, data assimilation, systems including multiple model components…).**

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