Statistics relating to ‘exceedance situations’ for London

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FAIRMODE Technical Meeting

June 2016

Zagreb

Croatia

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  - Model used, resolution etc
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Context

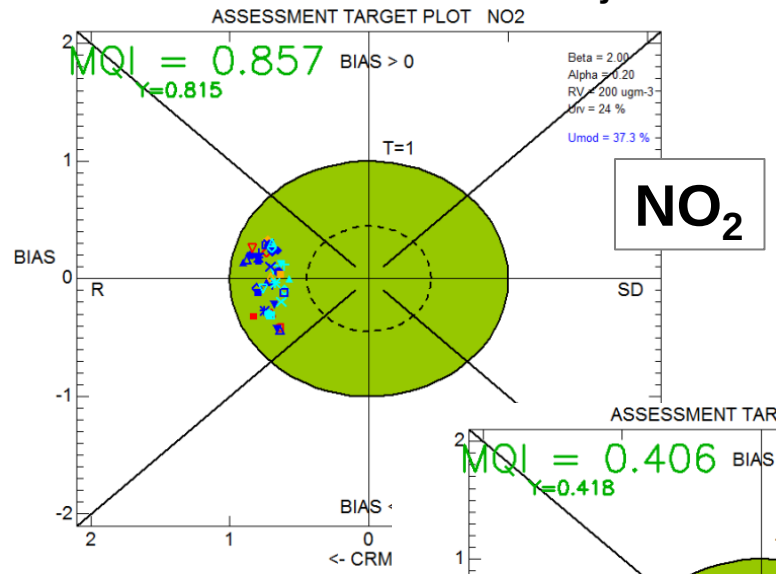
- Composite mapping could be used to estimate statistics of interest, specifically:
  - Estimate of surface area where the level was above the environmental objective
  - Estimate of the length of road where the level was above the environmental objective
  - Estimate of the total resident population in the exceedance area
  - Estimate of the ecosystem/vegetation area exposed above the environmental objective – *not calculated here*

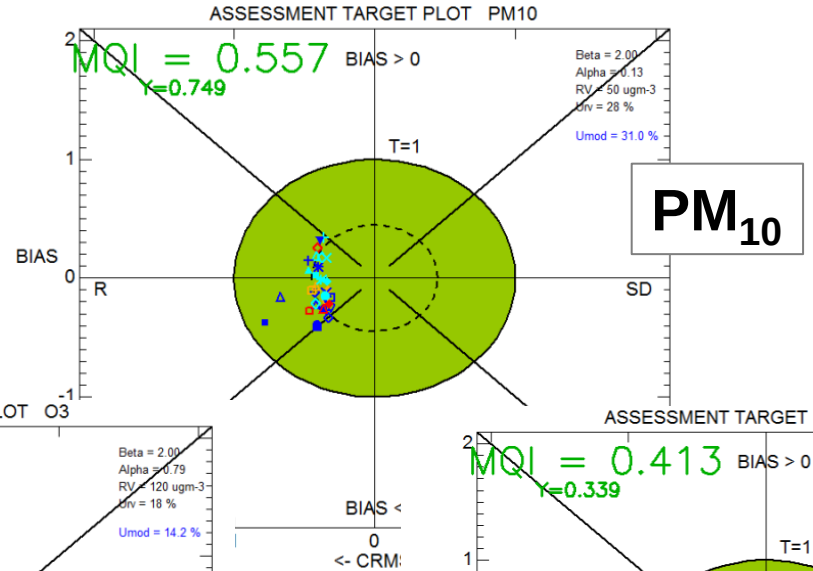
Calculation information

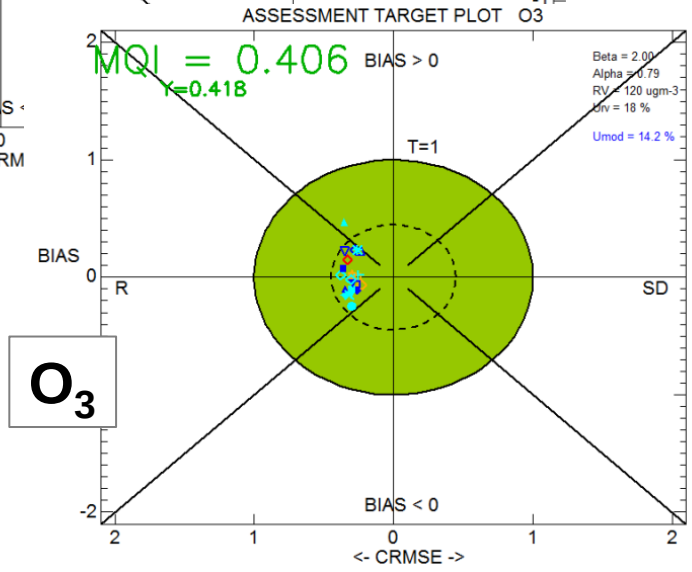
- ADMS-Urban used to calculate NO_2 and PM_{10} annual average concentration over Greater London
  - Gaussian-type dispersion model, explicit representation of major road and point sources, other sources in a ‘grid’
  - Modelled year 2012
  - Heathrow Airport meteorology
  - Monitored rural background data used for long-range transport
  - Area covered: 50 km x 60 km, high resolution output near road sources, lower resolution away from explicit sources
  - Hourly average concentrations and annual statistics calculated at each receptor

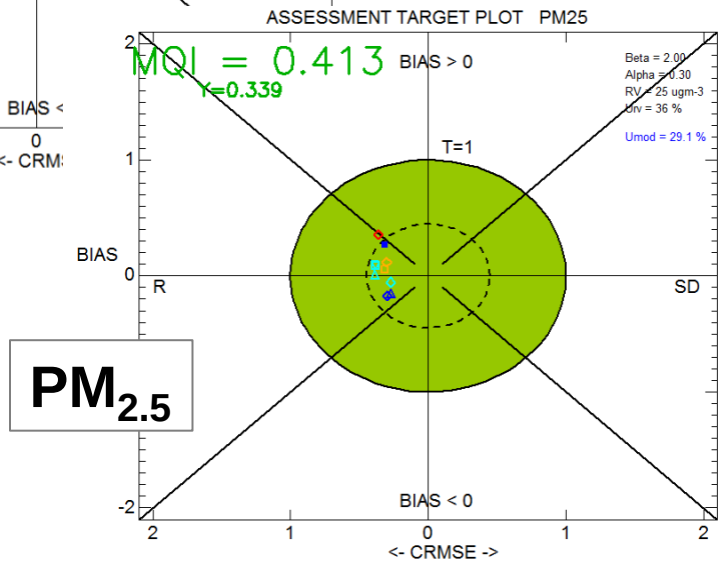
Model performance

- Model performs well for all pollutants (NO_2, PM_{10}, $PM_{2.5}$, O_3)
- Traffic emissions include:
  - NO_x adjustments to account for real-world emissions
  - PM non-exhaust adjustments based on measured concentrations





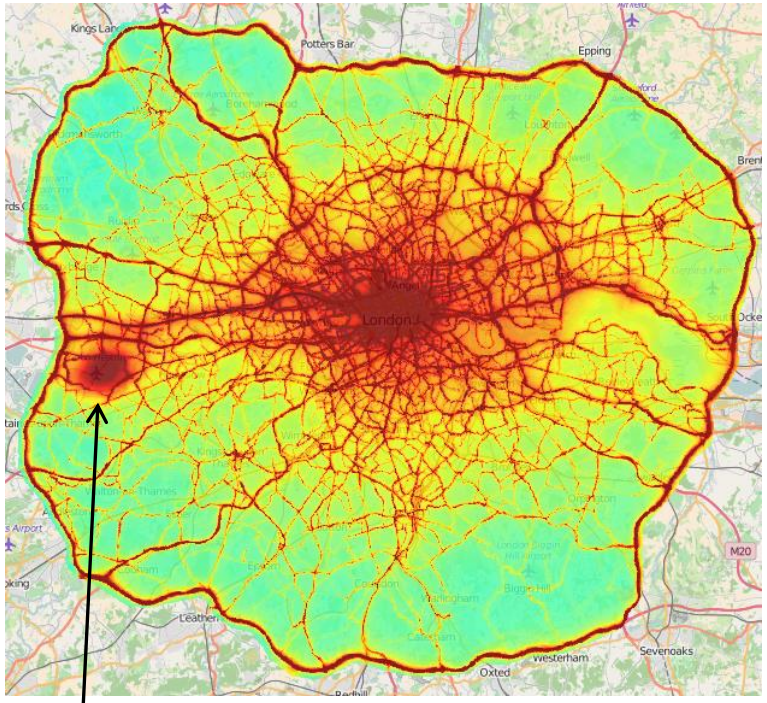




CERC

Composite mapping plots for London (CERC)

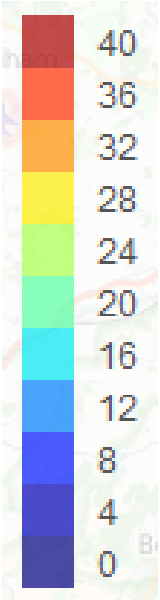
← 50 km →



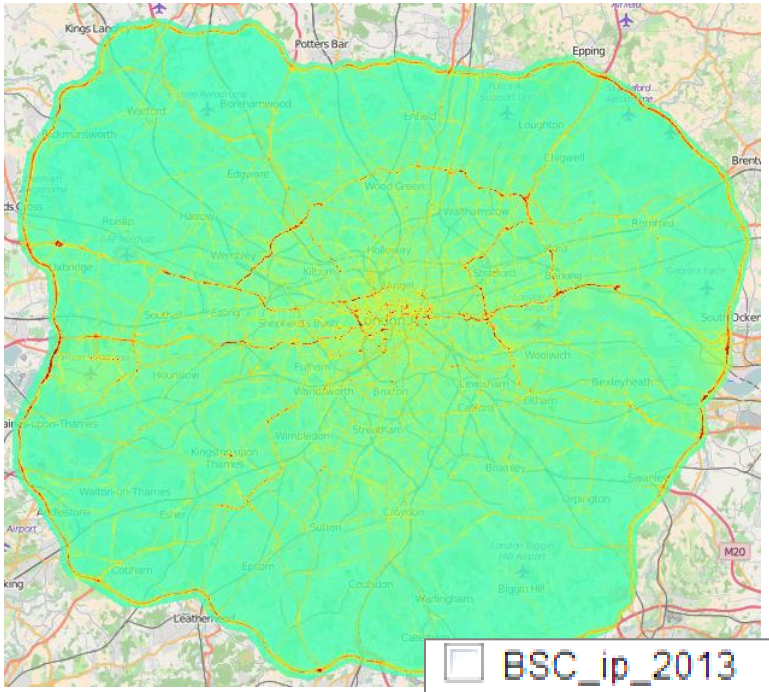
Heathrow!

NO_2 annual average (µg/m³)

Concentration (µg/m³)



PM_{10} annual average (µg/m³)



CERC

London exceedance calculation results (NO_2)

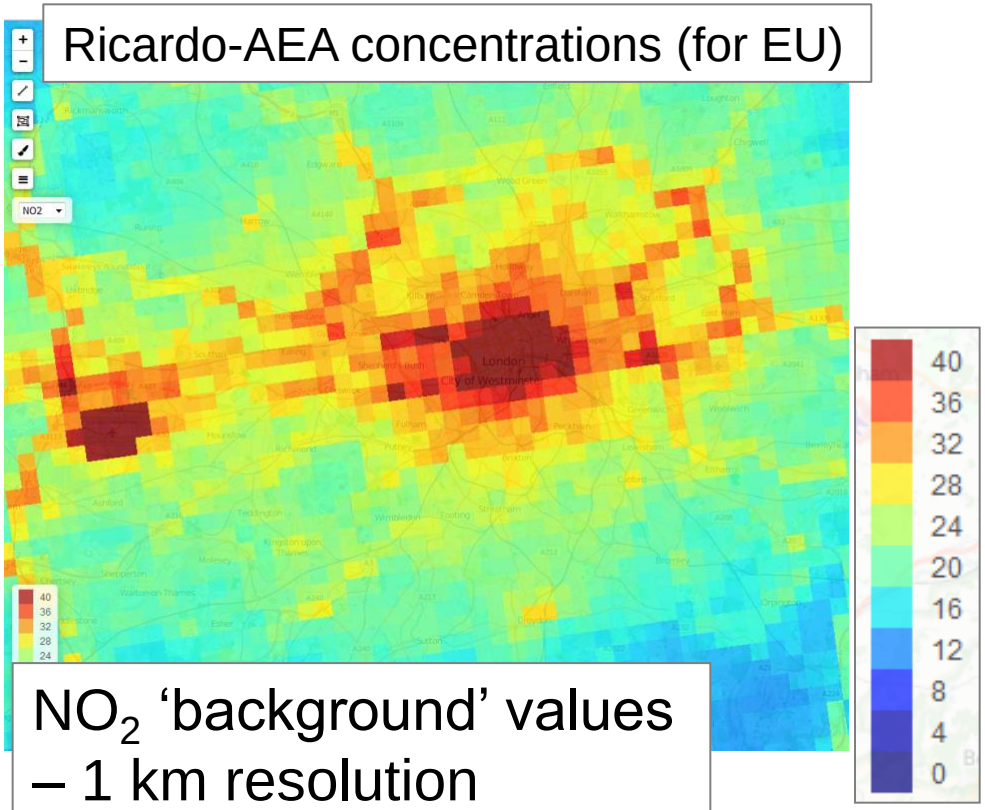
- Calculations performed using QGIS (version 2.14)

Metric	Value of exceedance	Total value	% Exceedance
Surface Area	323 km^2	1,572 km^2	**21 %**
Length of road	5,819 km	19,620 km	**30 %**
Resident population in exceedance area	2,144,516	9,091,477	**24 %**

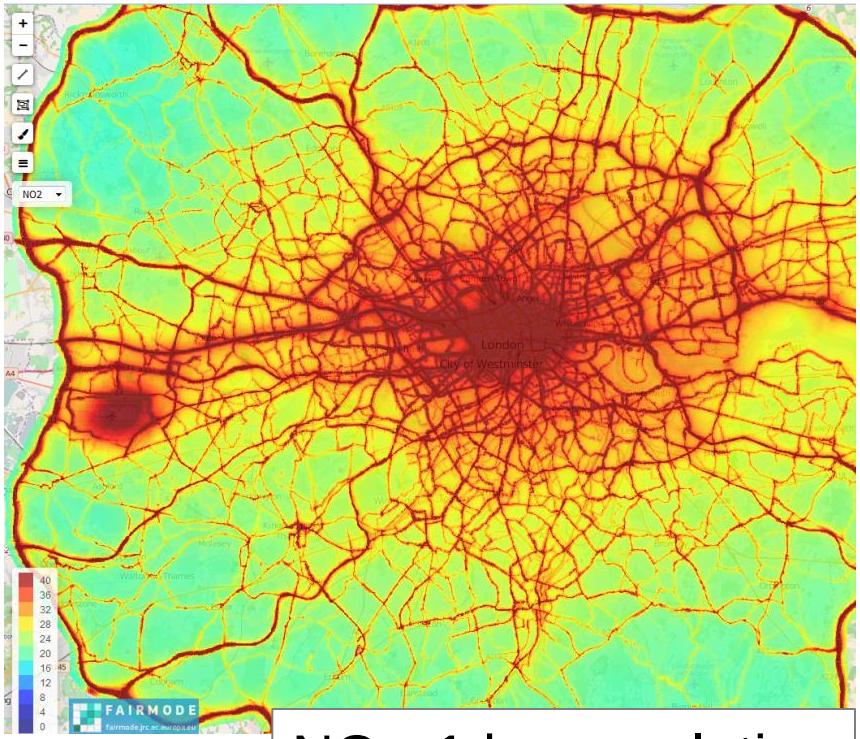
Discussion 1 of 2

- Compare 2 composite maps for the same urban area, different models
- 1 km maps represent ‘background’ concentrations
- Maps show broadly the same pattern e.g. in areas of ‘total exceedance’ & influence of prevailing wind direction

Ricardo-AEA concentrations (for EU)



NO_2 ‘background’ values – 1 km resolution

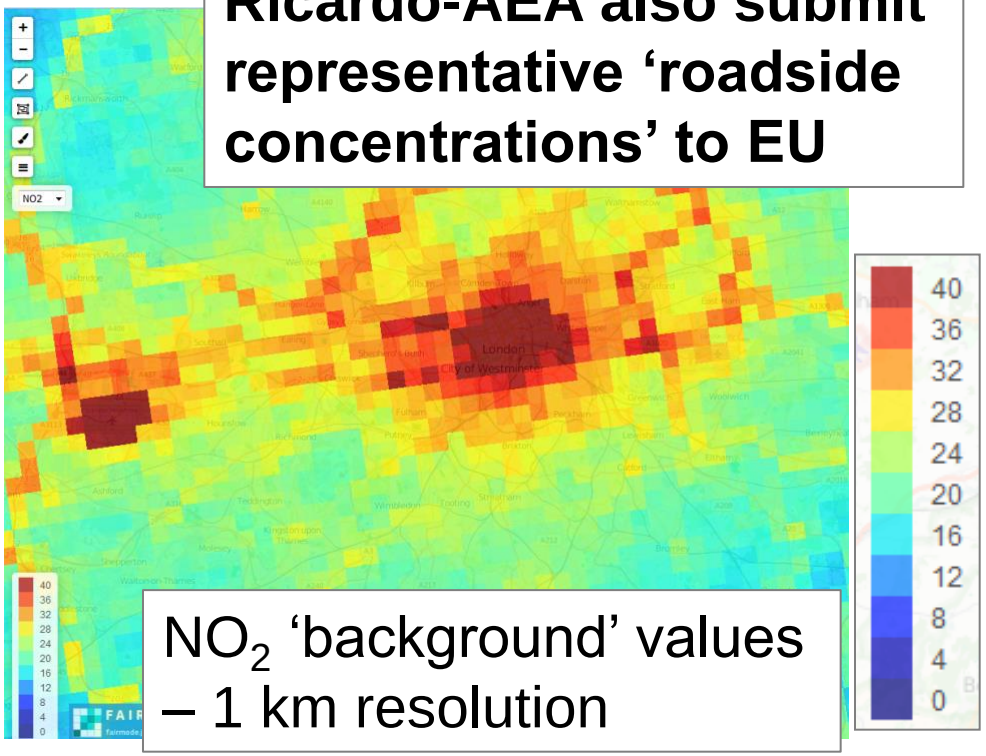


NO_2 1 km resolution

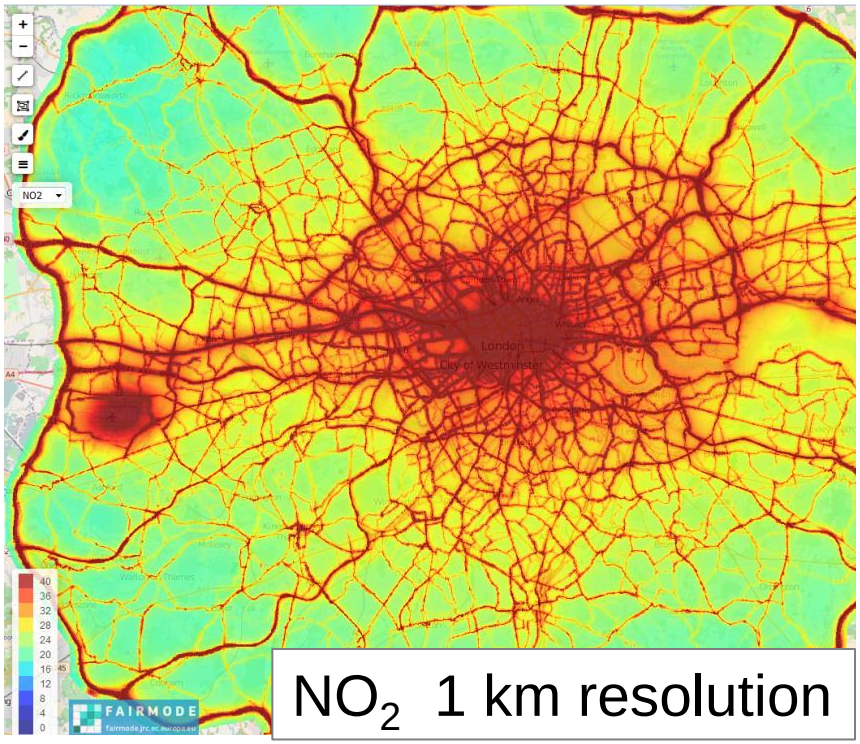
Discussion 2 of 2

- High resolution map demonstrates good model performance at roadside and urban background sites (Delta Tool)
- Low resolution map does not indicate as many exceedances
- Modelling explicit detail will lead to greater calculated exceedances – so should model resolution be specified?

Ricardo-AEA also submit representative 'roadside concentrations' to EU



NO_2 'background' values – 1 km resolution



NO_2 1 km resolution

Summary

- A significant percentage of London's population is exposed to NO_2 levels exceeding the EU limit value
- Prior to performing exceedance statistic calculations, models must be evaluated i.e. using the Delta tool
- Exceedance statistic calculation results are highly dependent on model resolution, with low resolution models underpredicting exceedance statistics