

Modelling annual mean NO₂ and PM₁₀ concentrations in the UK for Daughter Directive reporting

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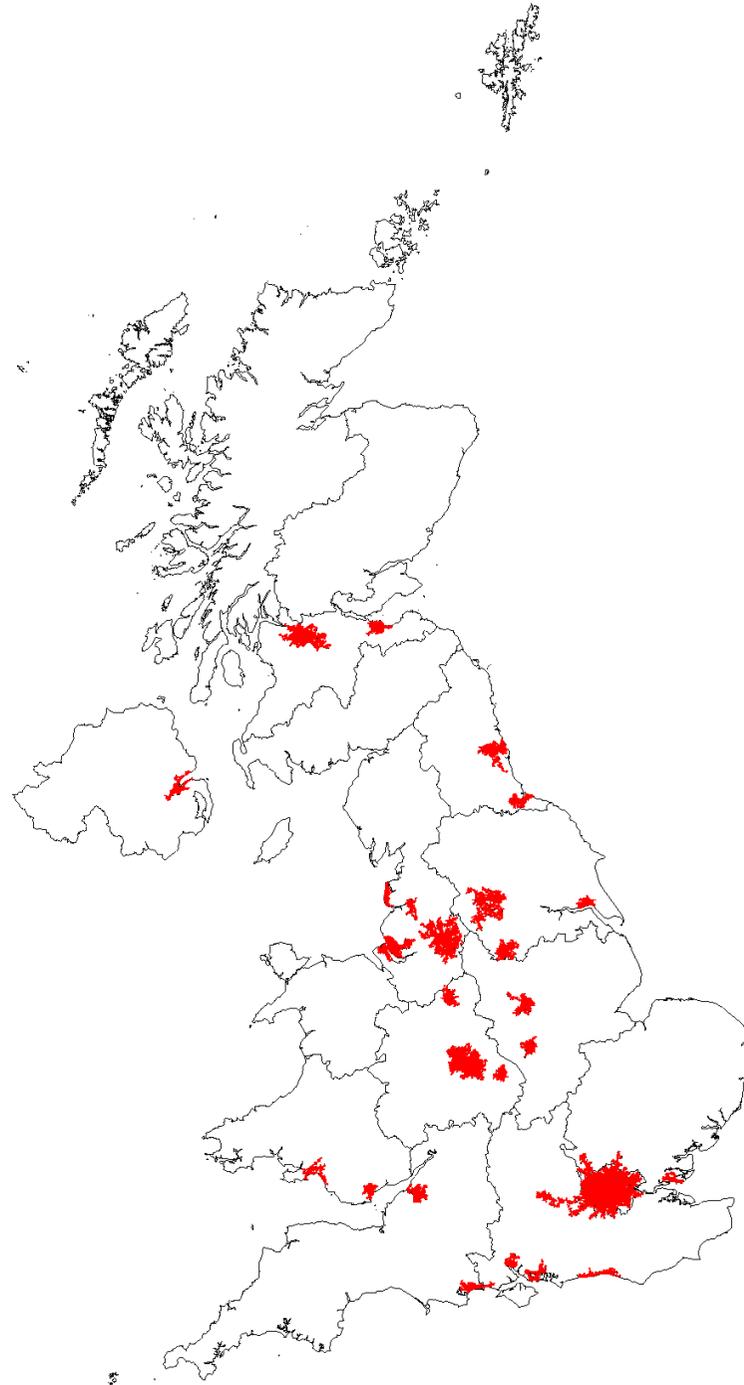
Introduction

- Preliminary Assessment
- NO_x maps
- NO₂/NO_x relationships
- Roadside concentrations
- PM₁₀ maps
- Recap

Preliminary Assessment

- Framework and 1st Daughter Directive set monitoring requirements for air quality assessment
- Much reduced if modelling is used to supplement monitoring results
- 43 zones in UK:
 - 28 agglomerations zones
 - 15 non-agglomeration zones
- At least one monitor in each zone + modelling

UK zones

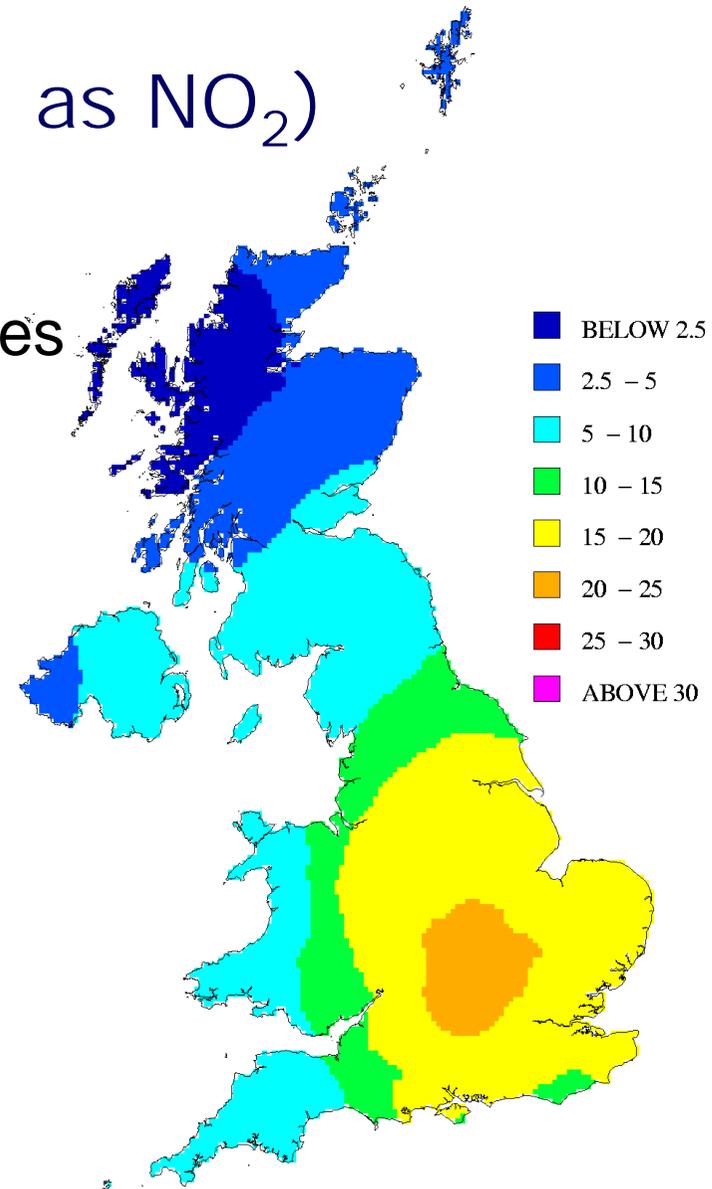


Components of Background NO_x map

- Interpolated rural concentrations
- Large point sources (> 500 Tonnes per year)
- Small point sources (< 500 Tonnes per year)
- Area sources

Interpolated rural NO_x concentration ($\mu\text{g m}^{-3}$, as NO₂)

- NO₂ diffusion tubes at 32 sites
- Corrected for local sources
- Interpolated
- Convert to NO_x (x 1.2)



Point Sources

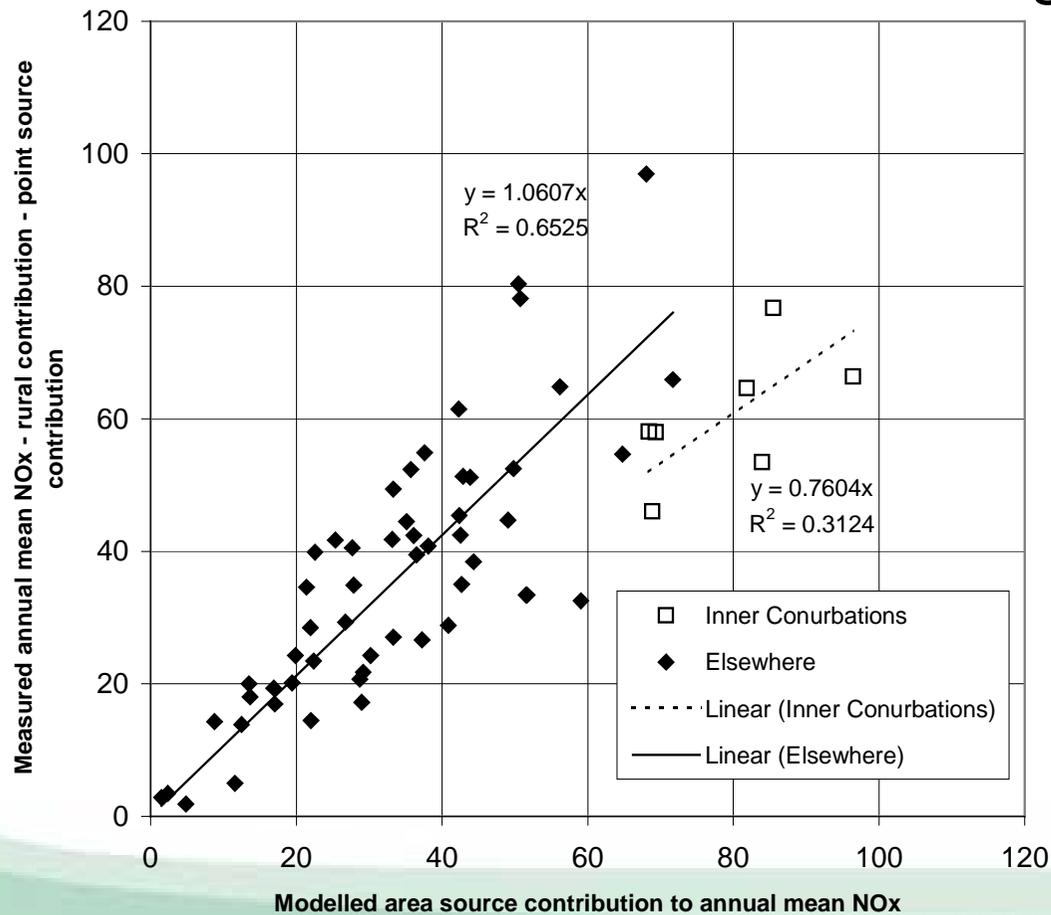
- Large point sources (> 500 Tonnes per year)
 - Modelled explicitly using a dispersion model (ADMS)
 - Met. data + release characteristics
- Small point sources (< 500 Tonnes per year)
 - ‘In square’ (1 km x 1 km) concentration modelled using a non-linear relationship to emissions and assumed release characteristics
 - ‘Out square’ concentration modelled using a dispersion kernel

Dispersion Kernels

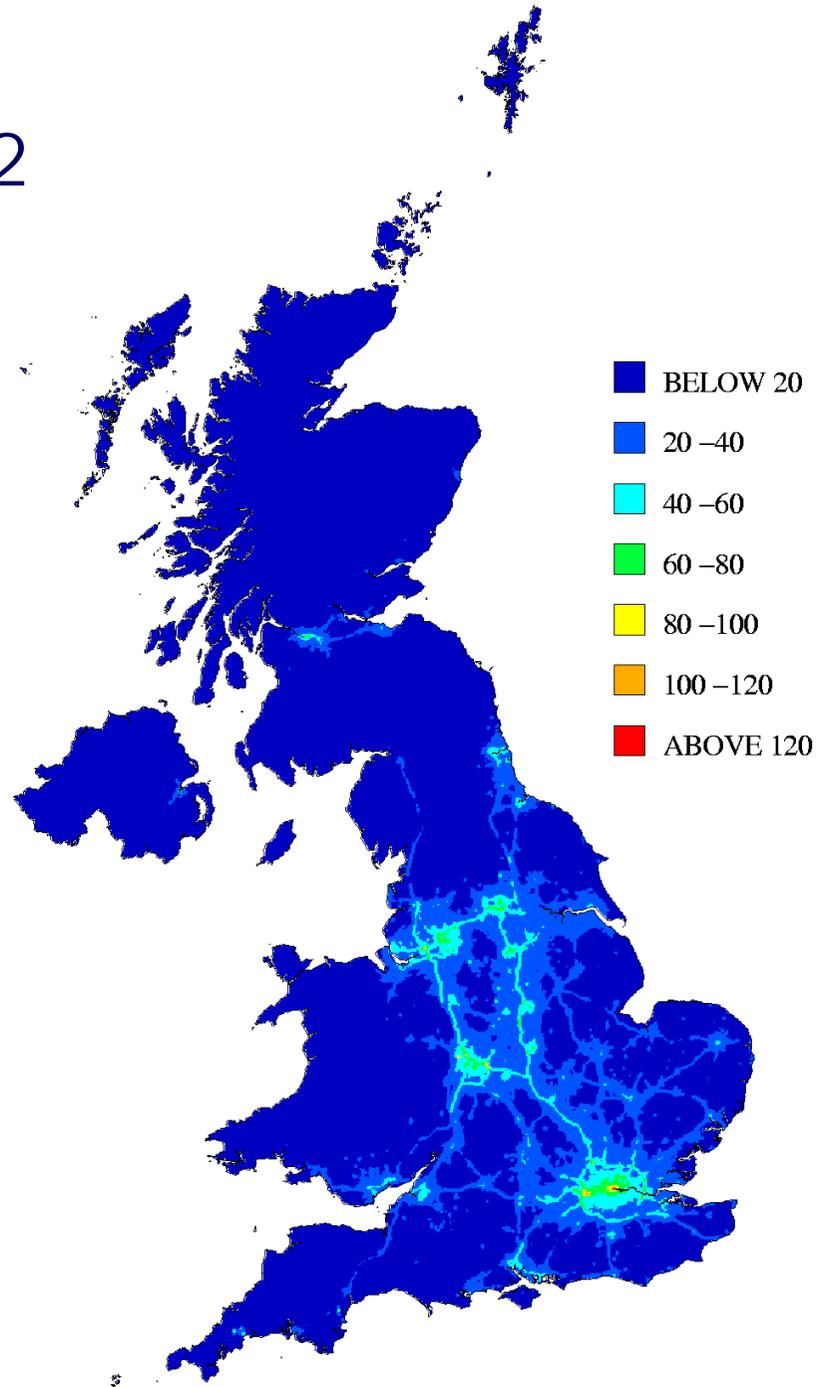
- Used to estimate the contribution to concentrations in a grid of receptors (33 km x 33 km) from a central source with unit emissions (1 g/s)
 - 10 years of sequential Met. data
 - appropriate release characteristics
 - calculated using a dispersion model (ADMS)
- Enables rapid calculations in a GIS

Area sources

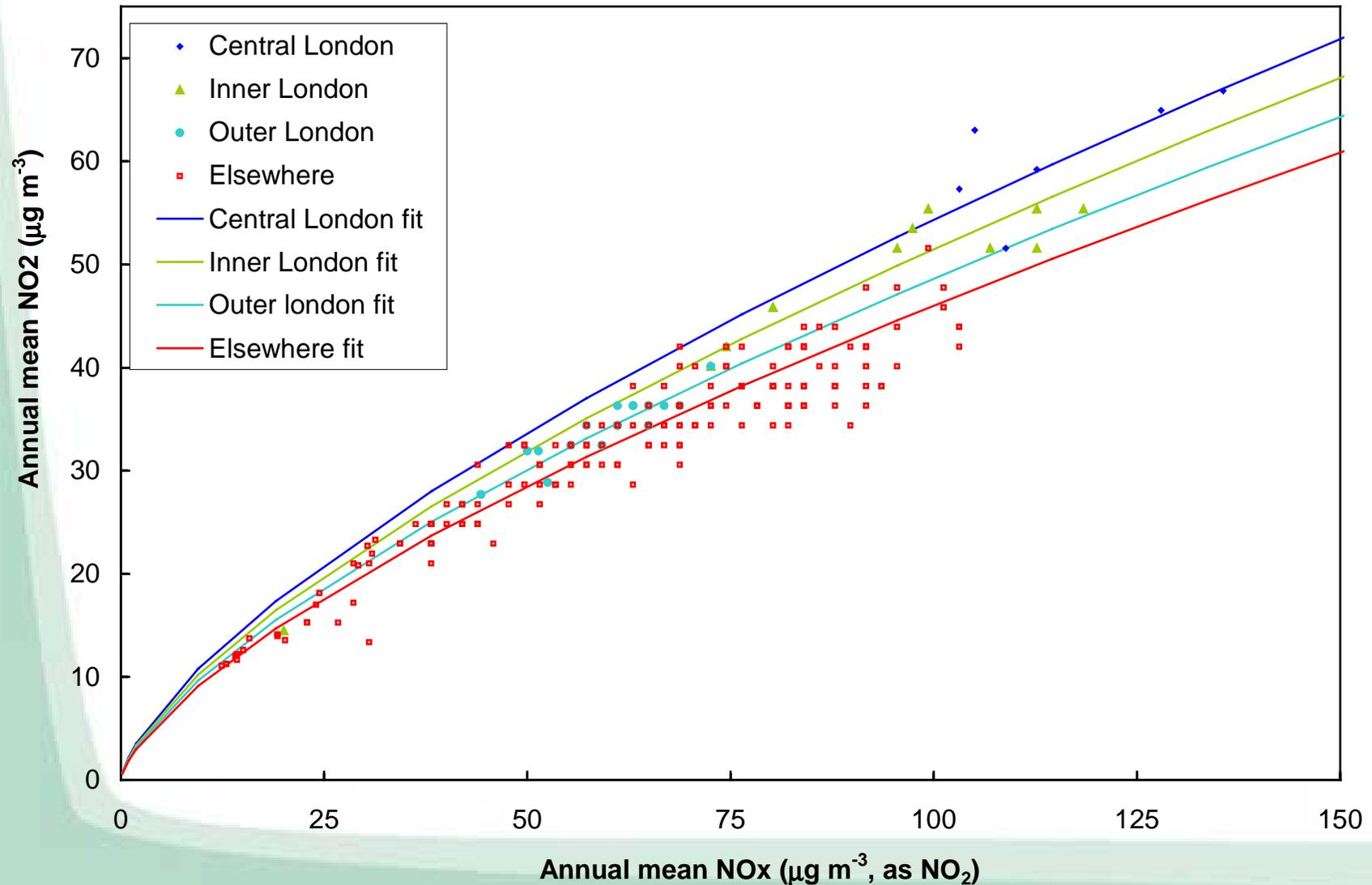
- Modelled using a dispersion kernel
- Calibrated with automatic monitoring data



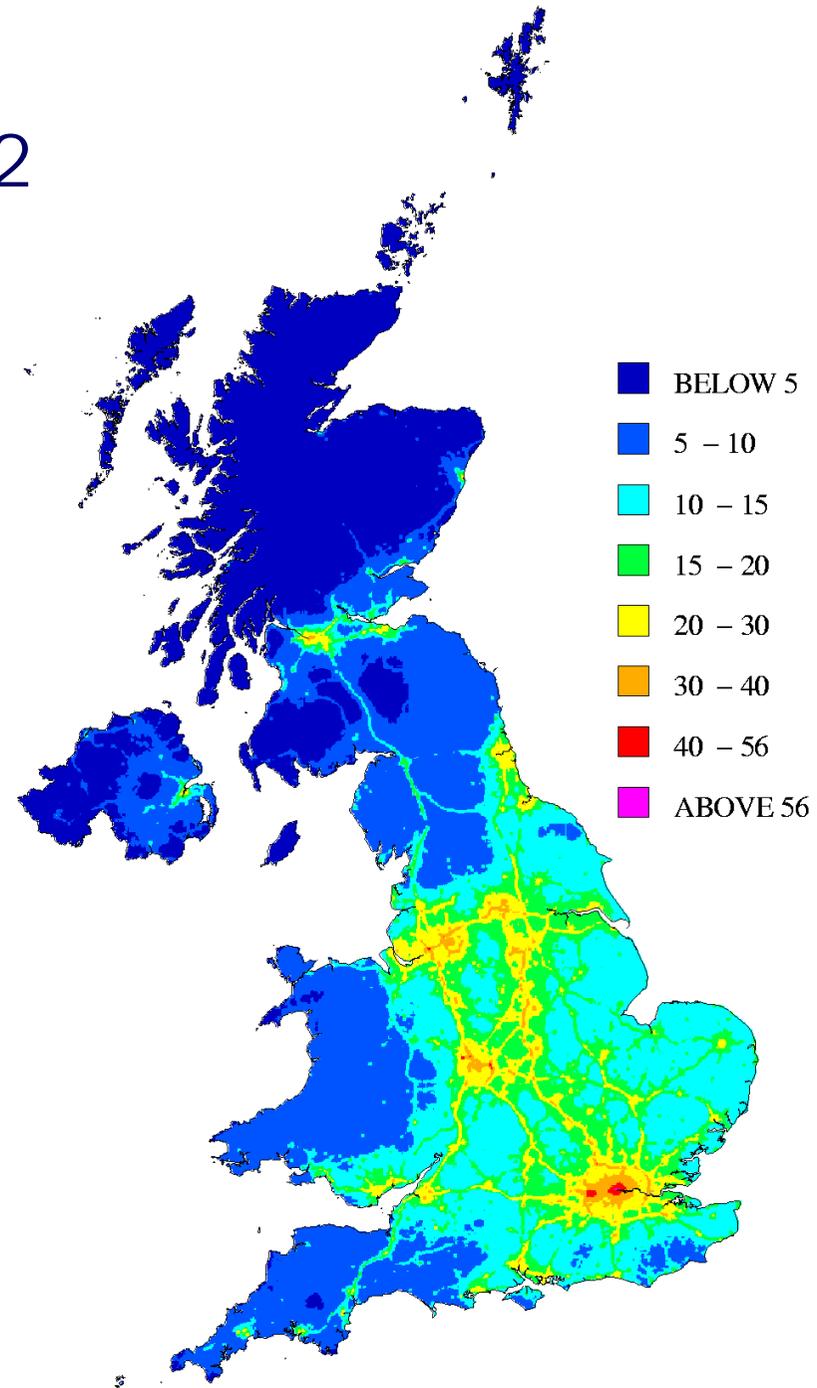
Annual mean NO_x concentration 2002 ($\mu\text{g m}^{-3}$, as NO_2)



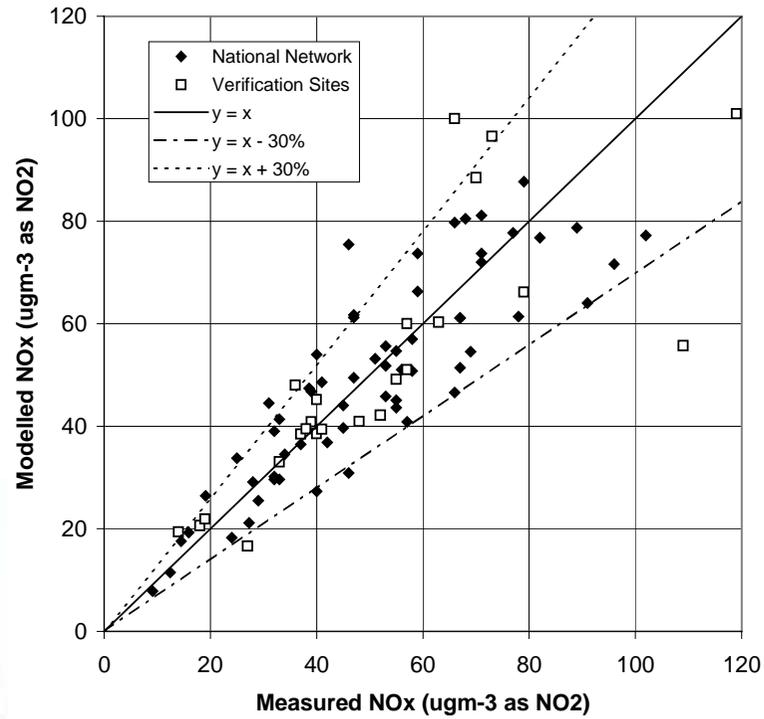
Relationships between annual mean NO₂ and annual mean NO_x



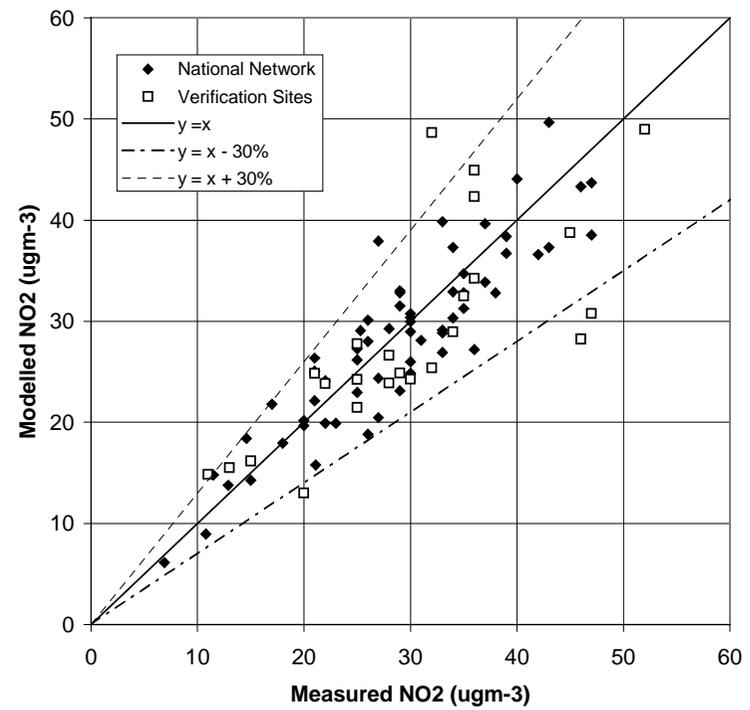
Annual mean NO₂ concentration 2002 ($\mu\text{g m}^{-3}$)



Verification of maps



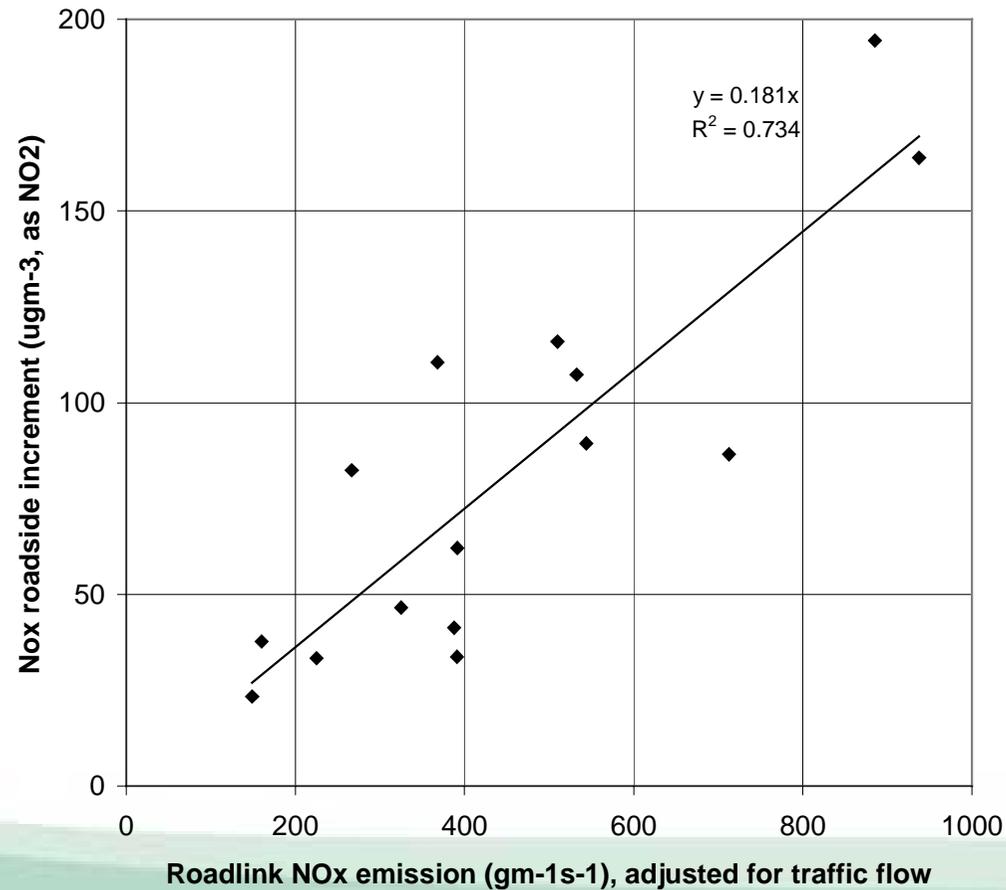
NO_x



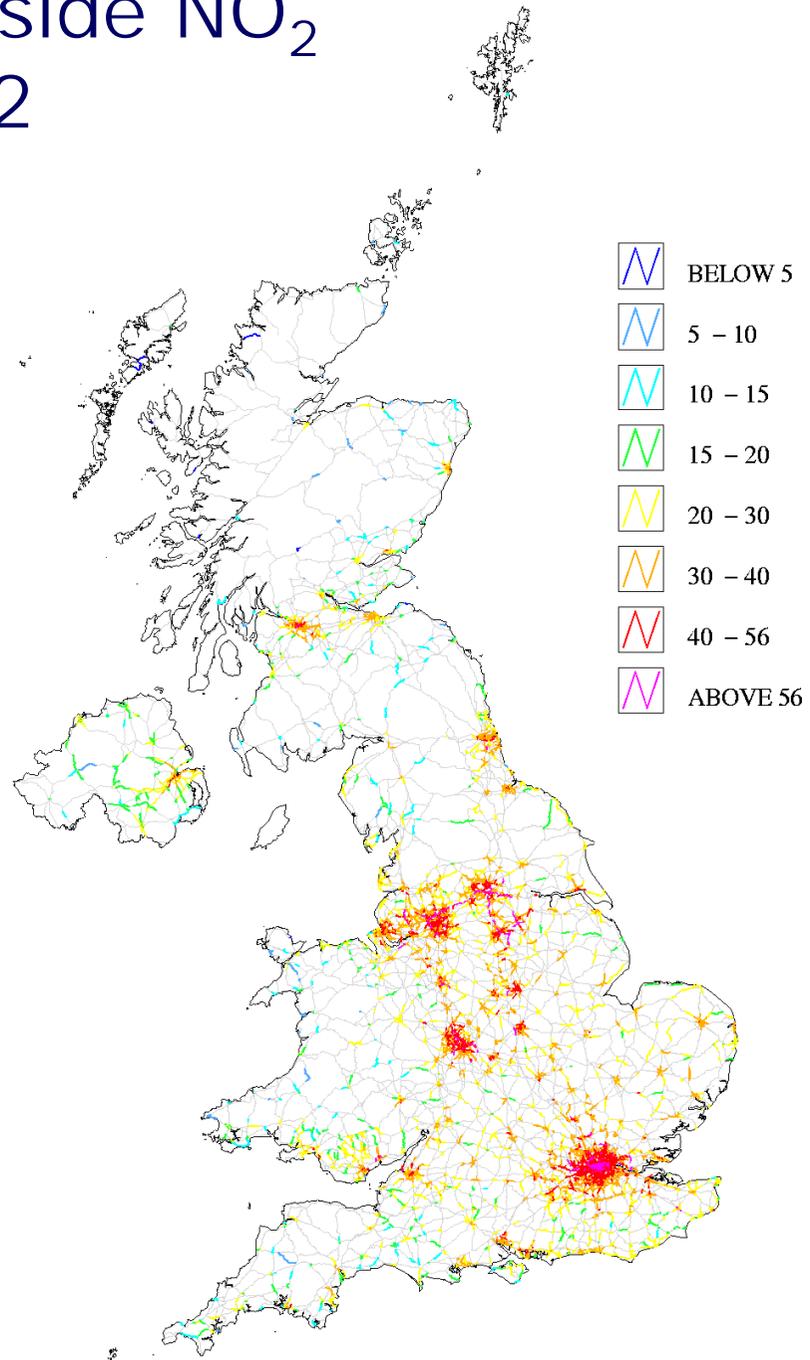
NO₂

Roadside concentration

- Roadside = background + roadside increment
- Calibrated with automatic monitoring data



Annual mean roadside NO₂ concentration 2002 ($\mu\text{g m}^{-3}$)

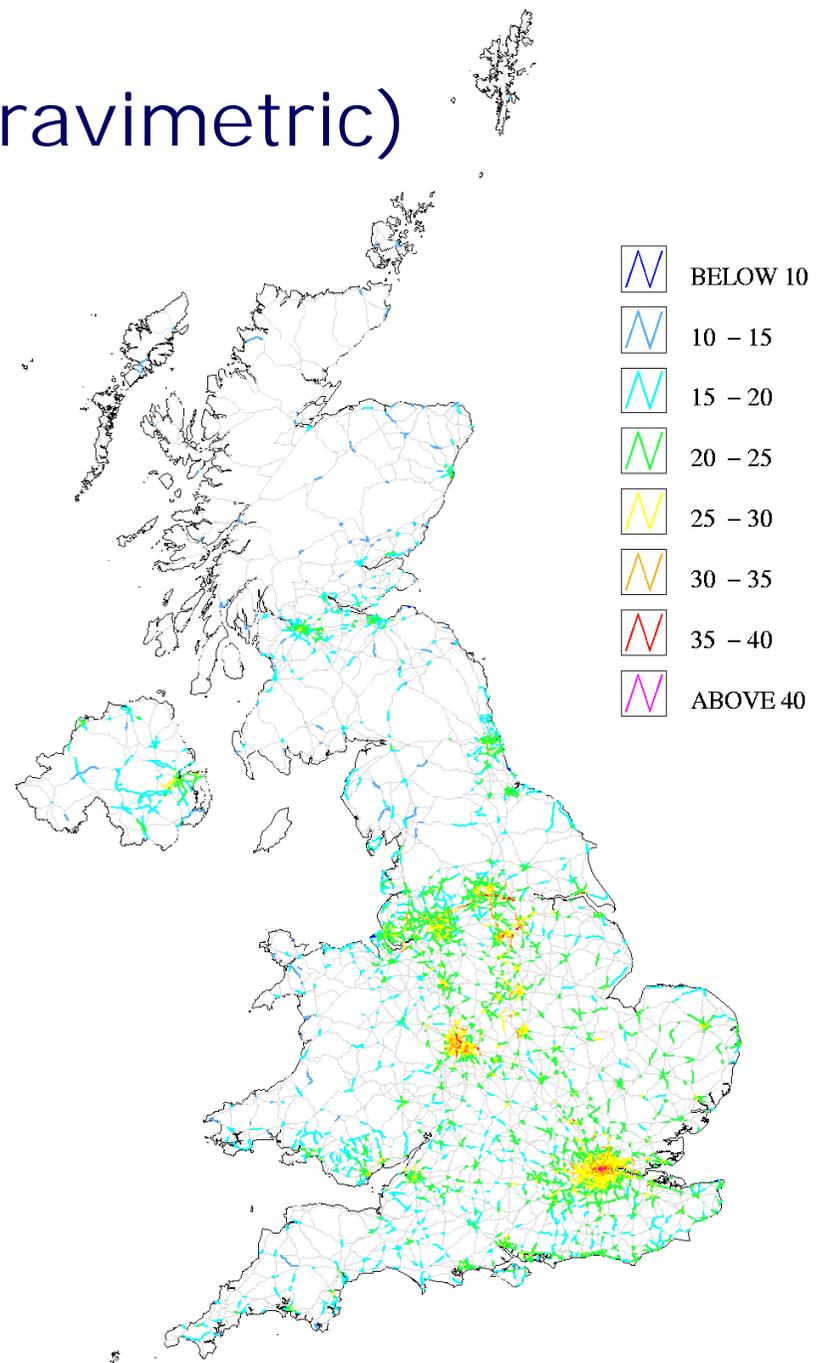
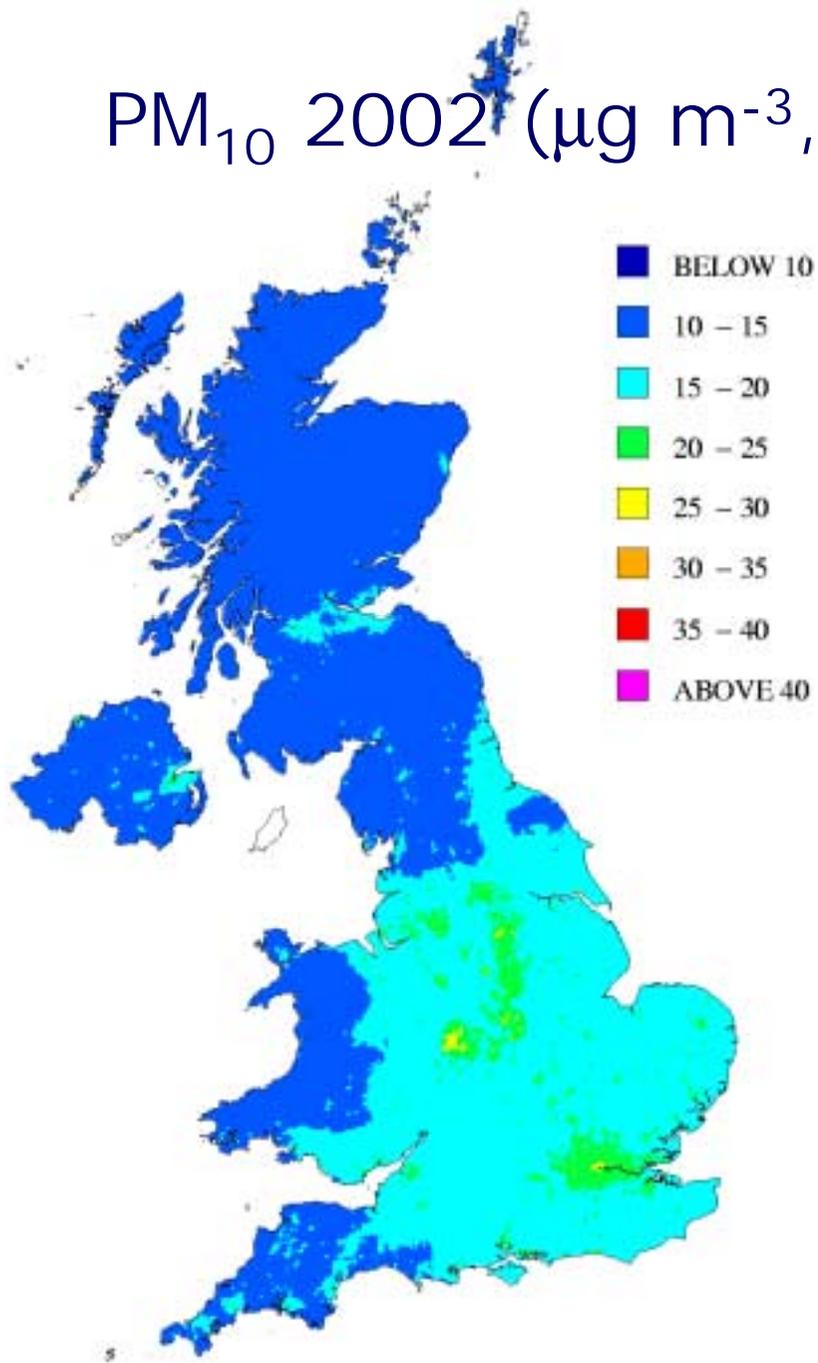


Components of PM₁₀ map

Calibrated using TEOM measurements (69 sites)

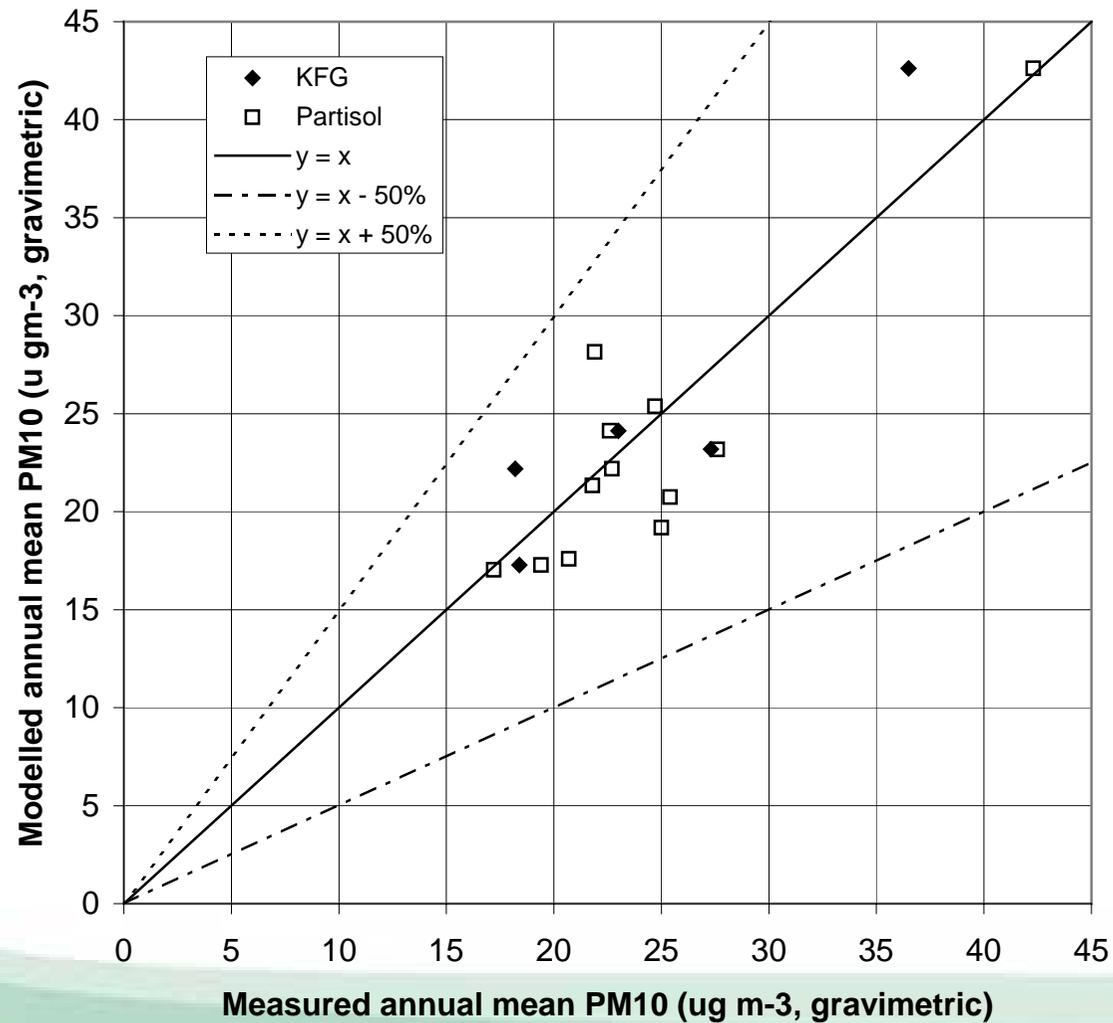
- Interpolated rural secondary particle concentrations
 - sulphate
 - nitrate
- Large point sources (> 200 Tonnes per year)
- Small point sources (< 200 Tonnes per year)
- Area sources
- Coarse particles (constant $9 \mu\text{g m}^{-3}$, gravimetric)
- (Roadside increment)

PM₁₀ 2002 ($\mu\text{g m}^{-3}$, gravimetric)



Comparison of gravimetric measurements with TEOM map x 1.3

Verification of gravimetric PM10 model 2002



Results of air quality assessment 2002

43 zones

SO₂: No exceedences

NO₂:

- 36 zones exceeded annual mean LV
 - 8 measured, 28 modelled
- 19 zones exceeded annual mean LV + MOT
 - 5 measured + 14 modelled

Results of air quality assessment 2002

PM₁₀ (Stage 1):

- 18 zones exceeded 24-hour mean LV
 - 2 measured, 16 modelled
- 1 zone exceeded 24-hour mean LV + MOT
 - modelled
- 2 zones exceeded annual mean LV
 - 1 measured, 1 modelled
- 1 zone exceeded annual mean LV + MOT
 - modelled

Lead: No exceedences

Recap: requirements

NO₂

- Rural measurements
- Point source emission inventory
- Area emission inventory (1 km x 1 km)
- Major road link emission inventory
- Met. data
- Automatic measurements to calibrate models

PM₁₀

- Similar, but also need sulphate and nitrate measurements