Improving the temporal profiles of emission input data for high resolution atmospheric transport modelling – a case study for the UK

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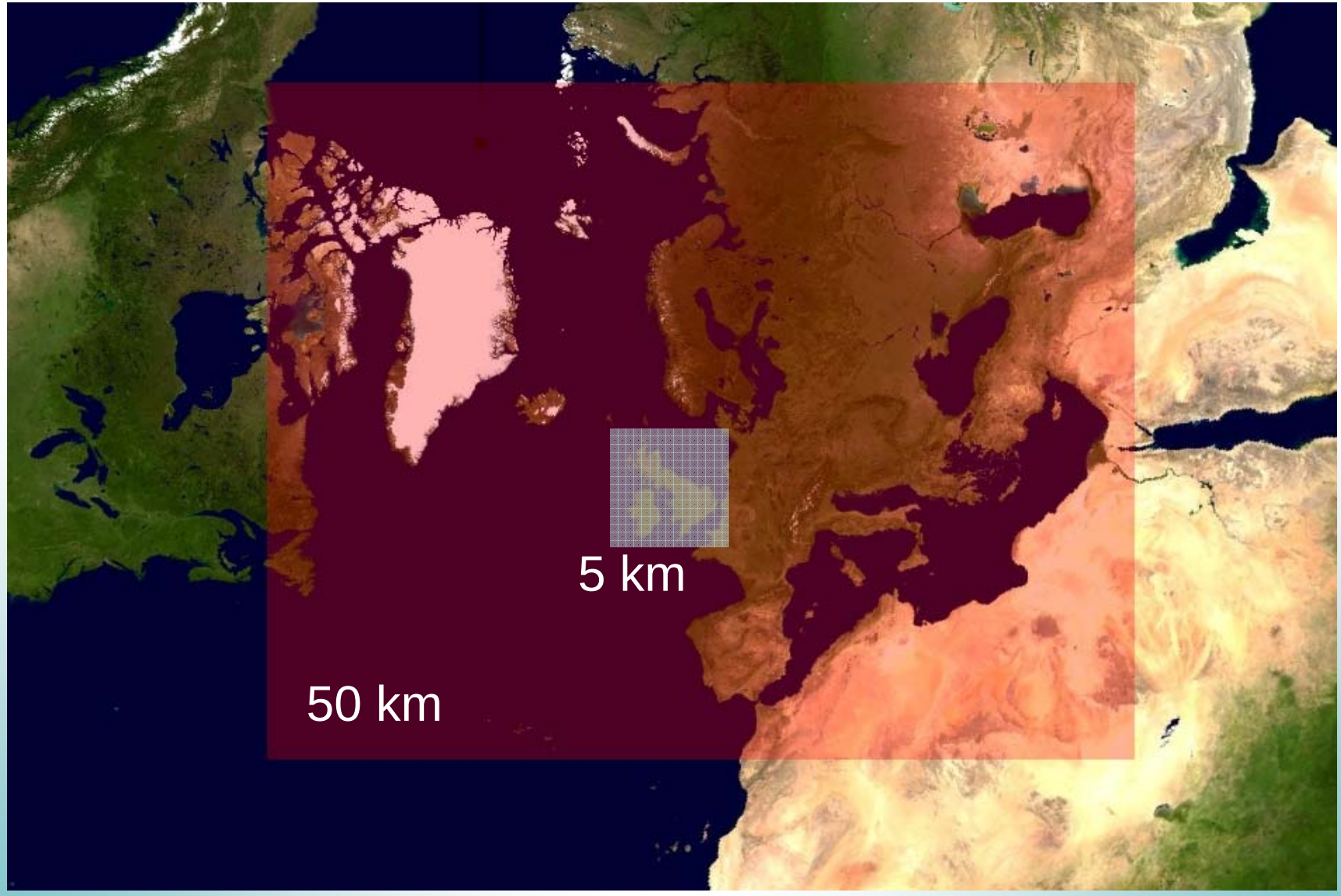
Overview

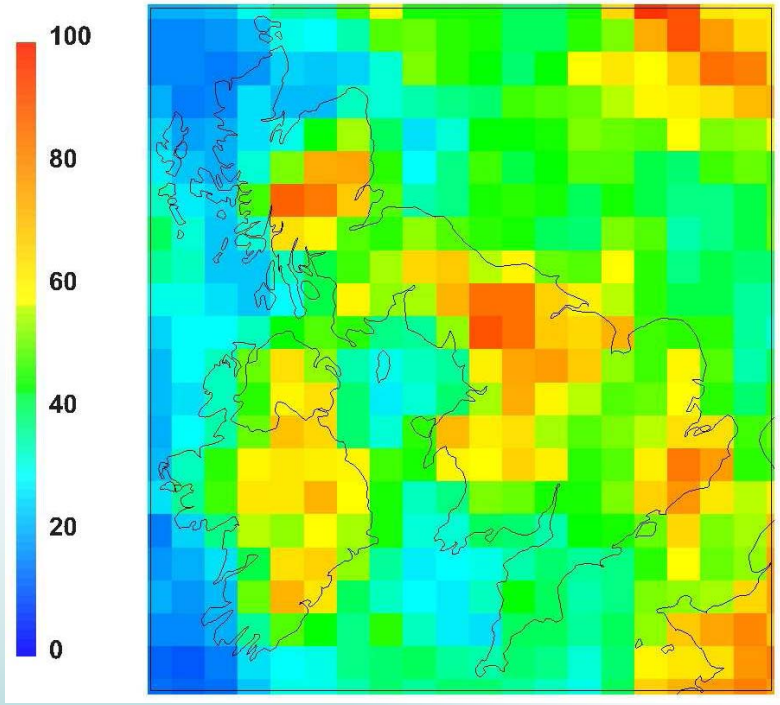
- EMEP4UK atmospheric model application for the UK
- Emission data – current state of play
- Activity data *(energy sector & road transport)*
- Approach to develop improved temporal profiles
- First evaluation of results
- Conclusions & Outlook

The EMEP4UK model domain

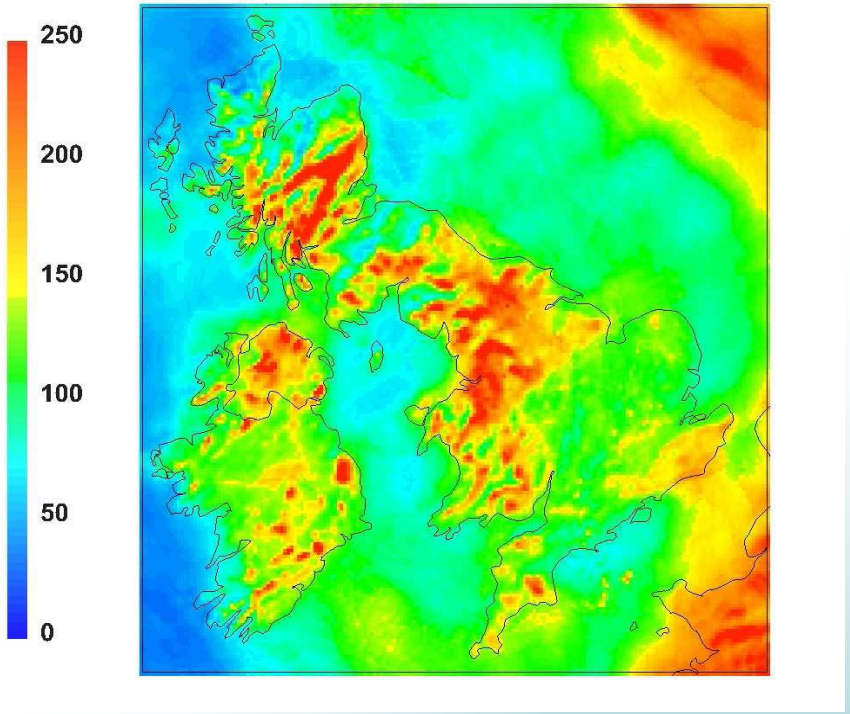


Spatial resolution

Comparison of model resolutions



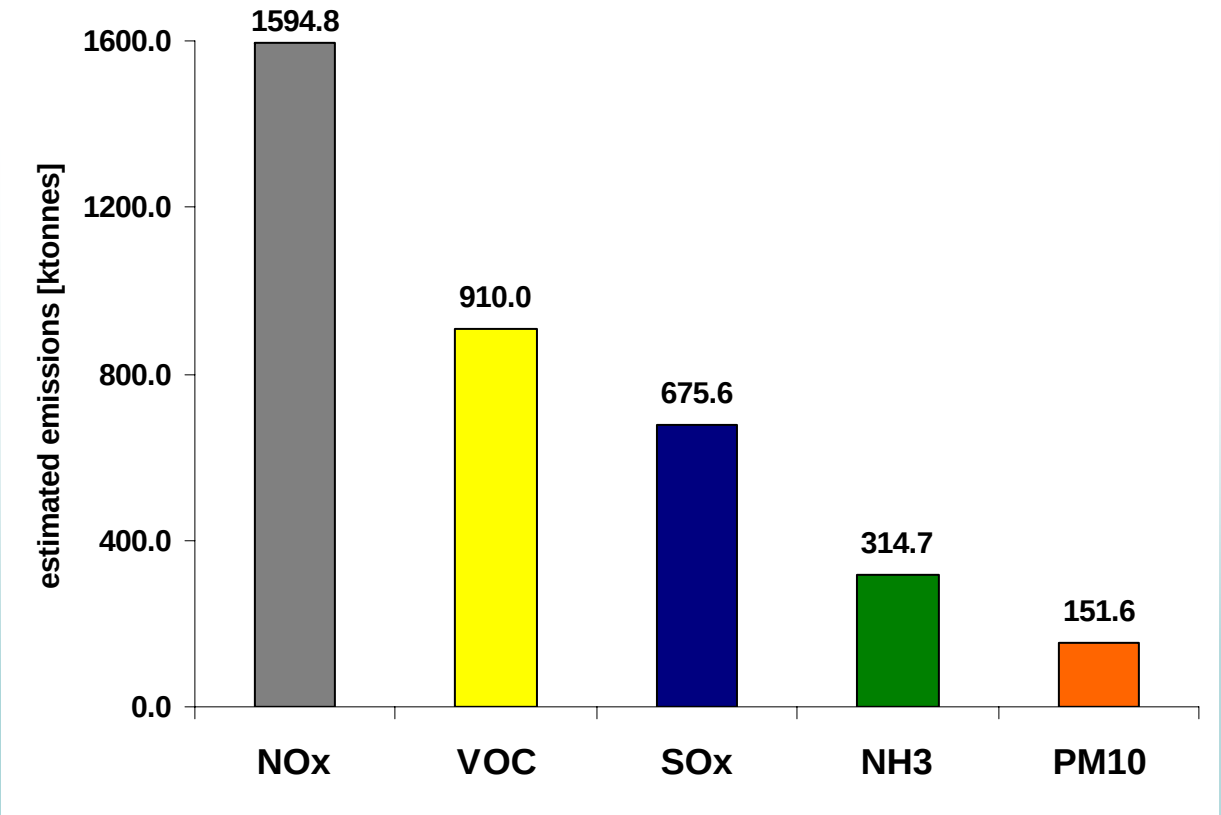
50 × 50 km resolution
EMEP Unified



5 × 5 km resolution
EMEP4UK

Emissions in the UK

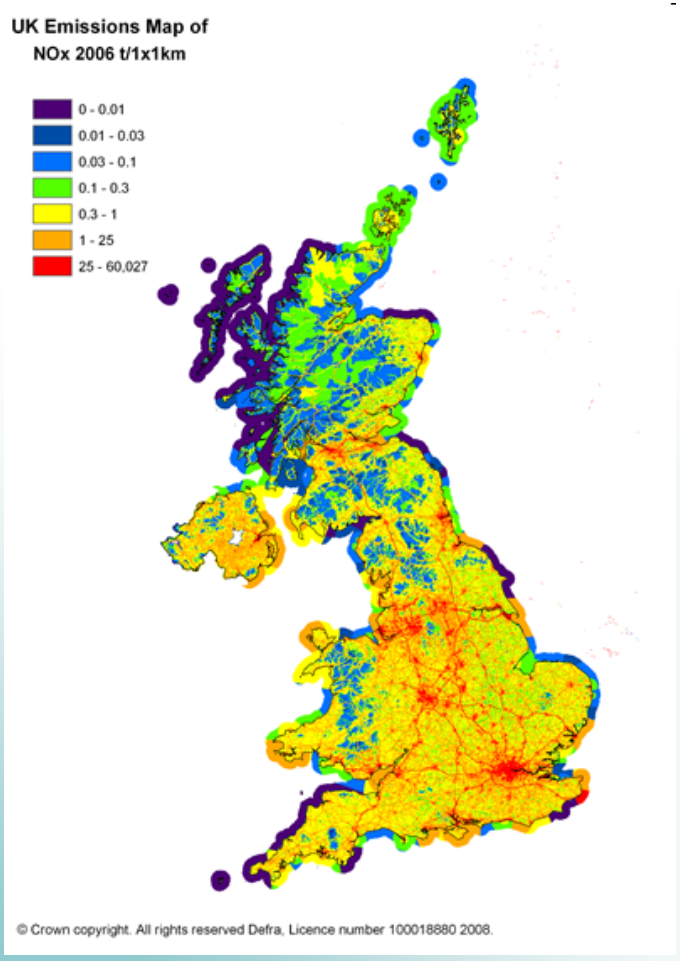
Annual anthropogenic emissions in 2006



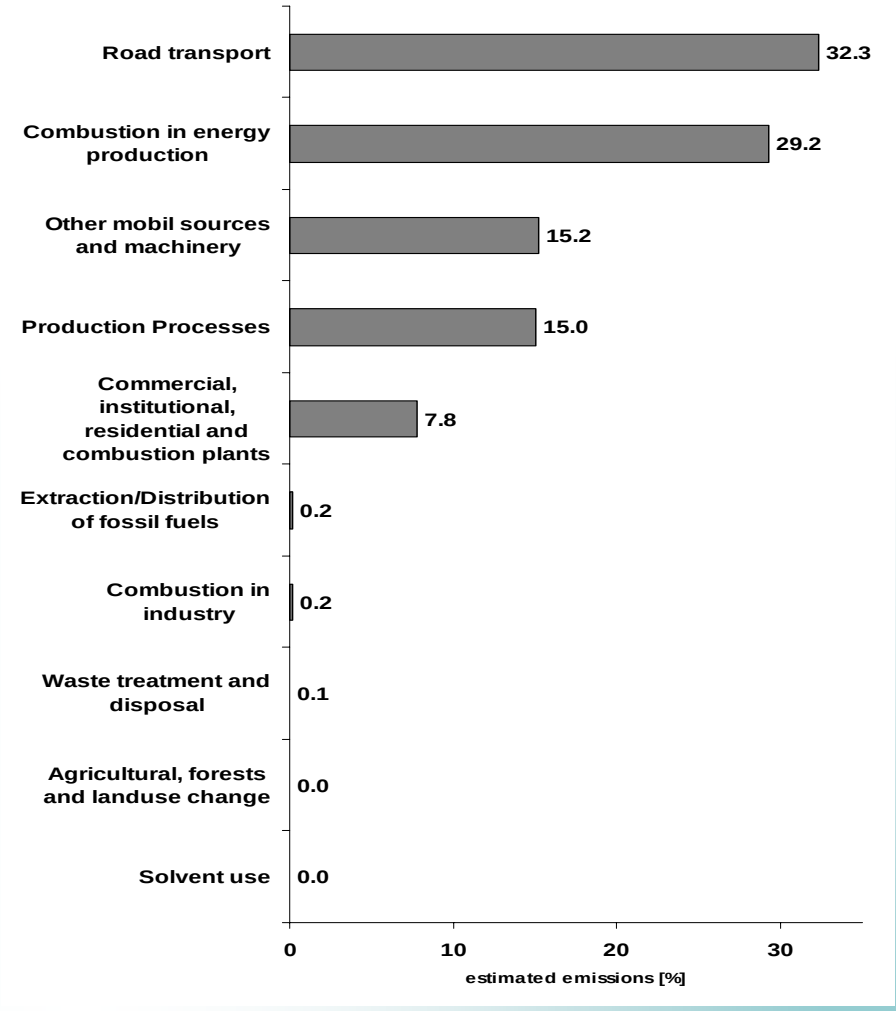
Source: UK Department for Environment, Food and Rural Affairs

Nitrogen Oxides

1594.8 ktonnes (2006)



Source: NAEI*

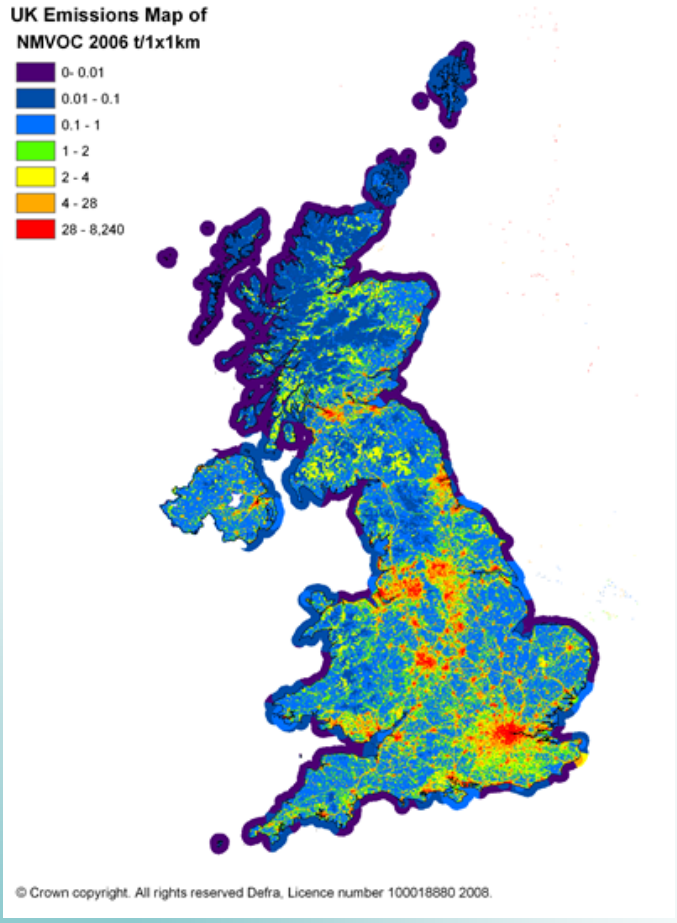


Source: Defra

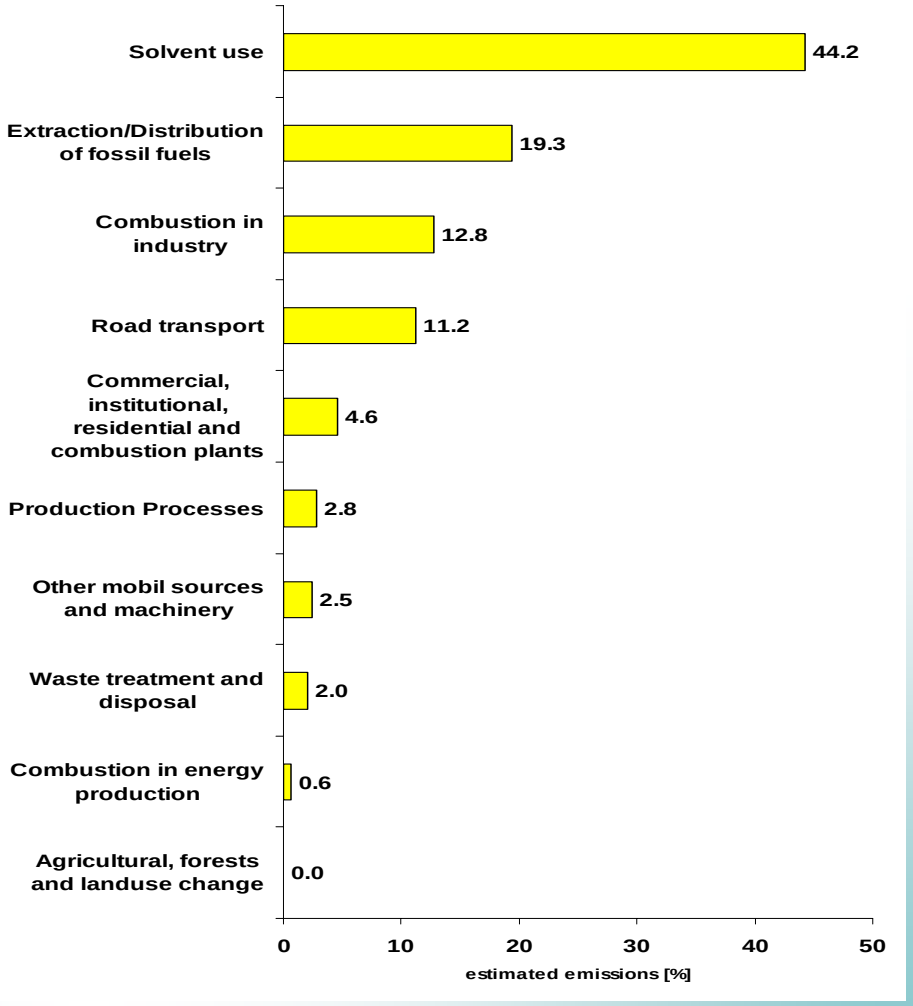
** National Atmospheric Emission Inventory*

NMVOC

910.0 ktonnes (2006)



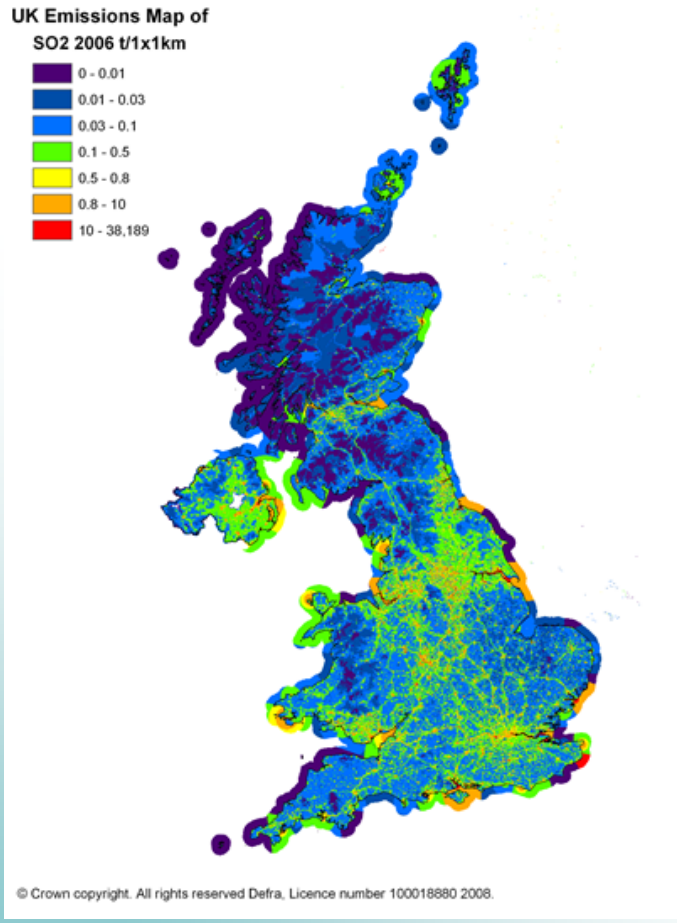
Source: NAEI



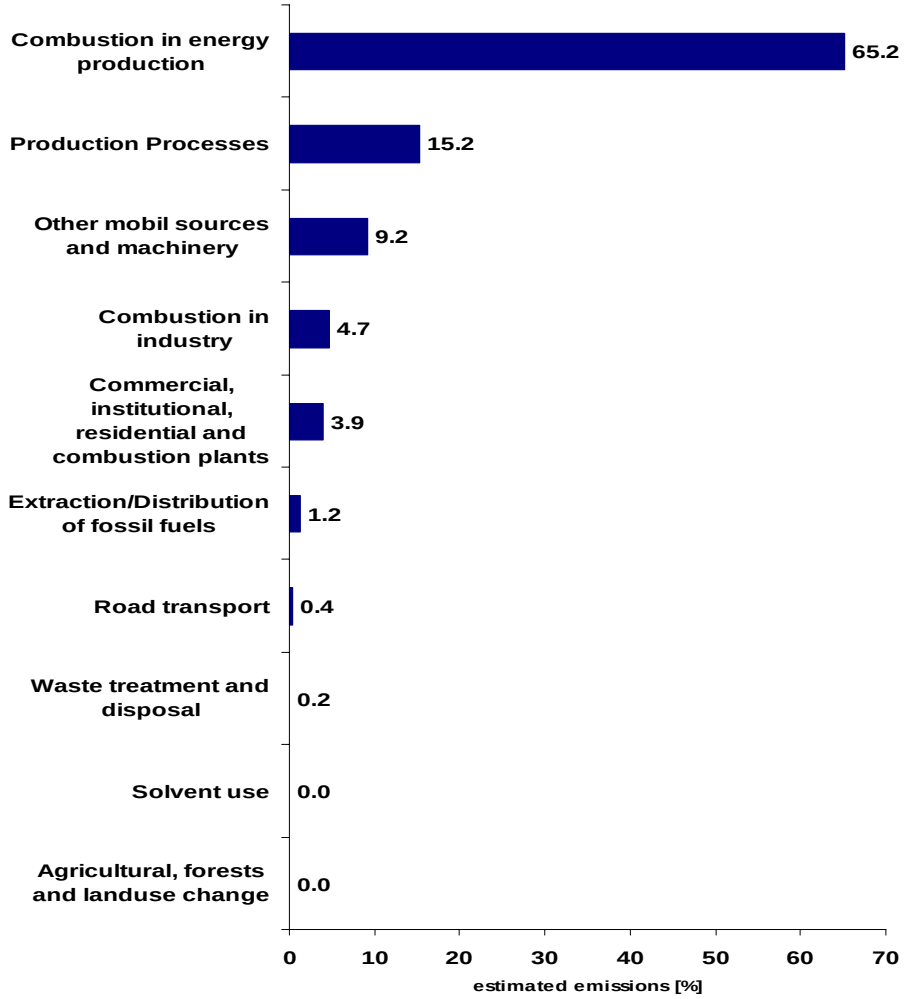
Source: Defra

Sulphur Dioxide

675.6 ktonnes (2006)



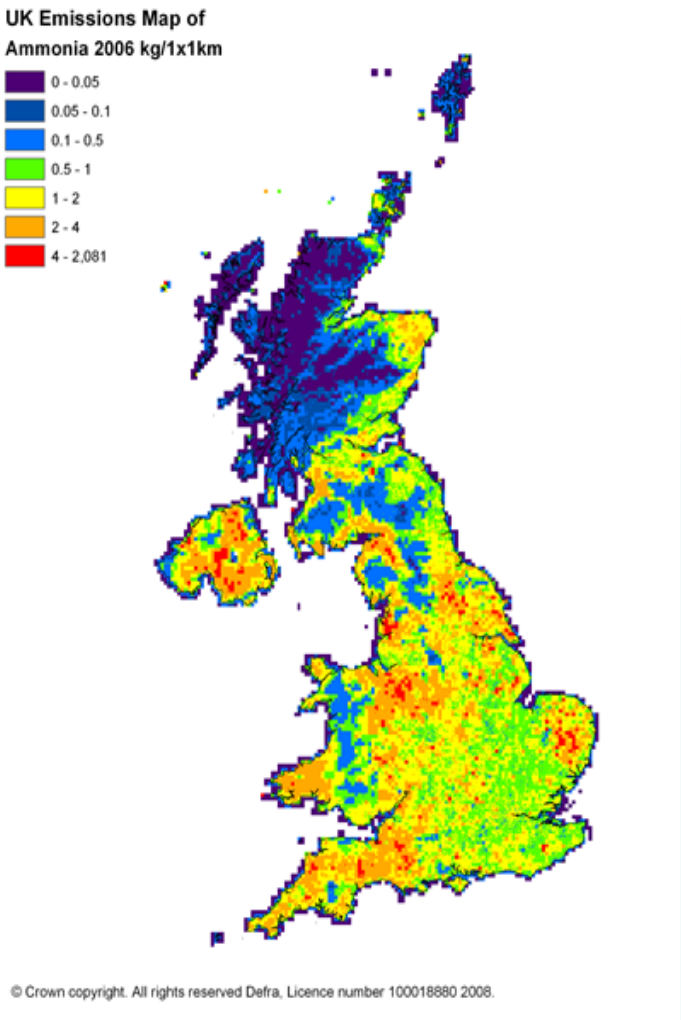
Source: NAEI



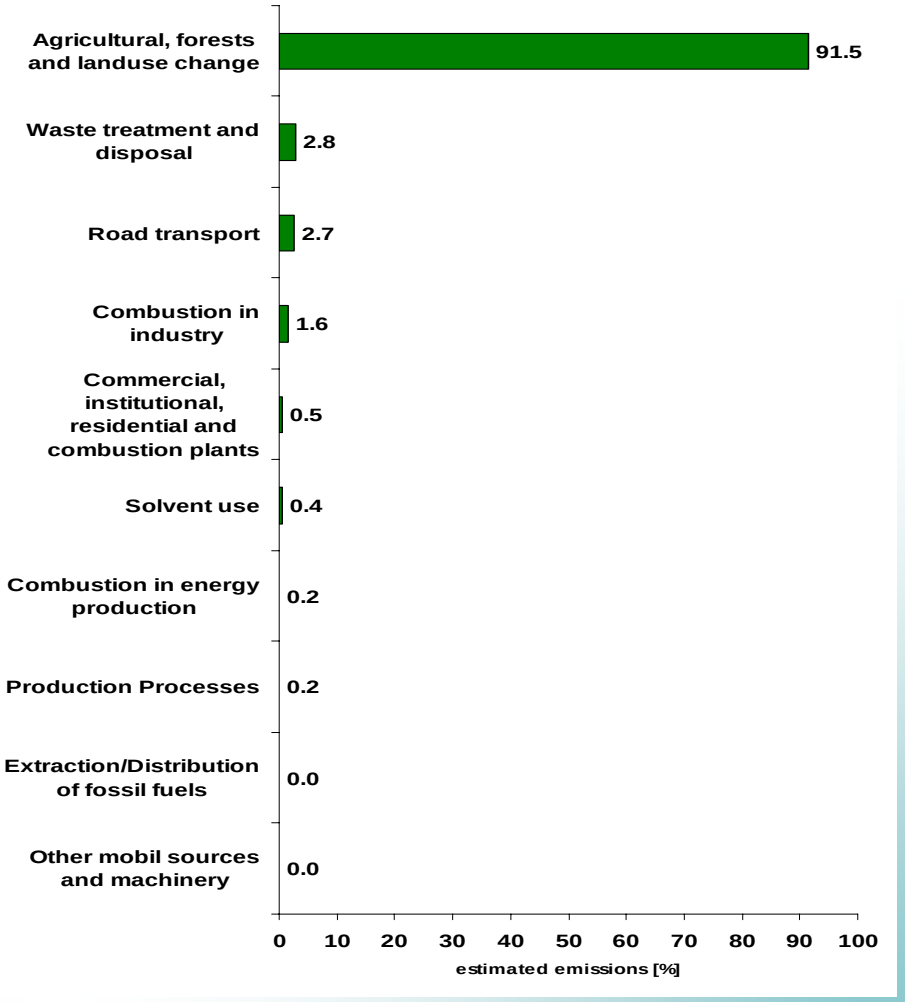
Source: Defra

Ammonia

314.7 ktonnes (2006)



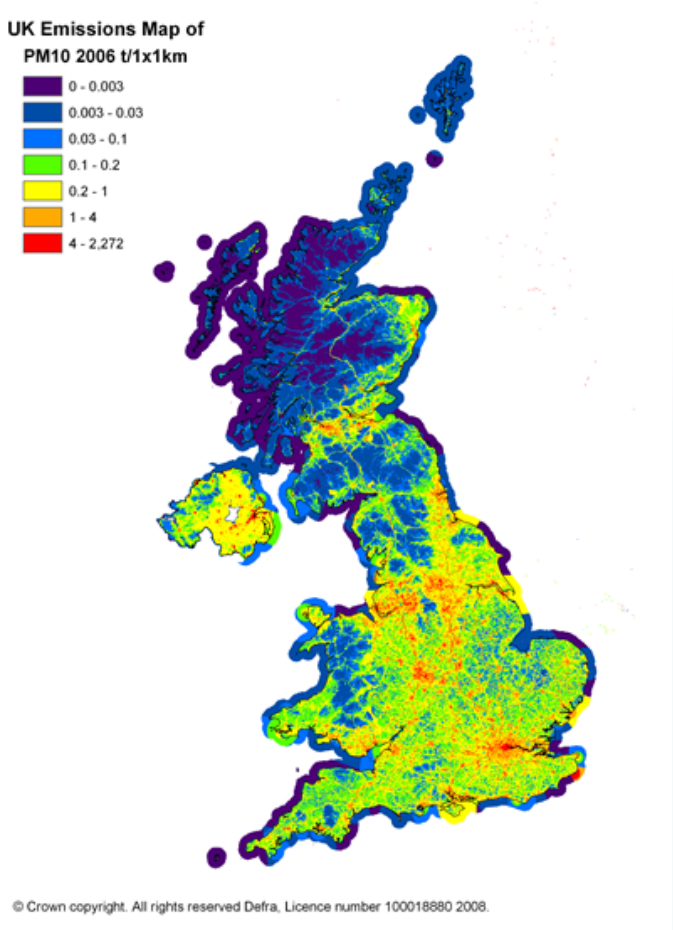
Source: NAEI



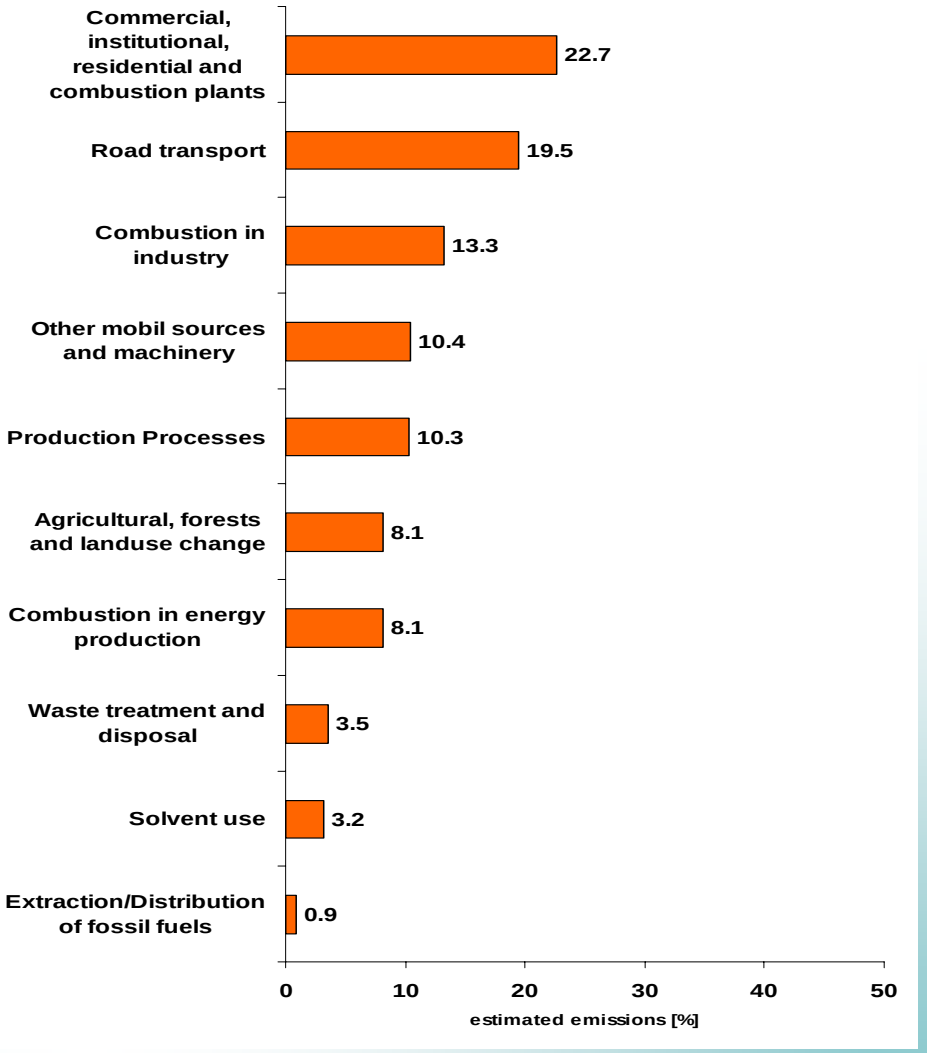
Source: Defra

Particulate Matter (PM10)

151.6 ktonnes (2006)

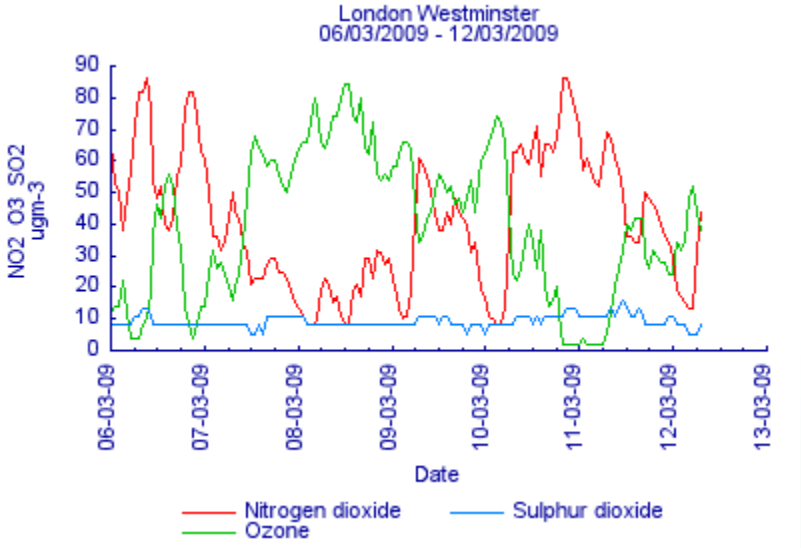


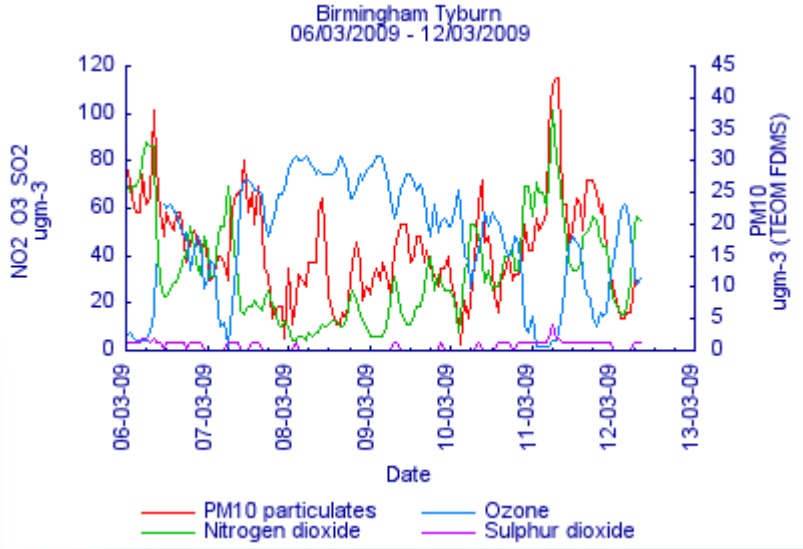
Source: NAEI

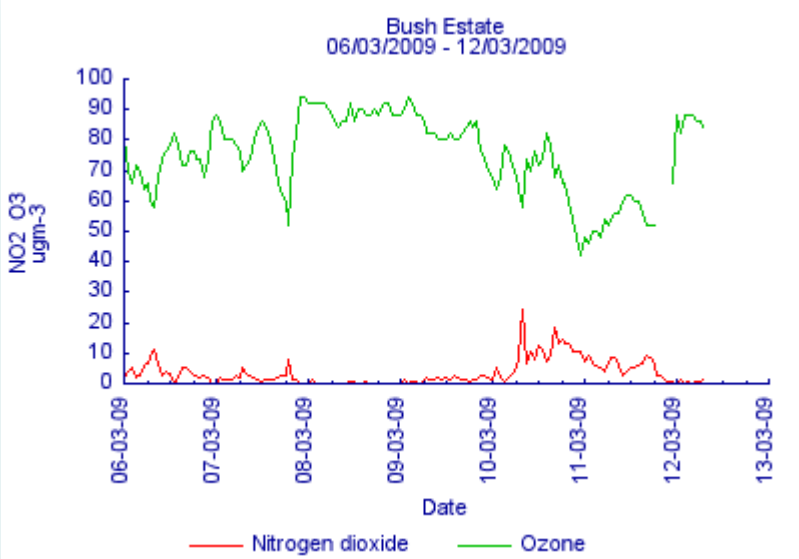


Source: Defra

Observed concentrations







Source: UK Air Quality Archive

Temporal distribution – general thoughts

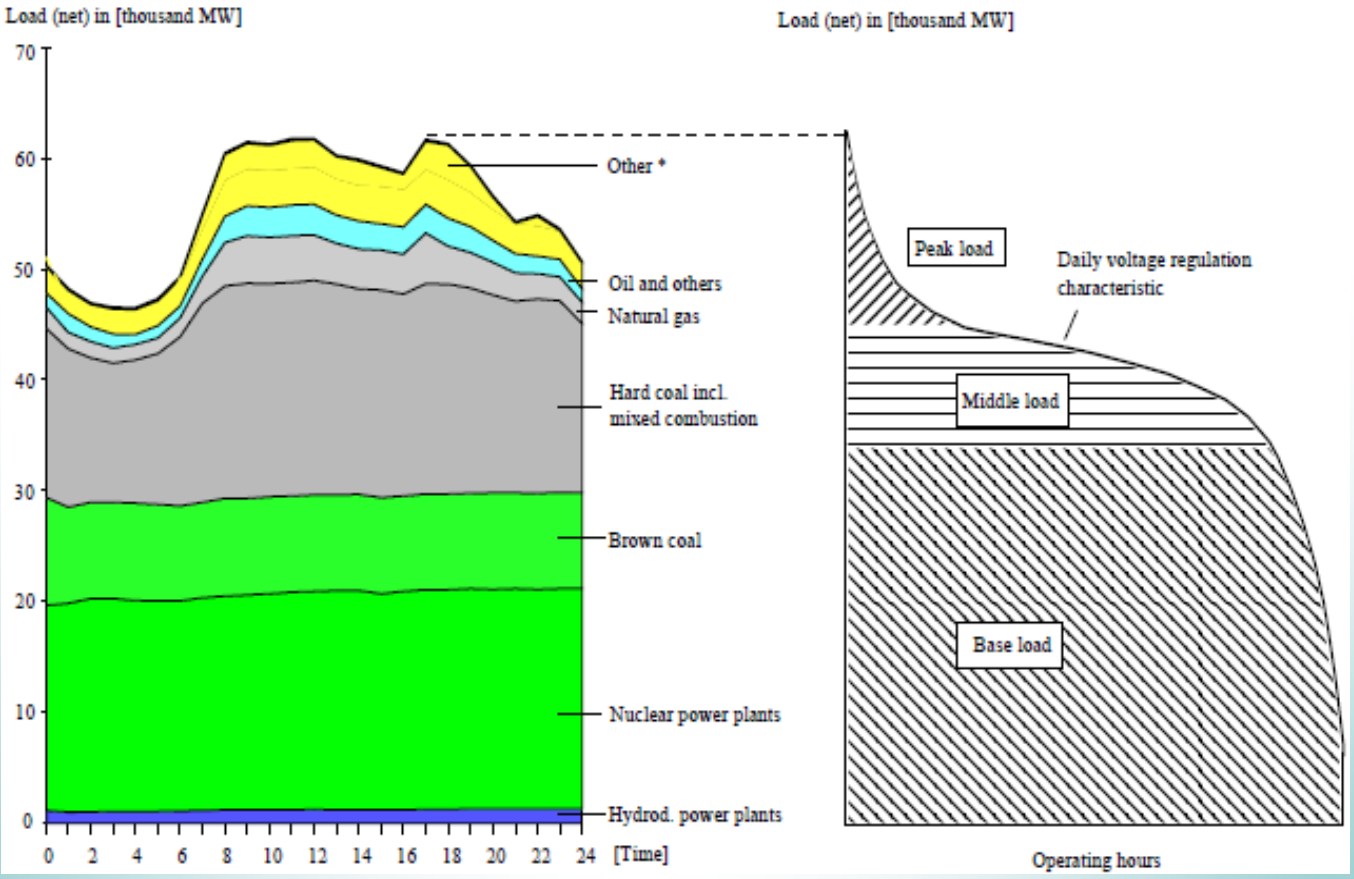
- Aiming to achieve the best available temporal resolution, with appropriate resources

- Activity consideration of the main emitters
  - user behaviour
  - production indices
  - energy consumption
  - traffic counts
  - temperature
  - working hours
  - holidays/vacation

perfect, real-time temporal allocation  availability of temporal data feasible, cost-effective approach

Combustion in Energy Production

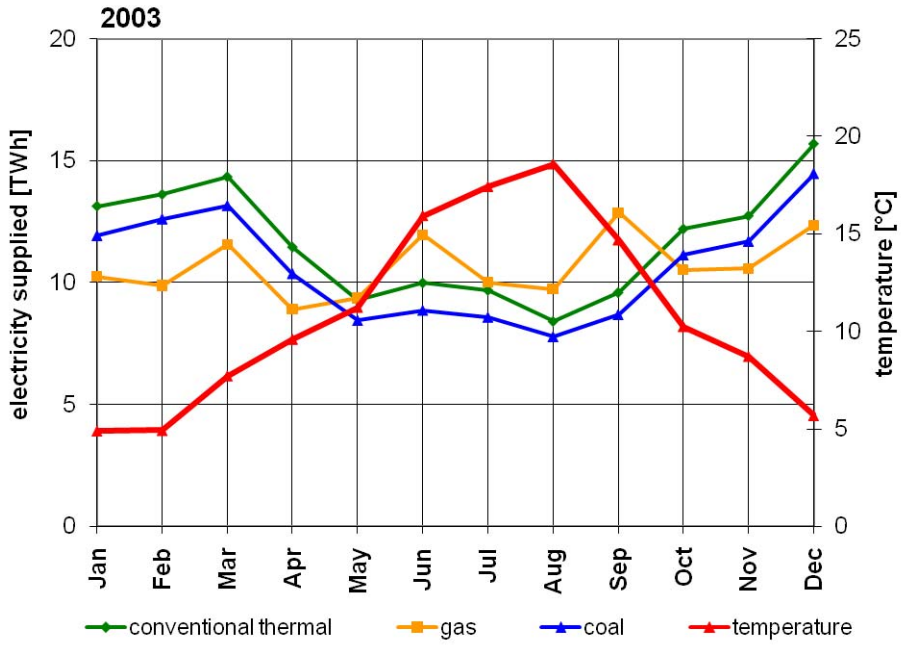
Load designs of power plants

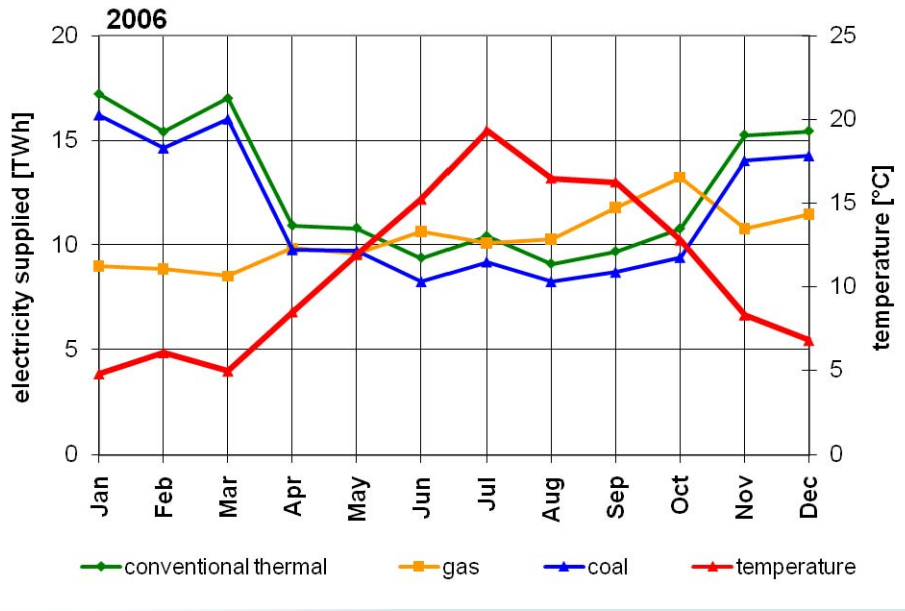


Source: EMEP/CORINAIR Emission Inventory Guidebook

Combustion in Energy Production

Activity data

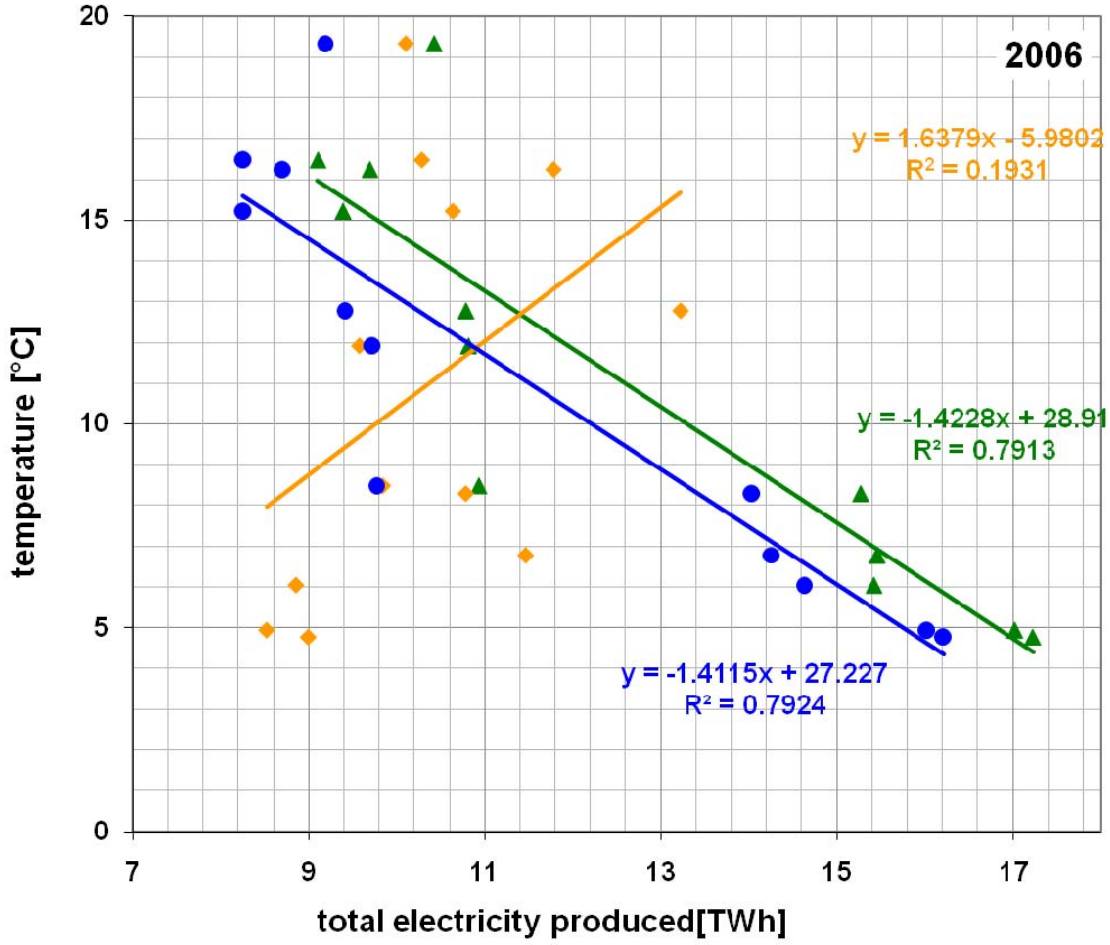




Source: Department for Business Enterprise & Regulatory Reform (BERR), Energy Statistics

Combustion in Energy Production

Influence of load and ambient temperature

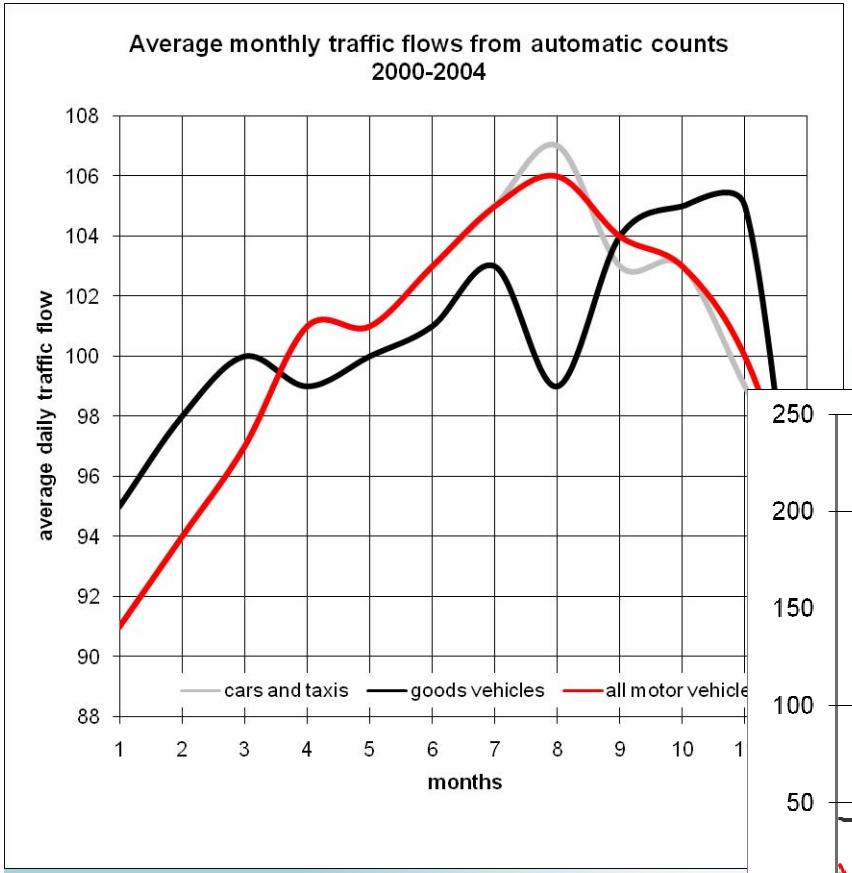


	Coal	Gas
Load design	Base and middle	Demand peaks
Consumption	Seasonal influenced	Short-term demand
Temporal resolution	yearly	hourly

Source: BERR, Energy Statistics

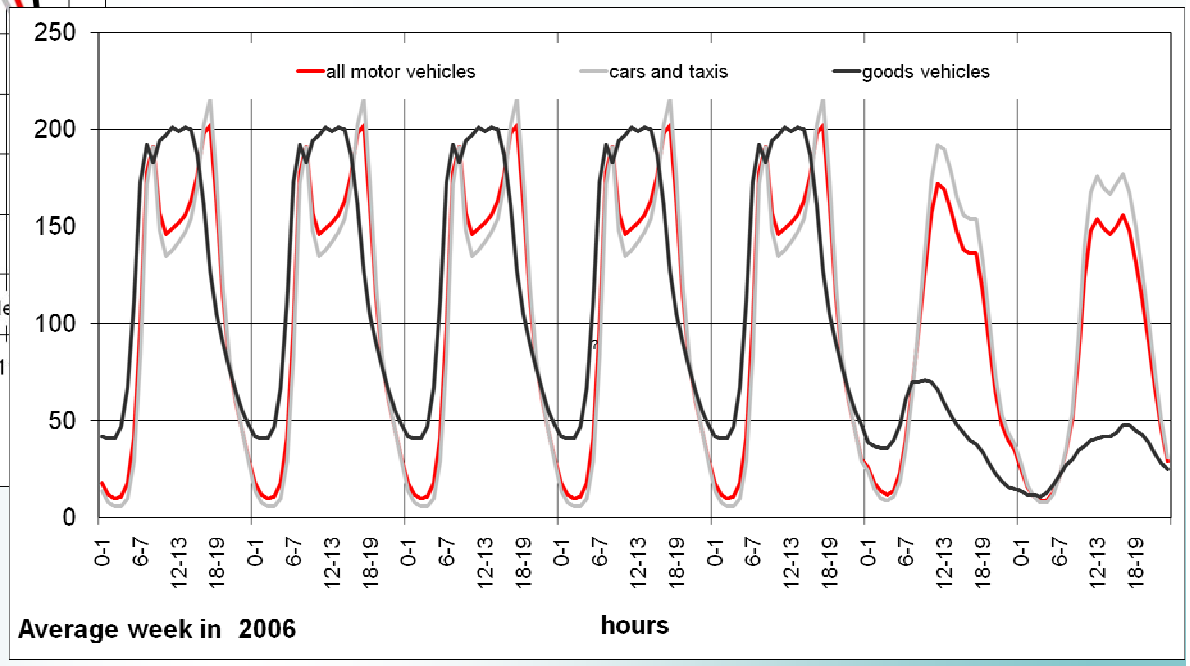
Road Transport

Activity data (I)



Annual profile

Average weekly profile

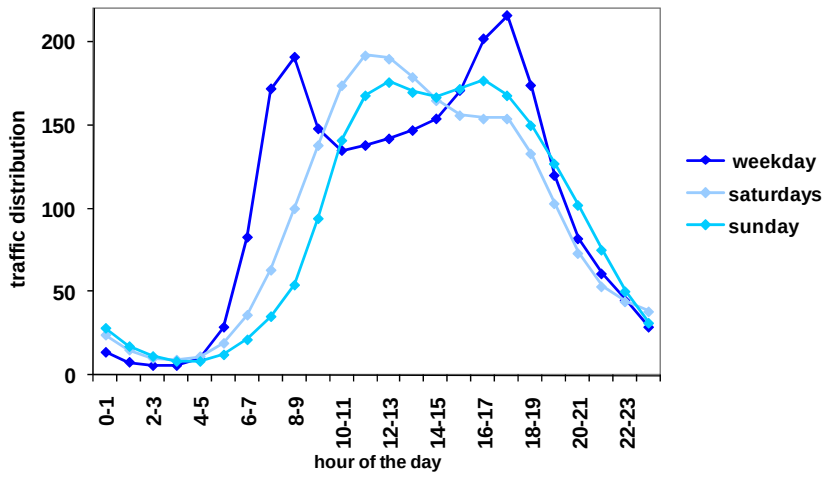


Source: UK Department of Transport (DETR)

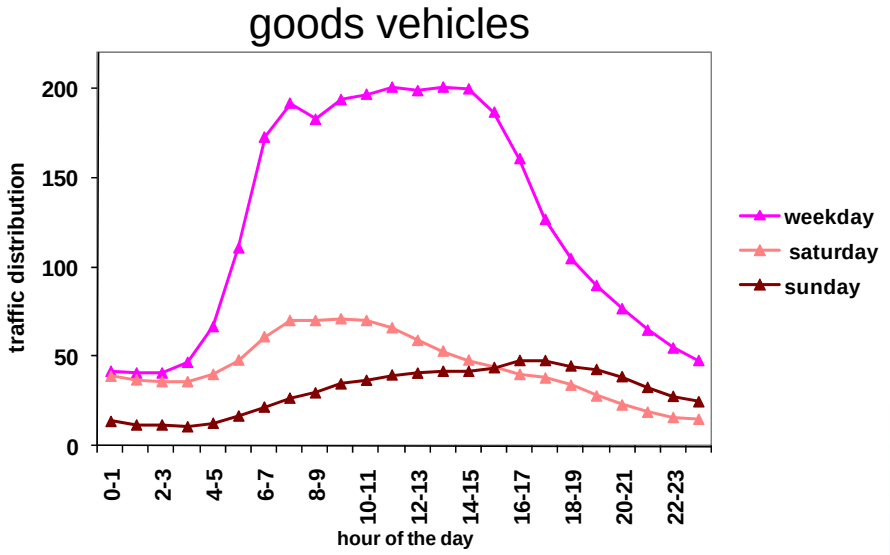
Road Transport

Activity data (II)

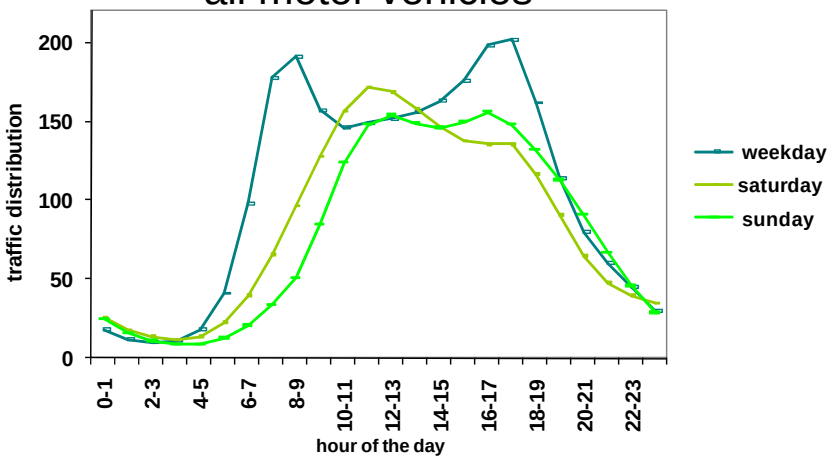
cars and taxis



goods vehicles



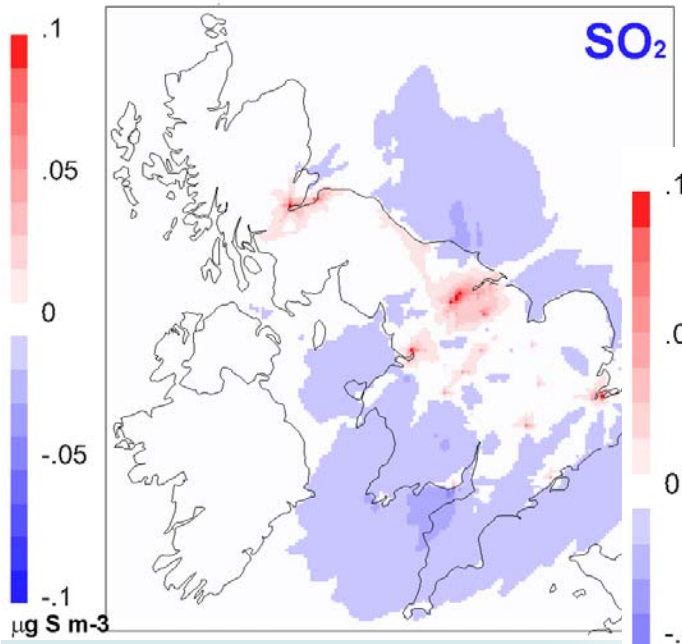
all motor vehicles

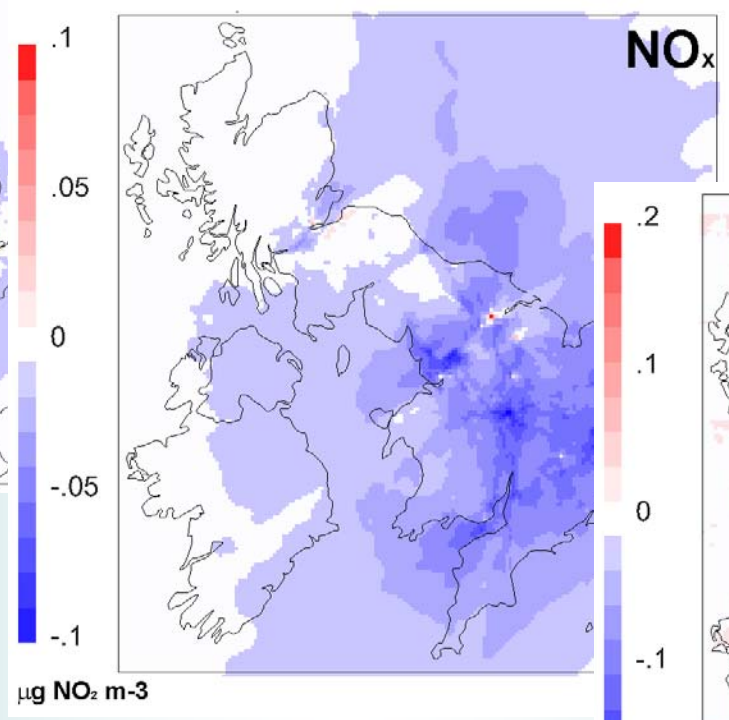


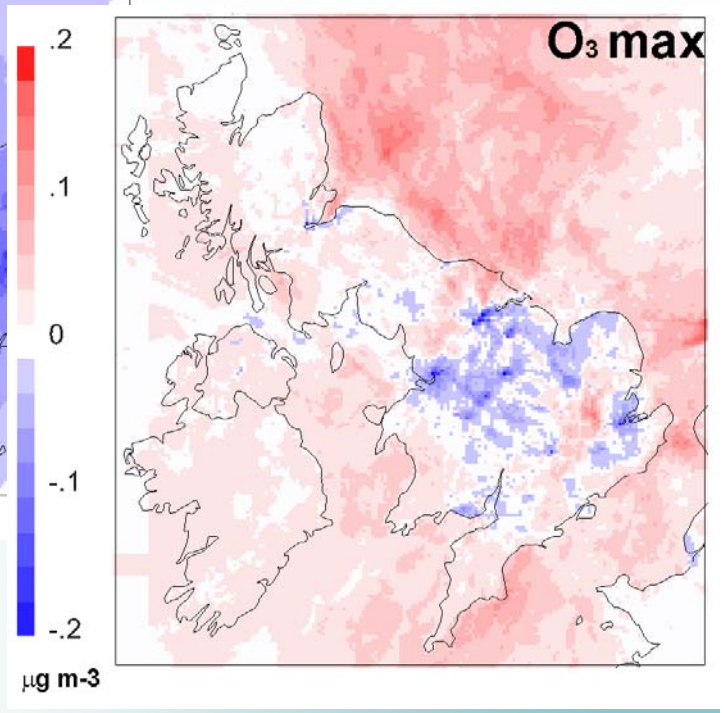
Source: DETR

First results

Annual differences

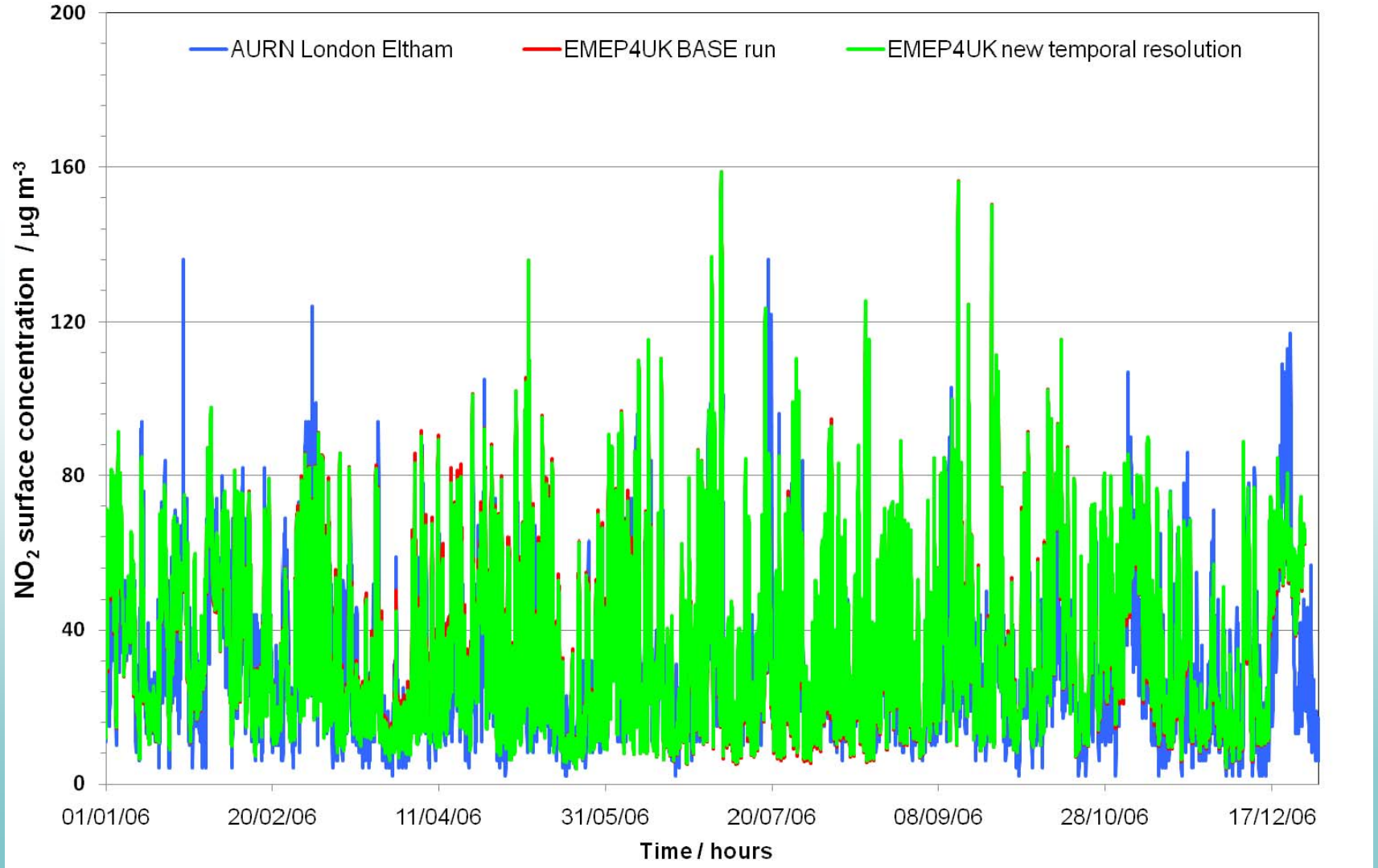






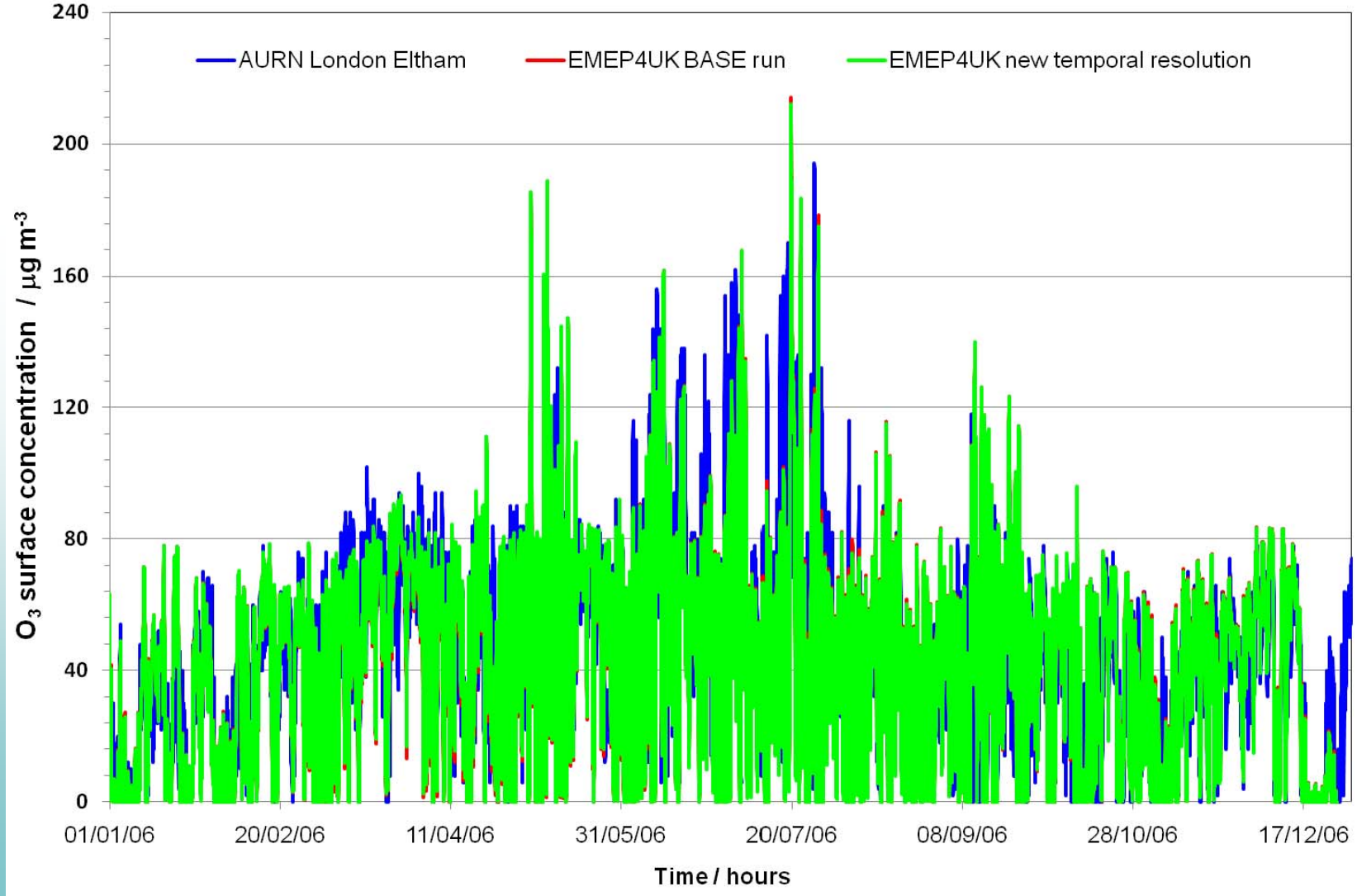
First results

Modelled vs. observed (I): NO_x



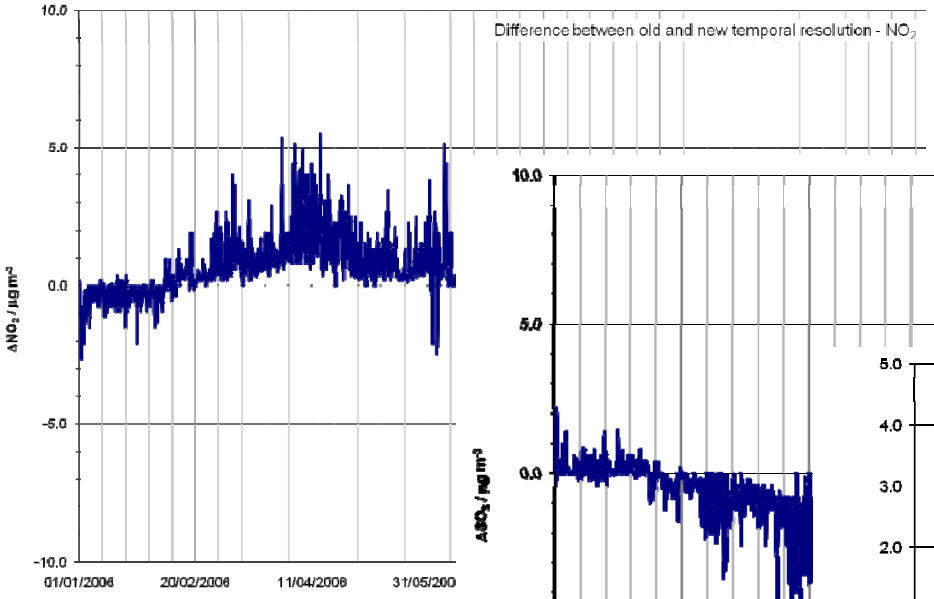
First results

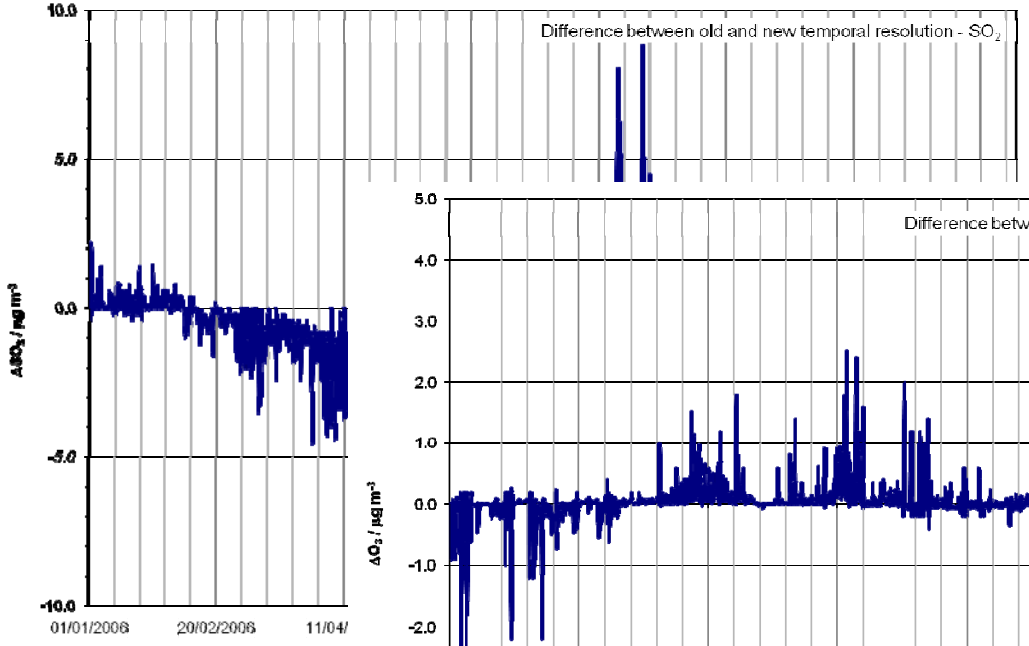
Modelled vs. observed (II): Ozone

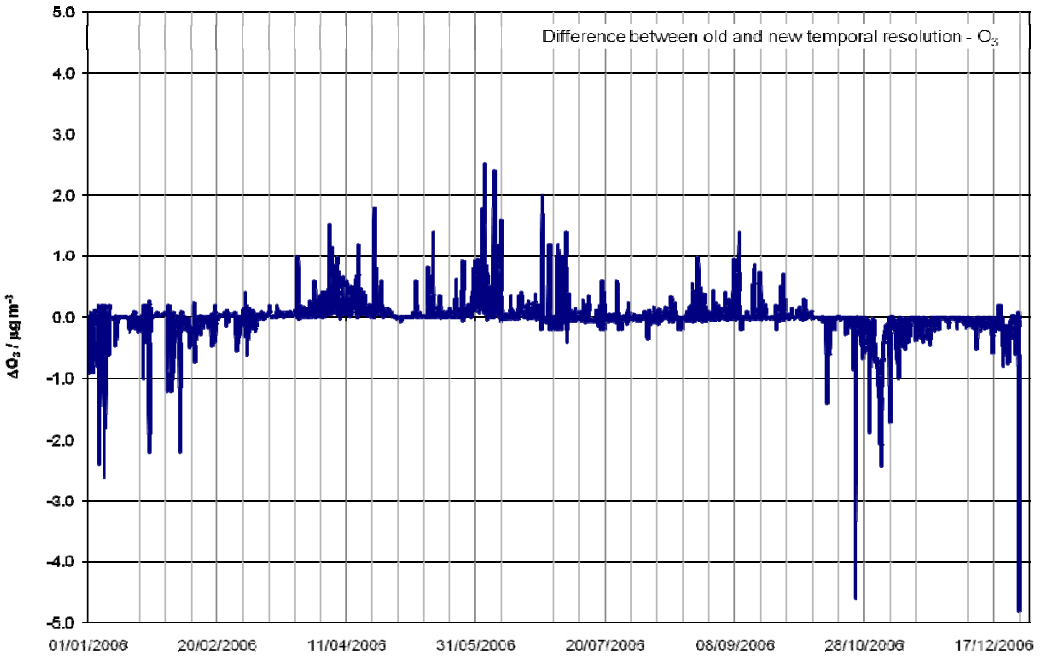


First results

Modelled vs. observed (III): differences







Conclusions & Outlook (I)

First analyses of model results for the test cases show:

- Significant seasonal differences over the year,
- Differences between pollutants,
- Differences in the spatio-temporal profiles.
- Small improvements of R^2 for NO_2, no change for O_3.

More detailed investigations have to be made regarding individual ***episodes*** *and comparing modelled vs. observed concentrations* ***across different stations****.*

Conclusions & Outlook (II)

Next steps:

- Current results were obtained with weekly/monthly profiles; effects of hourly profiles (e.g. for road transport) need yet to be assessed
- Further validation of model results vs. observations, in particular regarding urban/rural/background station variability
- Description of current and future levels of air pollution,
- Assessment of how far air quality standards, limit values and objectives are being met

Acknowledgements & Contact details

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