

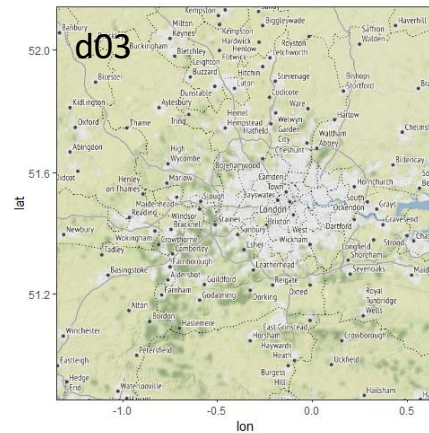
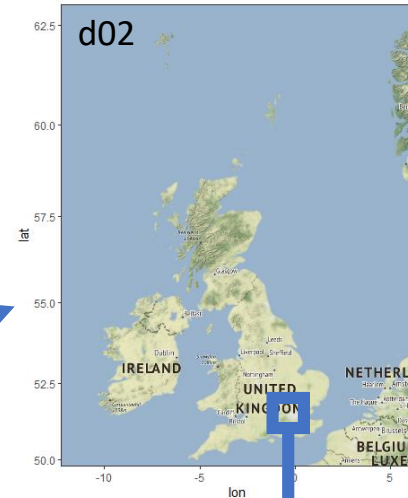
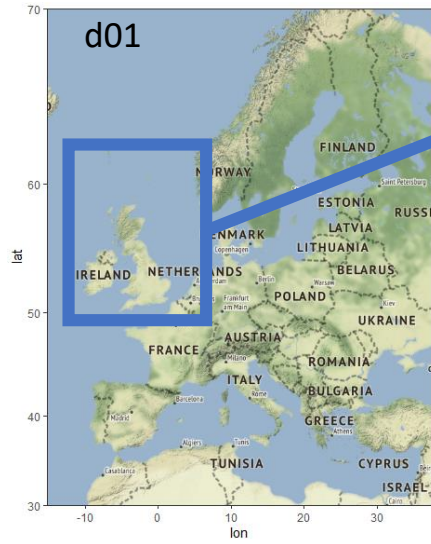


# Contribution to Assessment of sensitivity of model responses to emission changes (FAIRMODE CT9)

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# Domain configuration



	Europe	UK	London
Domain ID	d01	d02	d03
Resolution	25 km	5 km	1 km

## Model setup

### Period

- March 2015 & July 2015

### Meteorology model

- WRF version 4.2
- NCEP GFS initial-boundary condition data

### Air quality model

- CMAQ version 5.3.2

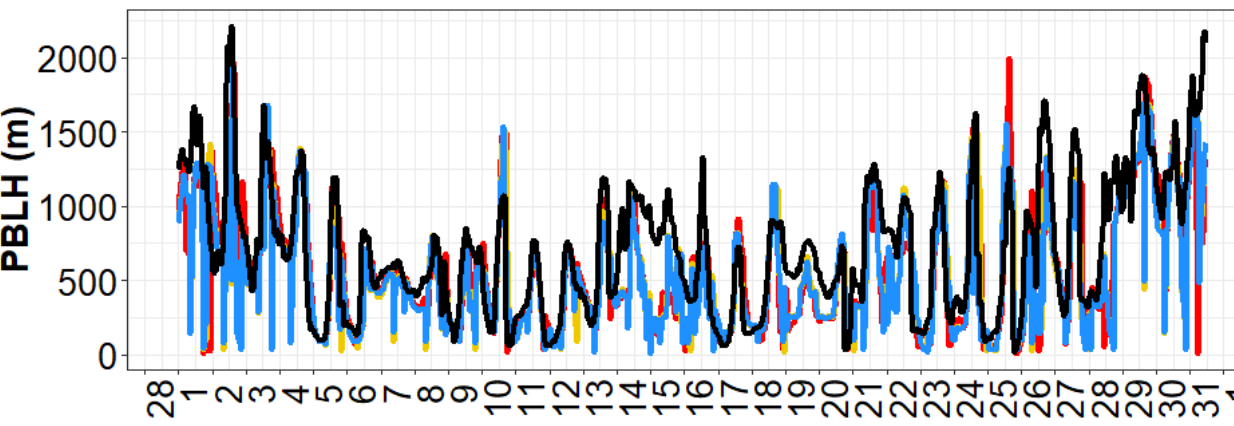
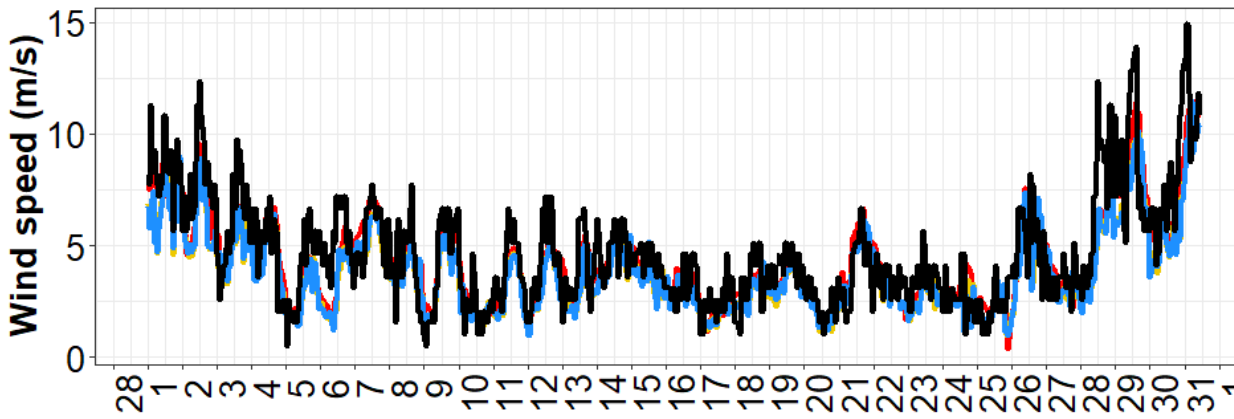
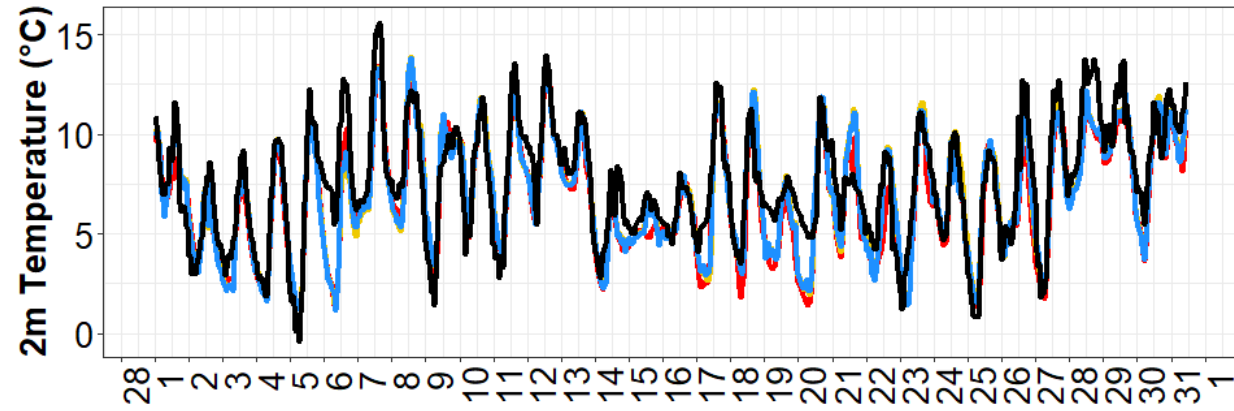
### Emissions

- EDGAR version 5 emission inventory for 2015
- Biogenic emissions via MEGAN version 2.1
- Anthropogenic emissions via SMOKE version 4.6

# WRF model performance evaluation for London Heathrow station for d01, d02 and d03

## Performance metrics

		n	FAC2	MB	MGE	NMB	NMGE	RMSE	r	IOA	r2
T2	d01	768	0.95	-0.84	1.23	-0.11	0.161	1.56	0.892	0.736	0.80
	d02	768	0.95	-0.57	1.13	-0.08	0.148	1.47	0.889	0.758	0.79
	d03	768	0.96	-0.63	1.14	-0.08	0.150	1.46	0.893	0.755	0.80
RH	d01	768	0.96	6.57	15.26	0.09	0.213	19.25	0.613	0.413	0.38
	d02	768	1.00	2.73	8.05	0.04	0.112	10.47	0.801	0.690	0.64
	d03	768	1.00	2.89	8.15	0.04	0.114	10.51	0.799	0.686	0.64
WS	d01	766	0.96	-0.35	1.04	-0.07	0.215	1.38	0.849	0.737	0.72
	d02	766	0.95	-0.87	1.21	-0.18	0.251	1.61	0.849	0.693	0.72
	d03	766	0.95	-0.87	1.26	-0.18	0.260	1.64	0.837	0.682	0.70
WD	d01	766	0.93	1.24	22.37	0.01	0.122	52.76	0.871	0.875	0.76
	d02	766	0.93	1.03	21.81	0.01	0.119	50.79	0.880	0.878	0.77
	d03	766	0.94	0.75	21.61	0.00	0.118	49.62	0.884	0.879	0.78
PBLH	d01	768	0.75	-149	254	-0.20	0.345	369	0.714	0.657	0.51
	d02	768	0.76	-172	256	-0.23	0.348	373	0.720	0.655	0.52
	d03	768	0.75	-190	257	-0.26	0.351	373	0.730	0.652	0.53

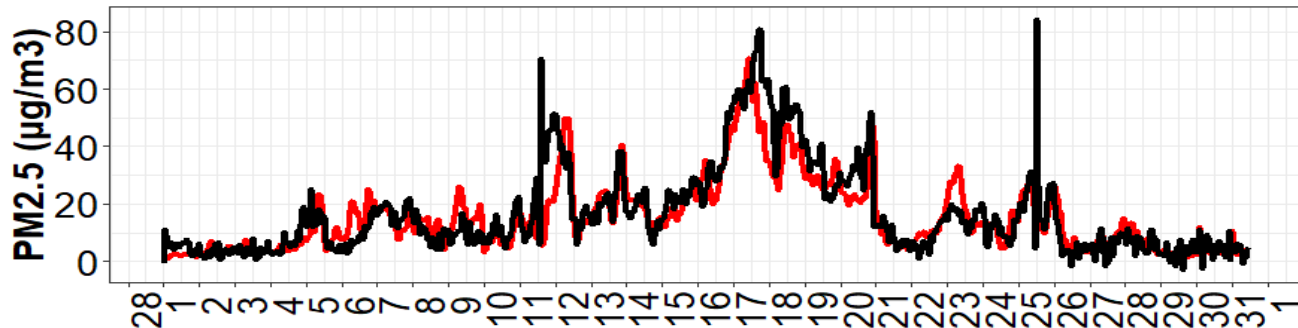


— d01 — d02 — d03 — MIDAS Observations

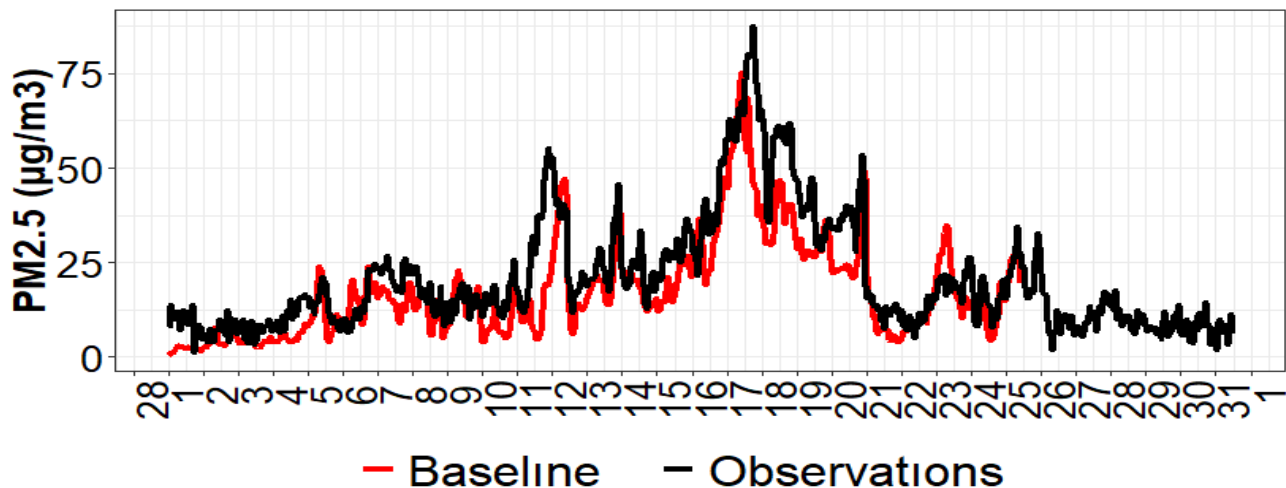
P.S. PBLH is compared to ERA5 where others compared to MIDAS observations.  
MIDAS : Met Office Integrated Data Archive System Land and Marine Surface Stations Data.  
Available from <http://catalogue.ceda.ac.uk/uuid/220a65615218d5c9cc9e4785a3234bd0>

# CMAQ model performance evaluation for d02 Baseline scenario for London North Kensington (urban) and London Bloomsbury stations

PM2.5 ( $\mu\text{g}/\text{m}^3$ ) hourly time series for March 2015  
London North Kensington station - d02

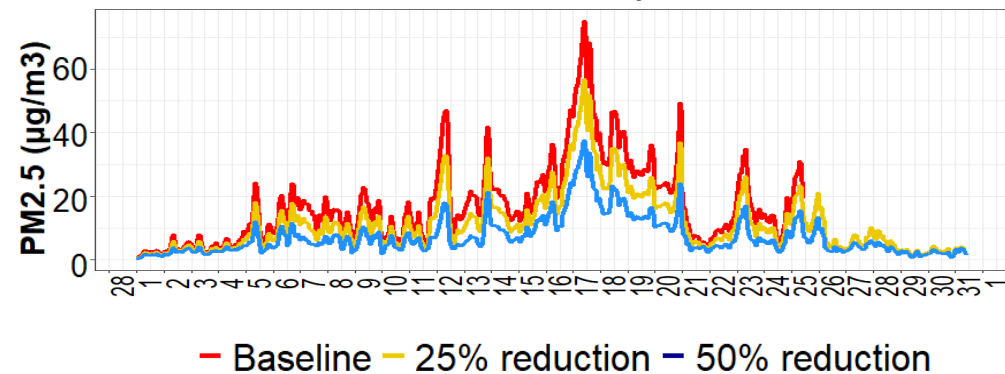
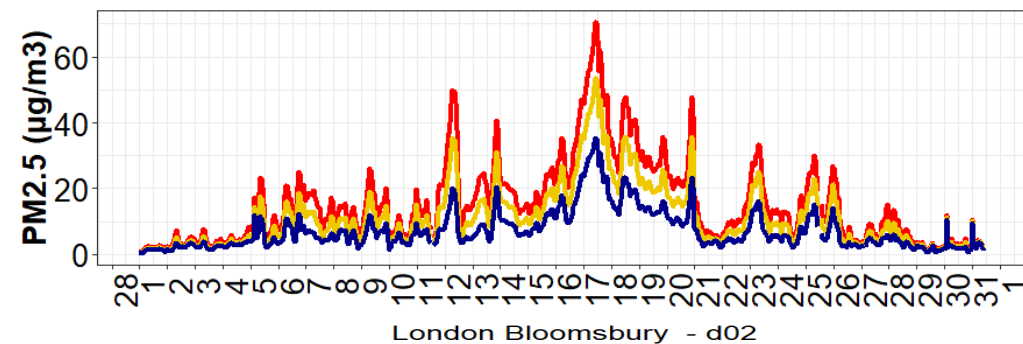


PM2.5 ( $\mu\text{g}/\text{m}^3$ ) hourly time series for March 2015  
London Bloomsbury - d02



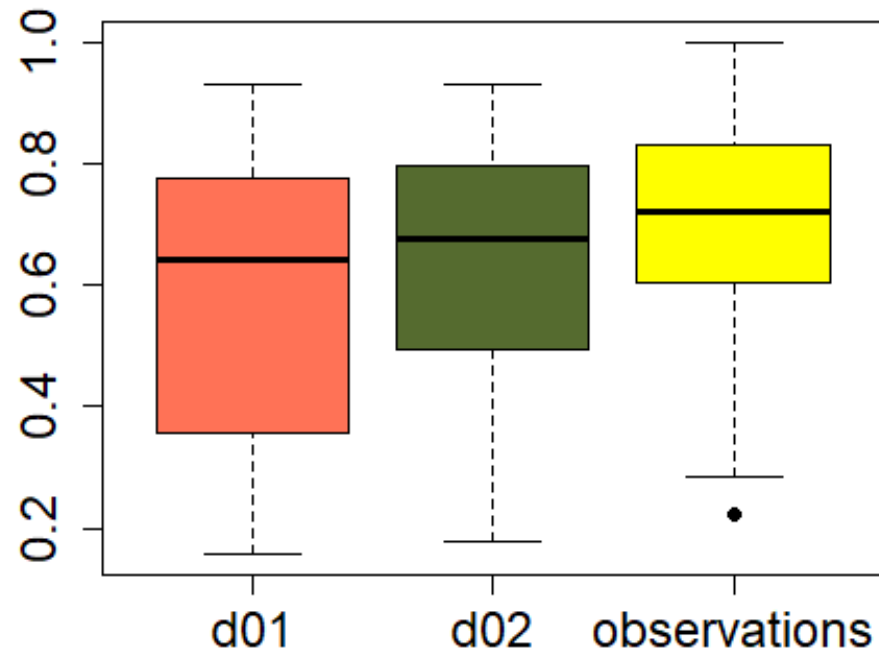
		n	FAC2	MB	MGE	NMB	NMGE	RMSE	r	IOA	r2
London North Kensington	O3	743	0.771	16.62	20.74	0.39	0.48	24.85	0.65	0.41	0.43
	NO	743	0.556	-2.51	4.69	-0.35	0.65	10.30	0.57	0.68	0.32
	NO2	741	0.799	-9.31	12.03	-0.27	0.36	16.19	0.72	0.60	0.52
	NOx	743	0.724	-15.44	19.38	-0.34	0.43	29.98	0.66	0.60	0.44
	PM10	736	0.913	-4.60	7.56	-0.17	0.28	10.15	0.82	0.69	0.67
	PM2.5	739	0.808	-1.18	5.24	-0.07	0.32	7.84	0.87	0.77	0.75
London Bloomsbury	O3	588	0.45	27.80	29.14	0.99	1.03	33.31	0.57	-0.05	0.32
	NO	587	0.16	-15.16	16.31	-0.74	0.79	22.64	0.47	0.44	0.23
	NO2	586	0.45	-27.15	28.21	-0.50	0.52	32.75	0.40	0.02	0.16
	NOx	586	0.31	-53.15	54.56	-0.62	0.64	65.61	0.46	0.21	0.22
	PM10	574	0.91	-4.88	8.48	-0.16	0.28	11.10	0.79	0.67	0.62
	PM2.5	587	0.81	-5.69	7.37	-0.24	0.31	9.91	0.86	0.70	0.74

PM2.5 ( $\mu\text{g}/\text{m}^3$ ) hourly time series for March 2015  
London North Kensington station - d02

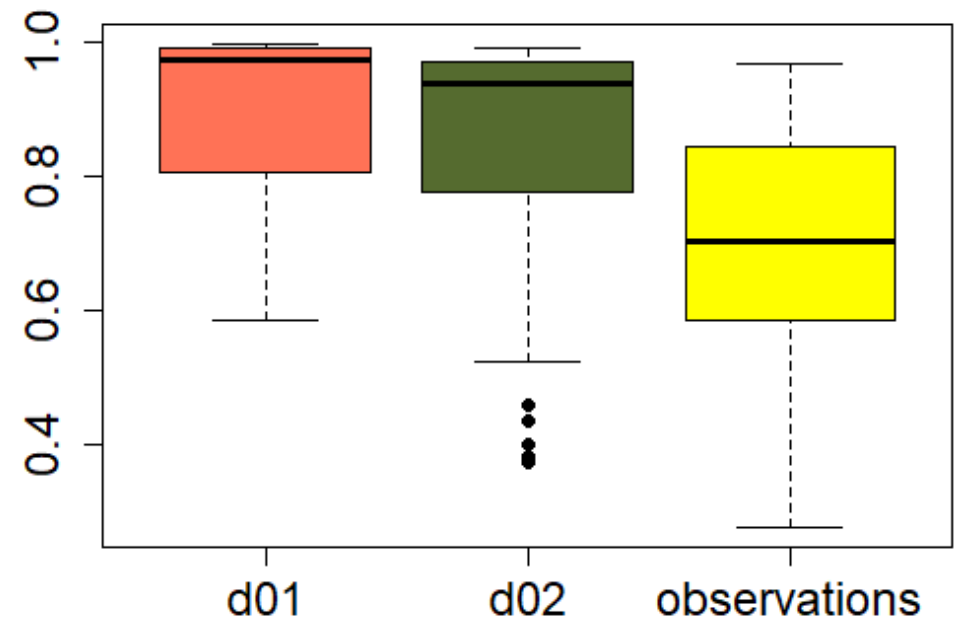


Boxplots of  $\text{NO}_2/\text{NO}_x$  and  $\text{PM}_{2.5}/\text{PM}_{10}$  as a function of grid resolution for London North Kensington station for BL

**$\text{PM}_{2.5}/\text{PM}_{10}$**



**$\text{NO}_2/\text{NO}_x$**



# Future work

- Remaining emission reduction scenarios are being calculated.
- Currently 0.1 degree (~11km) EDGAR v5.0 emission inventory is linearly interpolated for smaller resolutions. Therefore causes poorer performance of the model for d03 (1km grid resolution).
- d02 and d03 results will be improved by introducing national atmospheric emission inventory (NAEI\*) for London.
- NAEI emissions inventory will be embedded into the EDGAR inventory to increase model performance over UK.
- Better prediction of emissions is expected, especially for NO, NO<sub>2</sub> and NO<sub>x</sub>.

\* National Atmospheric Emissions (NAEI). Available from <https://naei.beis.gov.uk/>

# Thanks for listening

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Questions ?