Ultrafine particles in the UK

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1 Available data

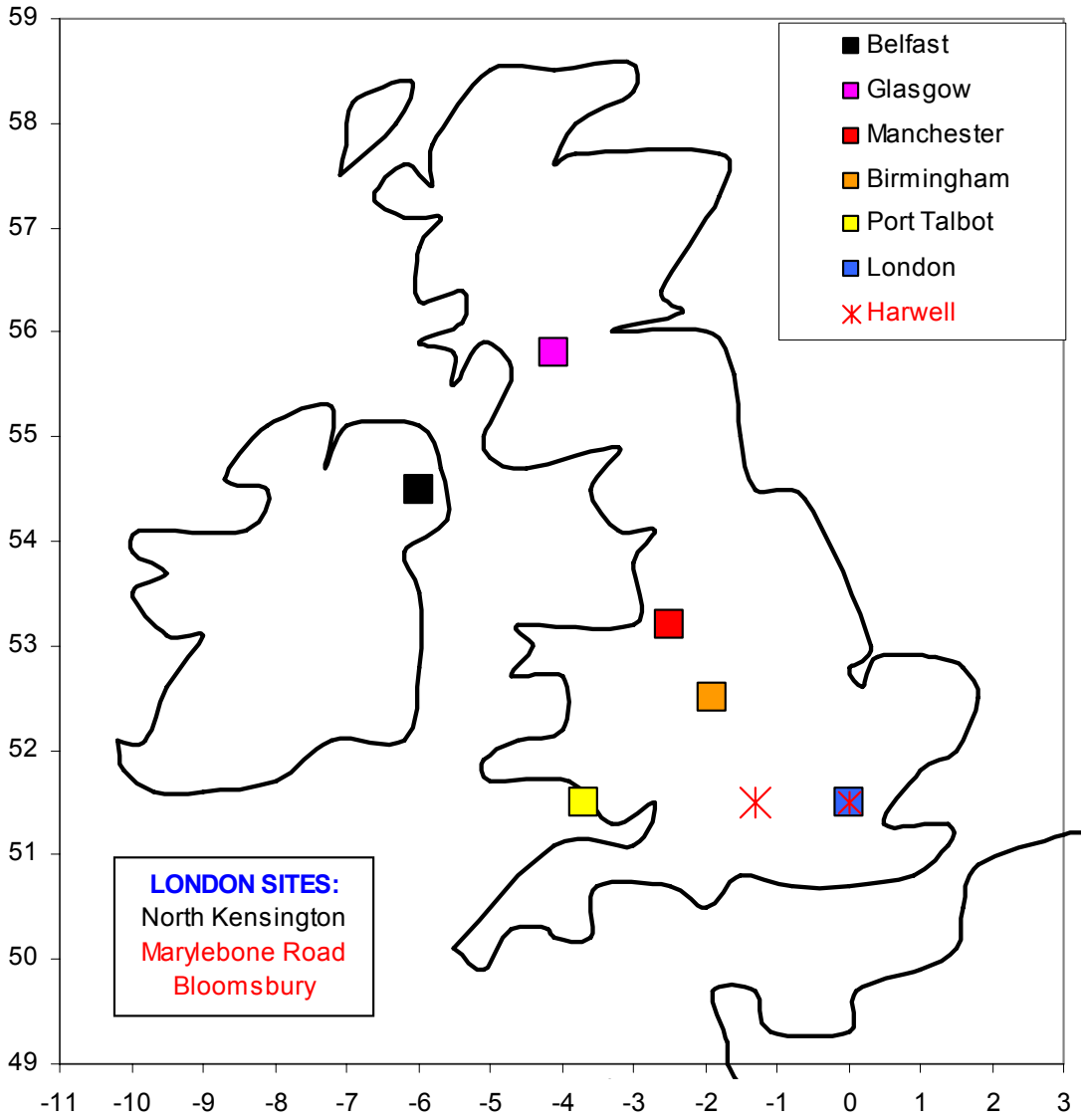
2 Seasonal & meteorological effects

3 Calculation of emission factors

Instrumentation

Particle number
Condensation Particle Counters
TSI 3022A
(50% detection at 7 nm)

Particle size spectra
Scanning Mobility Particle Sizers
TSI 3071A and TSI 3022A
(11 – 450 nm)



Map of sites in UK

■ CPC

x SMPS

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Sites – type and location

Site	Instruments	Site type	Longitude	Latitude
Belfast Centre	CPC	urban centre	-5.93	54.60
Glasgow Centre	CPC	urban centre	-4.26	55.86
Manchester Piccadilly	CPC	urban centre	-2.23	53.48
Birmingham Centre	CPC	urban centre	-1.91	52.48
Port Talbot	CPC	industrial	-3.76	51.57
North Kensington	CPC	urban background	-0.21	51.52
Bloomsbury	CPC + SMPS	urban centre	-0.16	51.52
Marylebone Road	CPC + SMPS	kerbside	-0.12	51.52
Harwell	SMPS	rural	-1.33	51.57

CPC - data capture rate

Site	Data capture rate (CPC) [%]						
	2000	2001	2002	2003	2004	2005	2006
Belfast Centre	57.9	66.0	92.7	77.9	65.6	79.4	85.0
Glasgow Centre		71.2	40.7	30.0	33.3	69.1	90.6
Manchester Piccadilly	21.8	21.6	71.7	63.4	61.7	60.1	89.3
Birmingham Centre	37.9	71.9	64.6	56.3	82.0	33.7	78.0
Port Talbot	52.1	64.2	87.2	51.8	85.8	84.9	86.7
North Kensington	35.9	74.3	70.3	63.6	68.5	72.4	87.1
Bloomsbury			58.0	40.3	26.2		
Marylebone Road		65.7	17.6		11.2	52.9	77.0

SMPS - data capture rate

Site	Data capture rate (SMPS) [%]								
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Bloomsbury	32.6	54.5	55.2	39.4	54.7	52.6	22.8	52.6	1.4
Marylebone Road	38.4	29	28.6	45.5	69.3	45.3	41.5	54.2	5.2
Harwell	46.7	55.7	61.6	62.2	56.9	28.2	57.2	79.3	15.4

Data sources

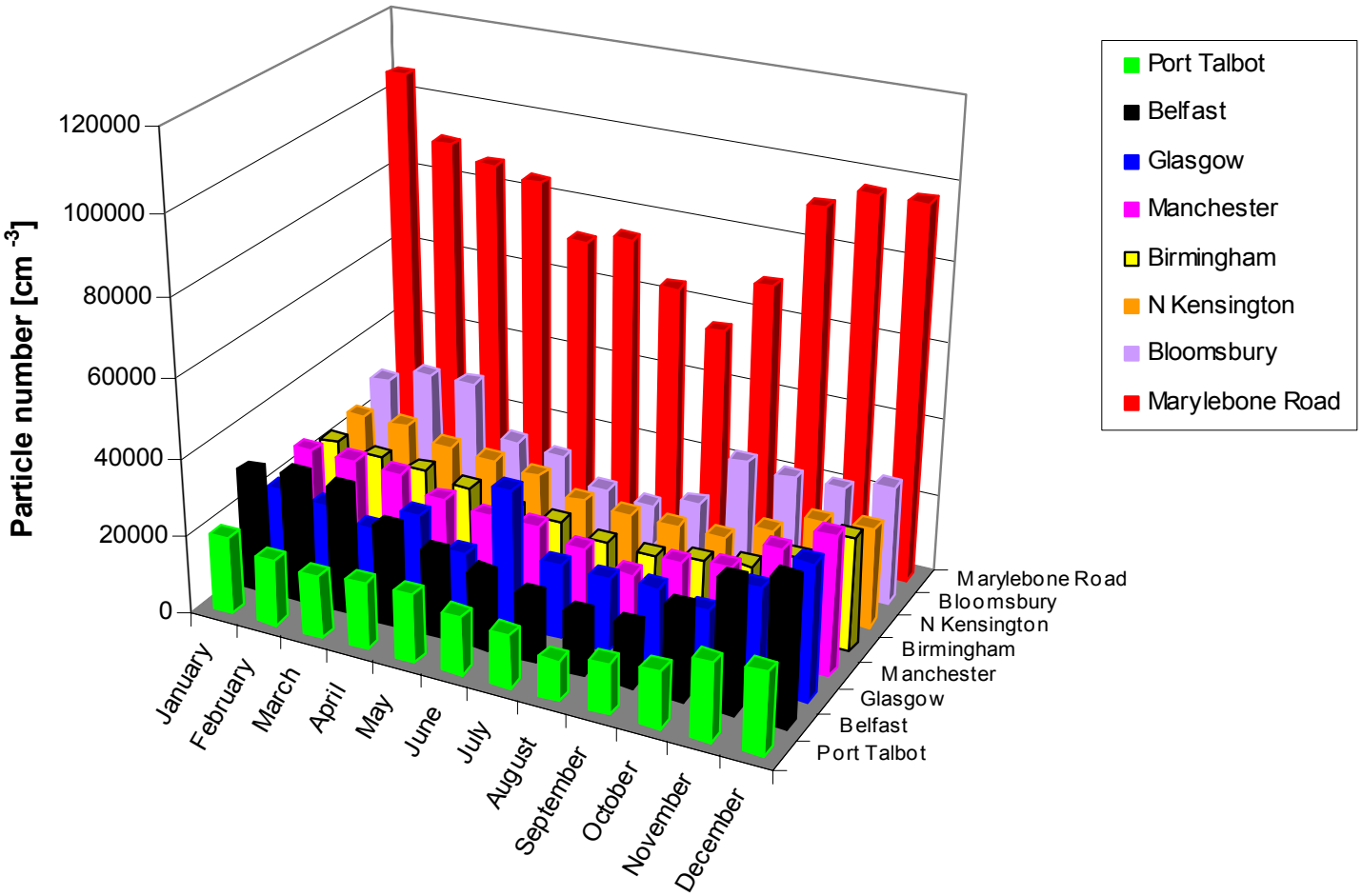
Particle number and spectra data:

www.airquality.co.uk/archive/particle_data.php

Site information:

www.bv-aurnsiteinfo.co.uk

Monthly variation of particle number



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Glasgow Centre site - December

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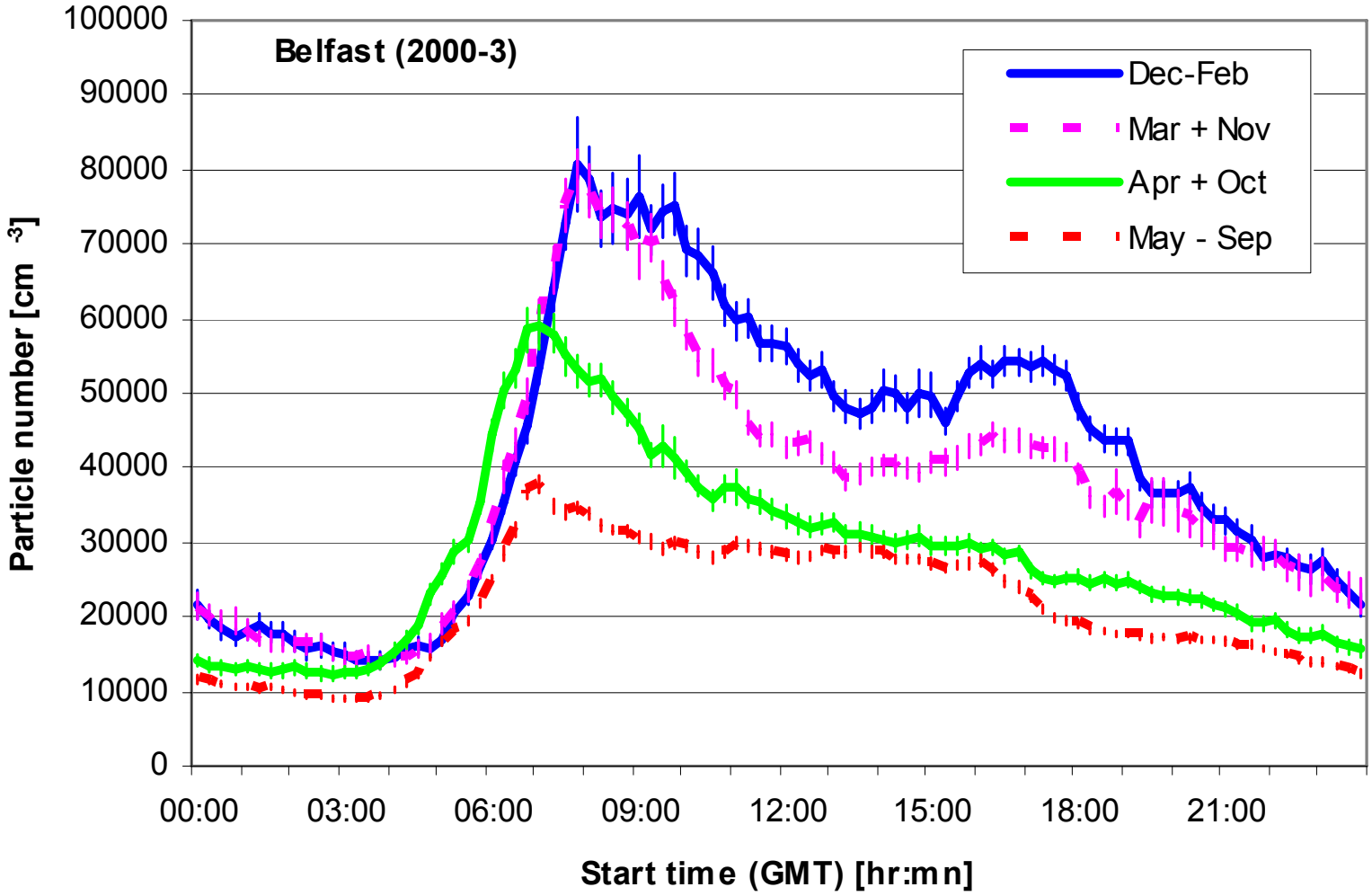
Diurnal profile of particle number



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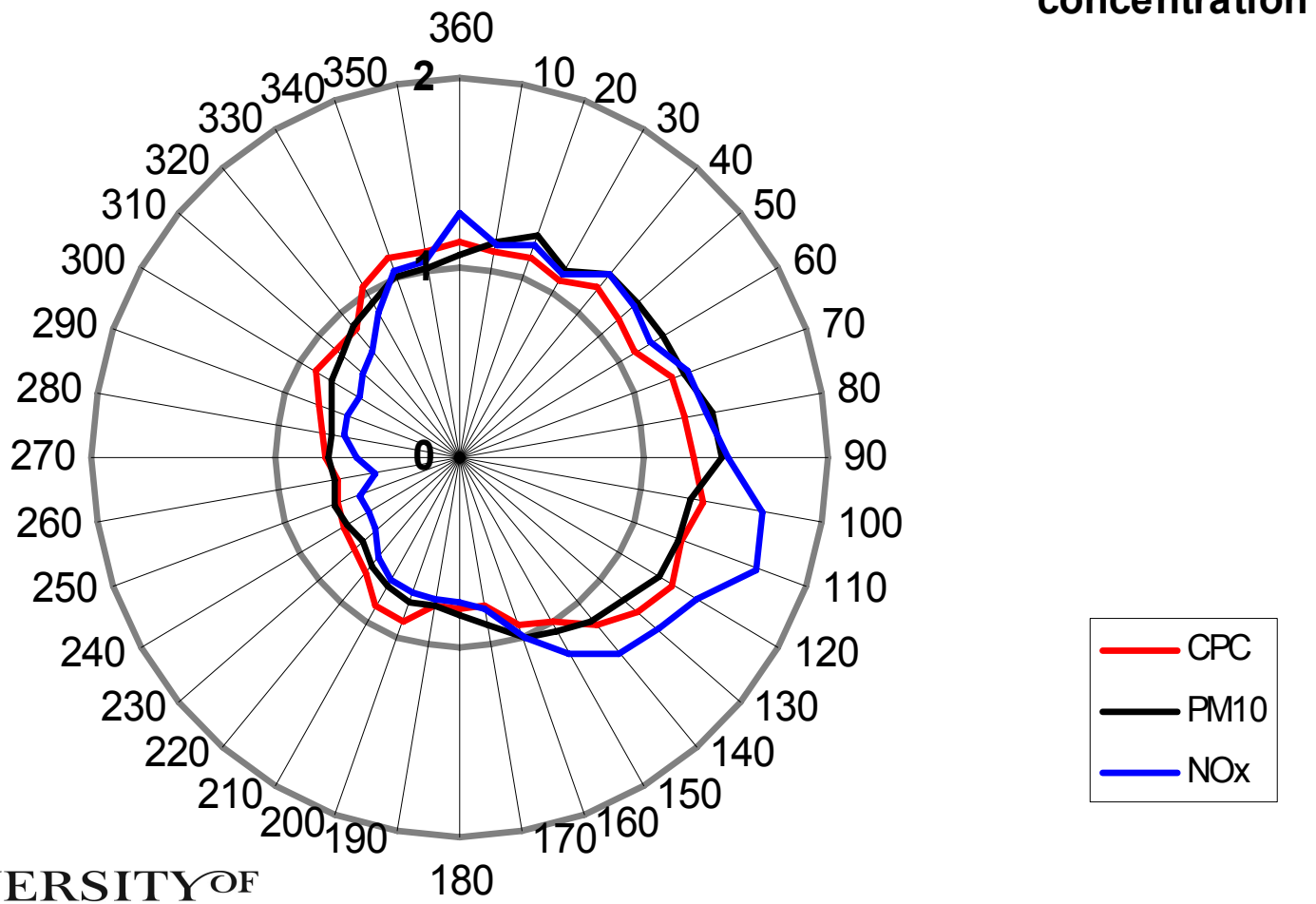
Directional profile - Birmingham



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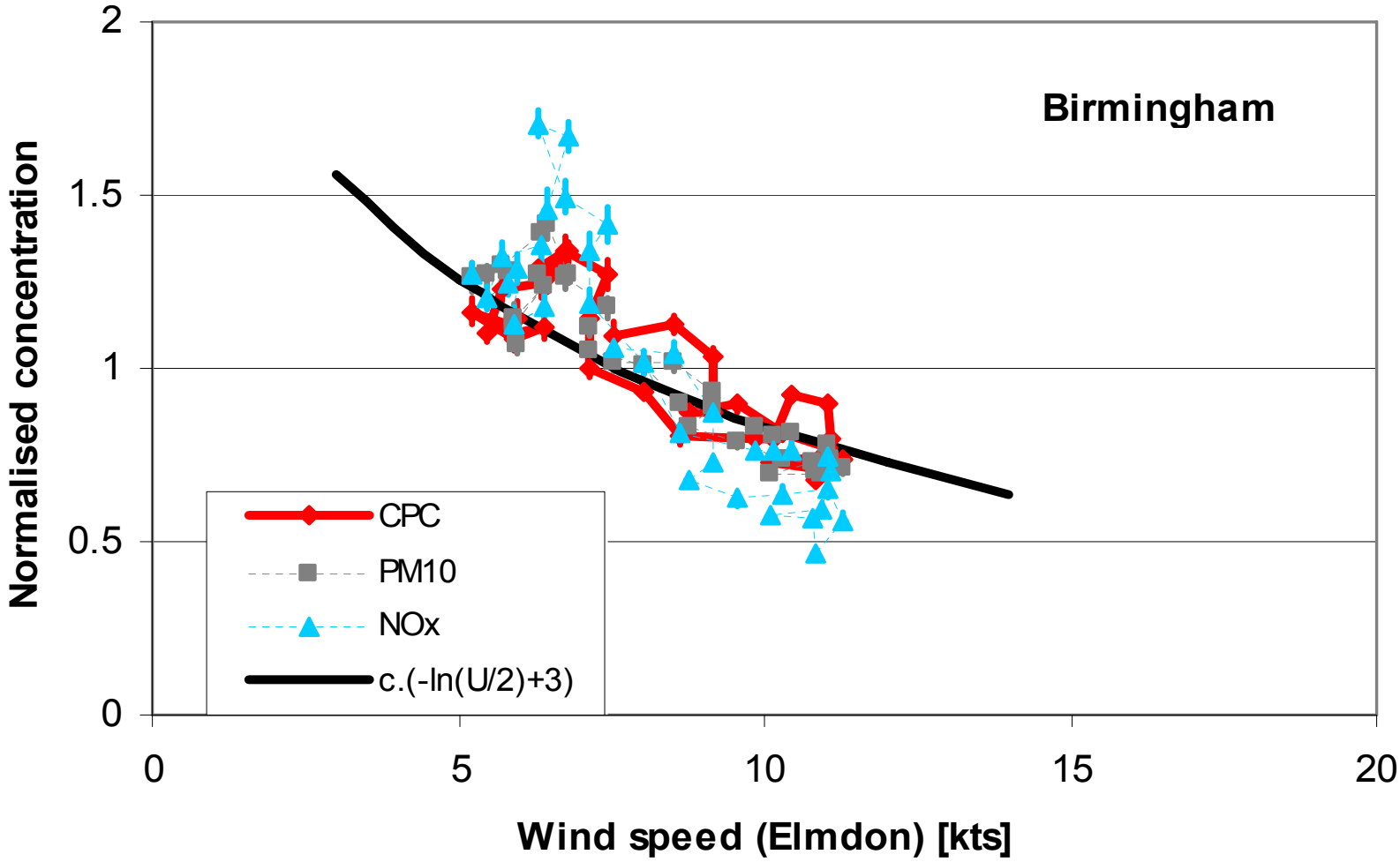
Concentration v Wind speed (Birmingham)



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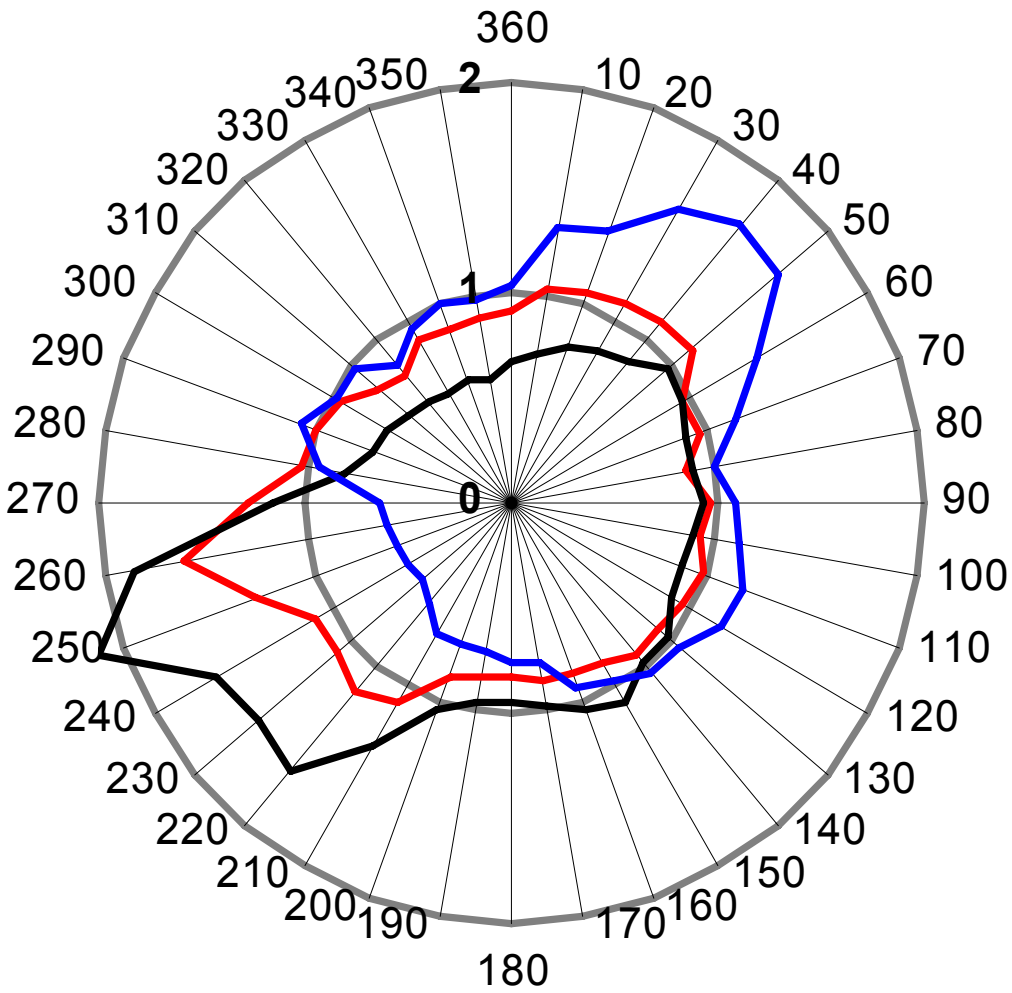
Directional profile – Port Talbot



Port Talbot Normalised concentration

CPC
PM10
NOx

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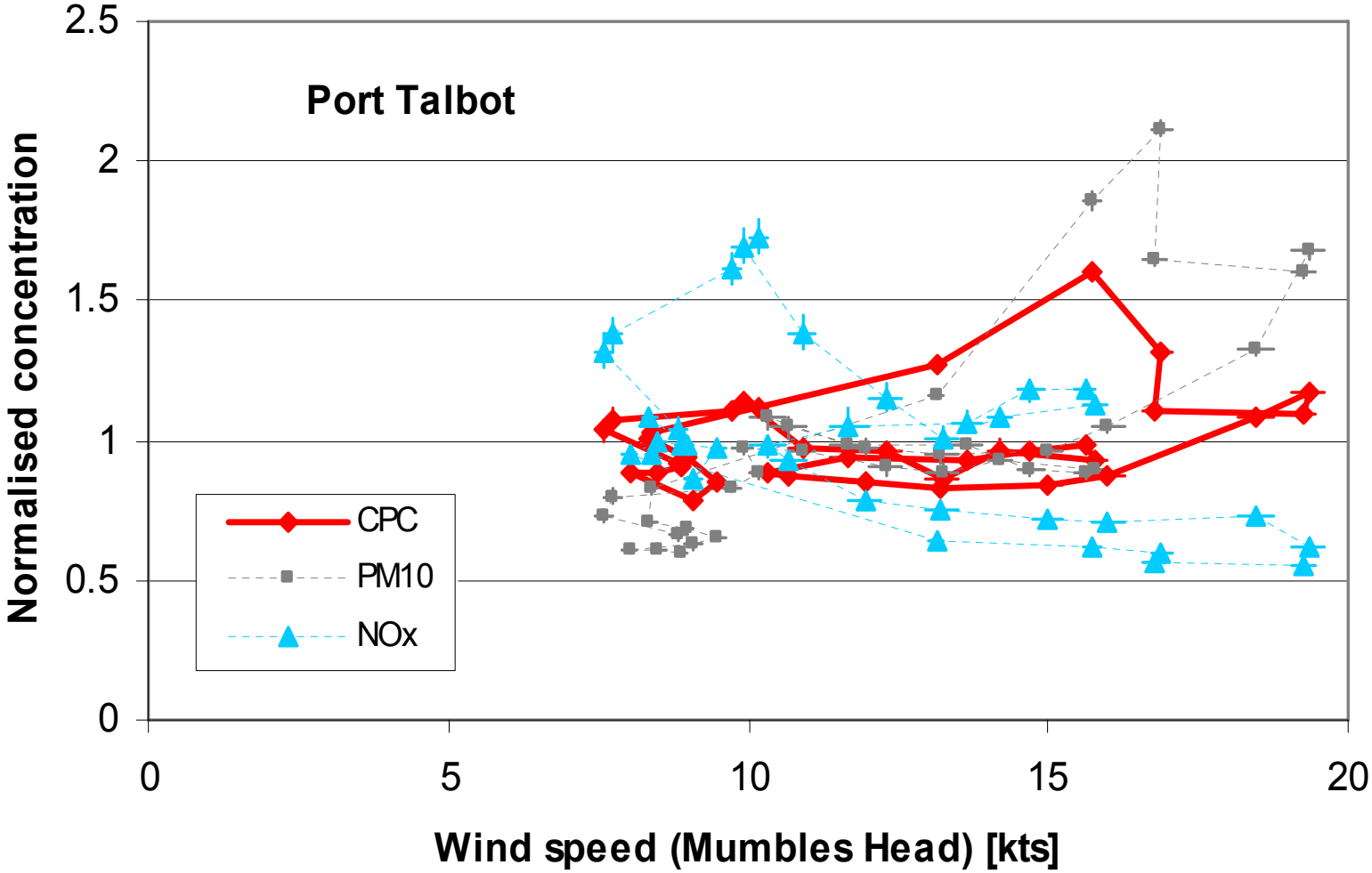
Concentration v Wind speed (Port Talbot)



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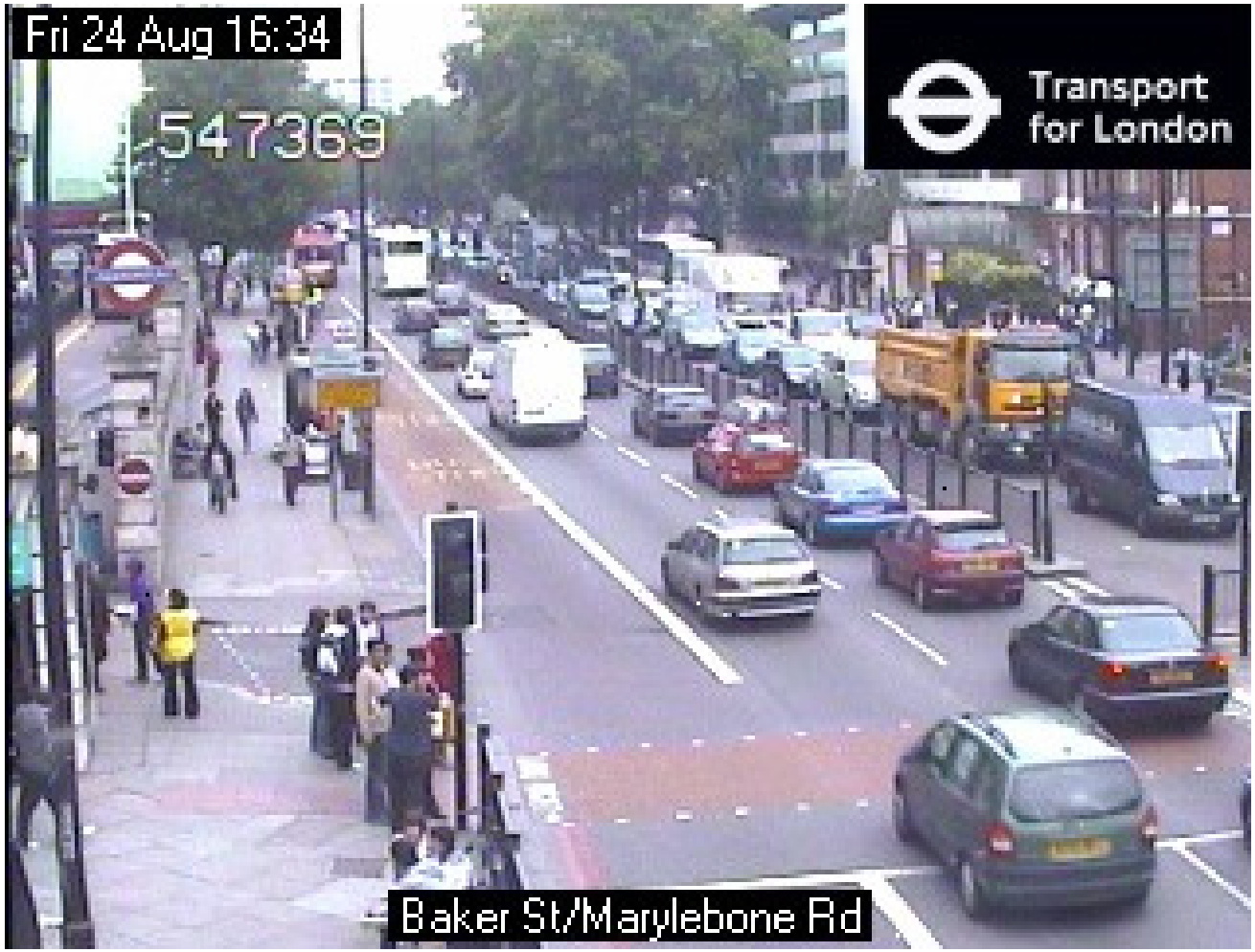
Marylebone Road



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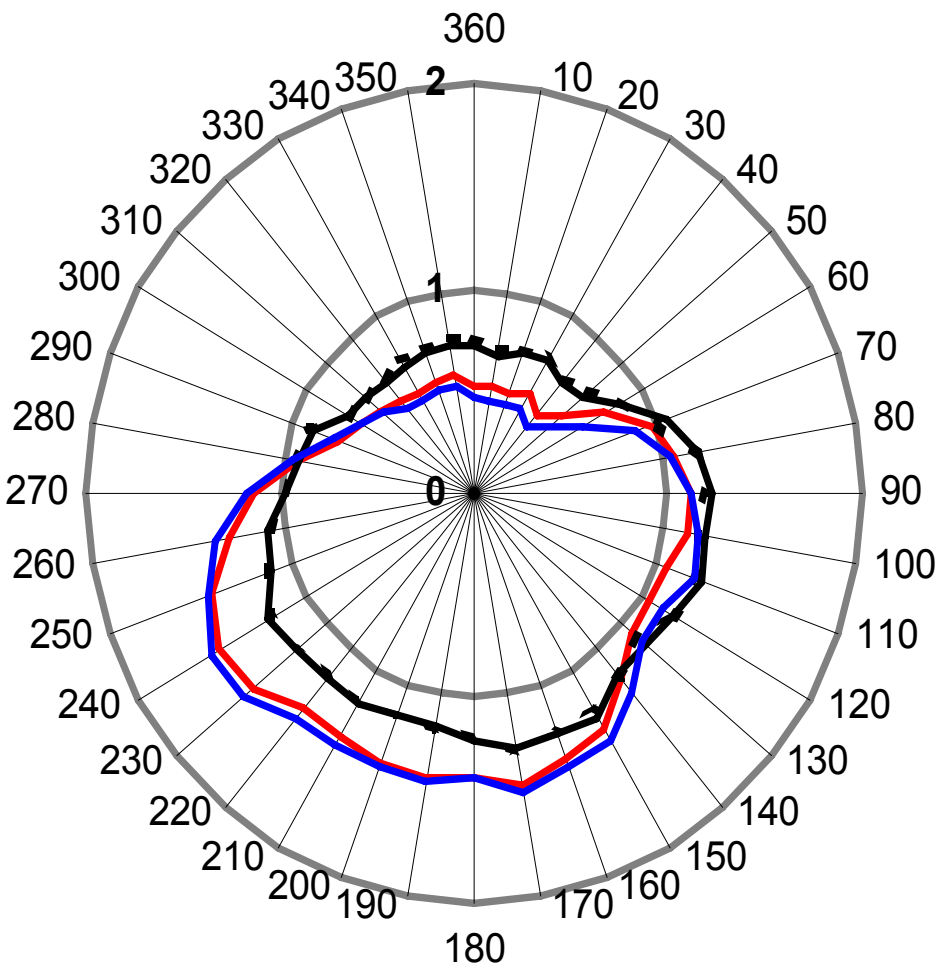
Directional Profile – Marylebone Road



Marylebone Road Normalised concentration

CPC
PM10
PM2.5
NOx

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Calculation of particulate emission factors

Uses:

SMPS data in three size ranges:

11 – 30, 30 – 100, > 100 nm

Calculation of particulate emission factors

Assumes:

Same relationship between emissions from vehicles passing sampling point and kerbside increment of concentration over background for both particle number and NOx.

Calculation of particulate emission factors

NOx emissions:

Calculated from National Atmospheric Emission Inventory database
using traffic data from induction loops
for hours when wind direction was between 160^0 and 170^0
during 2002 to 2003.

Calculation of particulate emission factors

Emission factors:

Calculate total particulate emission in different particle size groups for each hour and regress against number of heavy and light duty vehicles to calculate emission factors.

Calculated emission factors

Particle size range (nm)	Emission factors (number veh^{-1} km^{-1})	
	Heavy duty vehicles	Light duty vehicles
11 – 30	$2.14(\pm0.41).10^{14}$	$2.30(\pm0.74).10^{13}$
30 – 100	$3.19(\pm0.39).10^{14}$	$2.84(\pm0.70).10^{13}$
>100	$1.03(\pm0.12).10^{14}$	$0.70(\pm0.22).10^{13}$

Acknowledgements

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Other data: From UK Meteorological Office via British Atmospheric Data Centre, and UK Air Quality Archive.

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