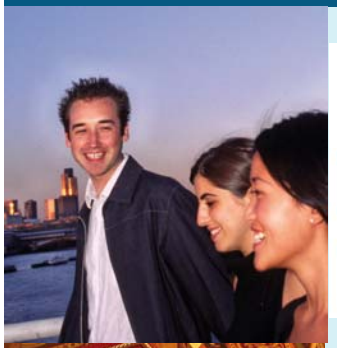

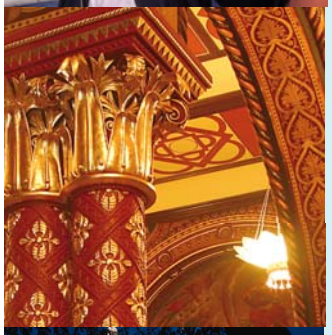

MRC-HPA Centre for Environment and Health

Imperial College London

MRC Medical Research Council

Health Protection Agency

KING'S College LONDON

# The London specific component of $PM_{10}$ toxicity

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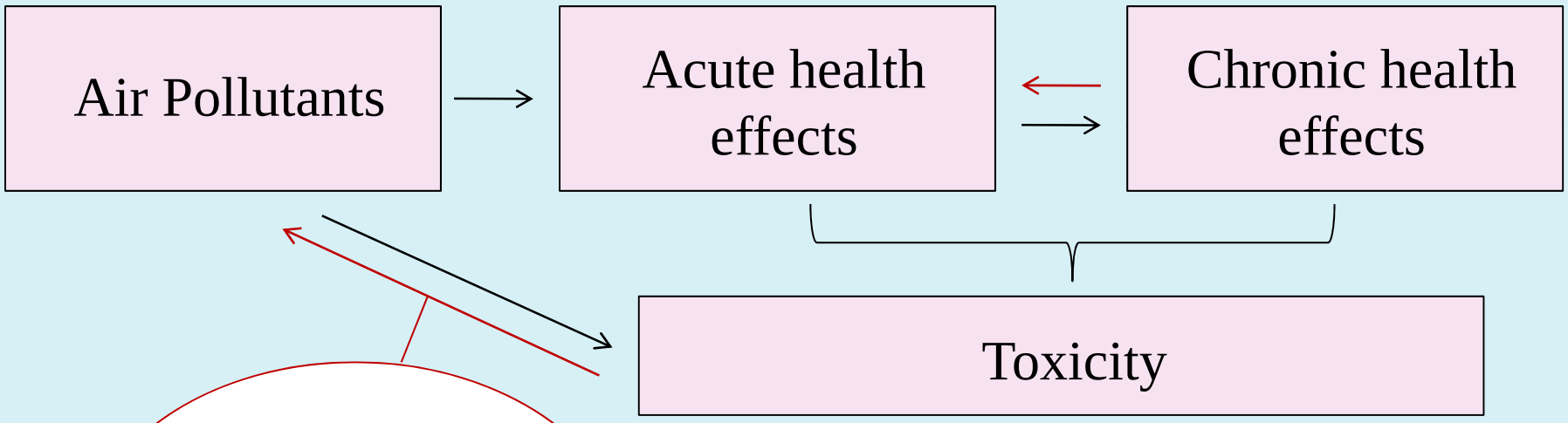
# What do we mean by the London (urban) specific (informative) component (s) of $PM_{10}$ "toxicity"?




Refinement of standard air pollution metrics to reflect their potential toxicity in vivo

- Biological plausibility
- Identify mechanisms
- Establish thresholds
- Understand sensitivity
- Identify causative components

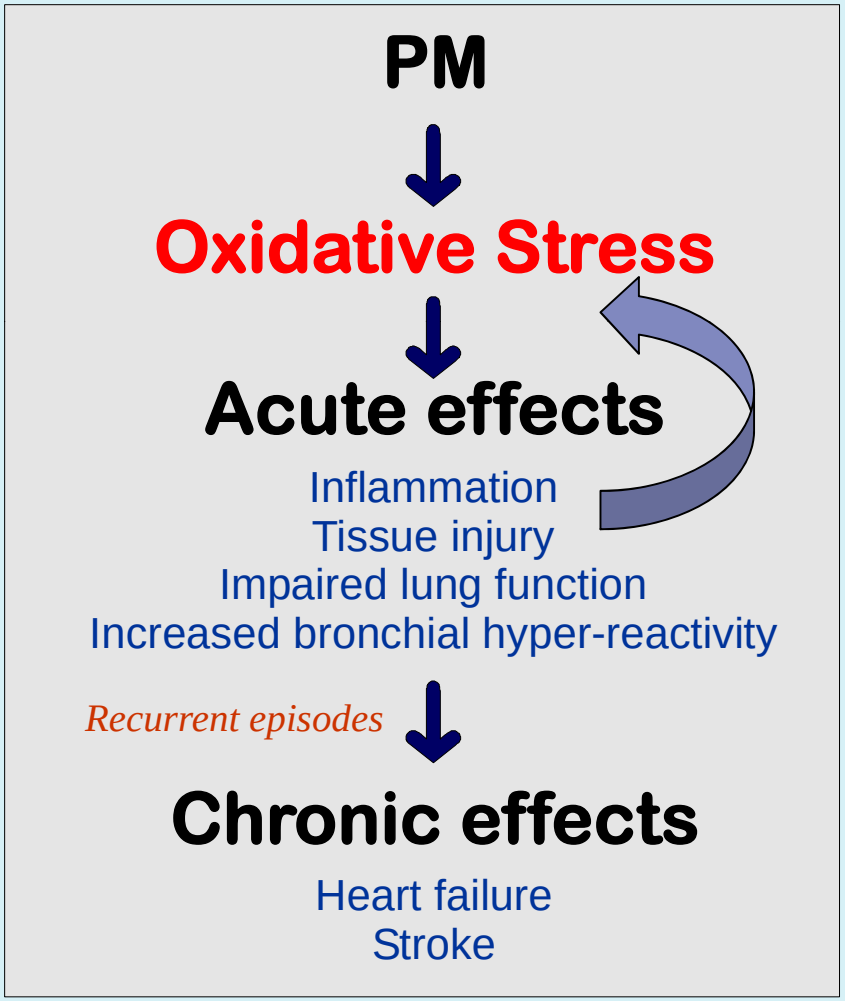
# Aims

1. Review the mechanisms by which inhaled PM cause injury to the lung

2. Outline the development of a toxicologically '*informative*' PM metric

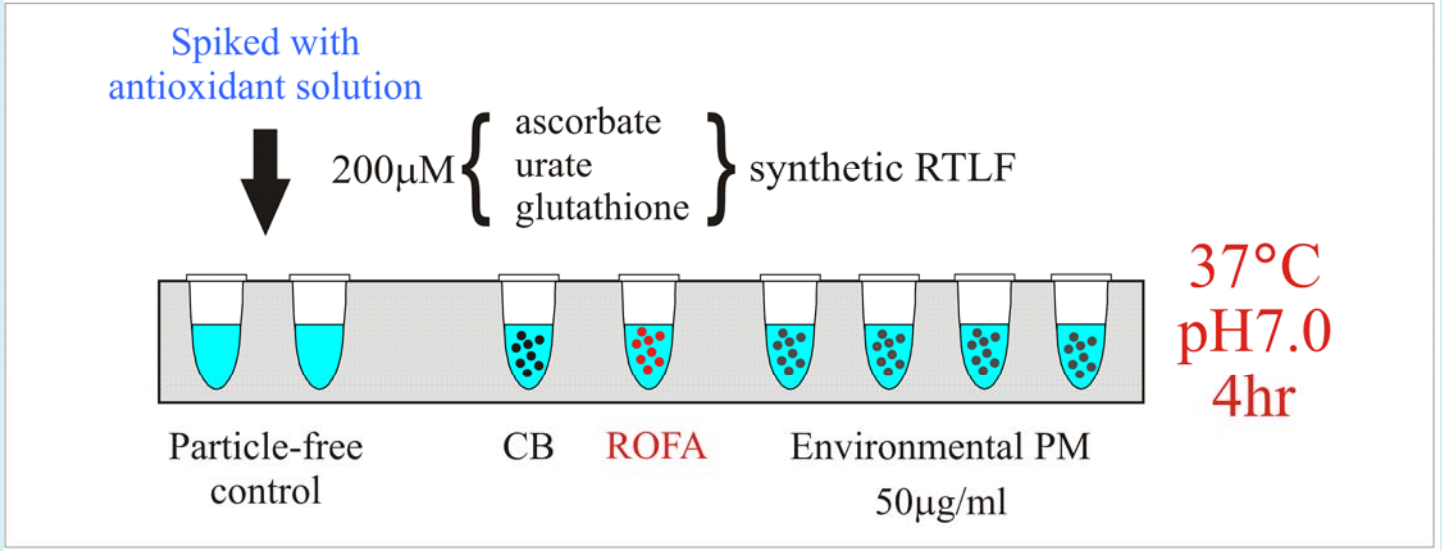
3. Provide information of the spatial temporal variation of this metric in London and attempt to quantify the city-specific component

4. Somehow provide a link to $NO_2$ and biomass derived PM



# How to screen environmental PM for their capacity to cause oxidative stress?

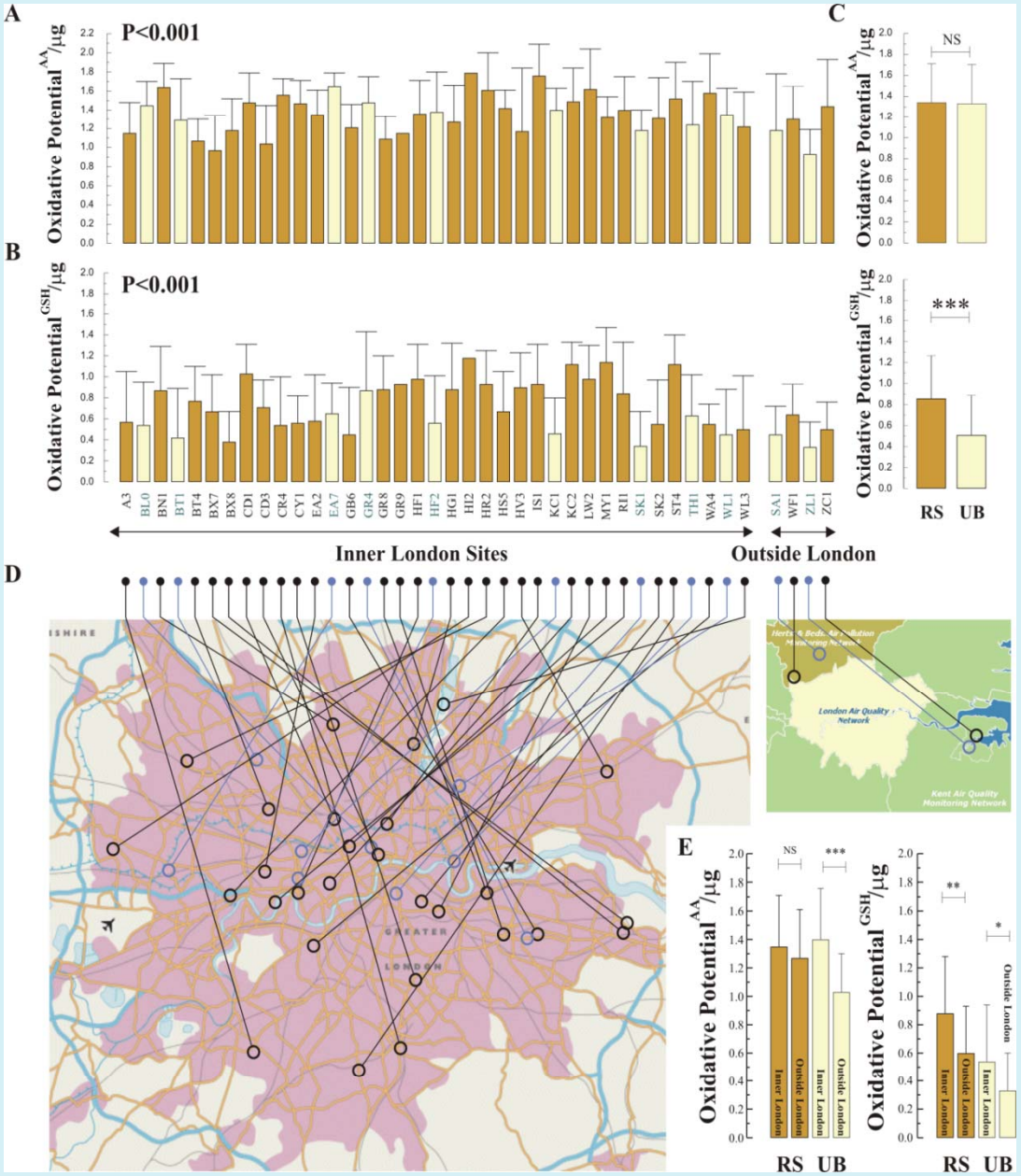
**Exposure model**




**Analysis**

Asorbate & urate: HPLC-ECD
GSH & GSSG: GSSG-reductase recycling assay

# How does $PM_{10}$ oxidative potential vary across London?

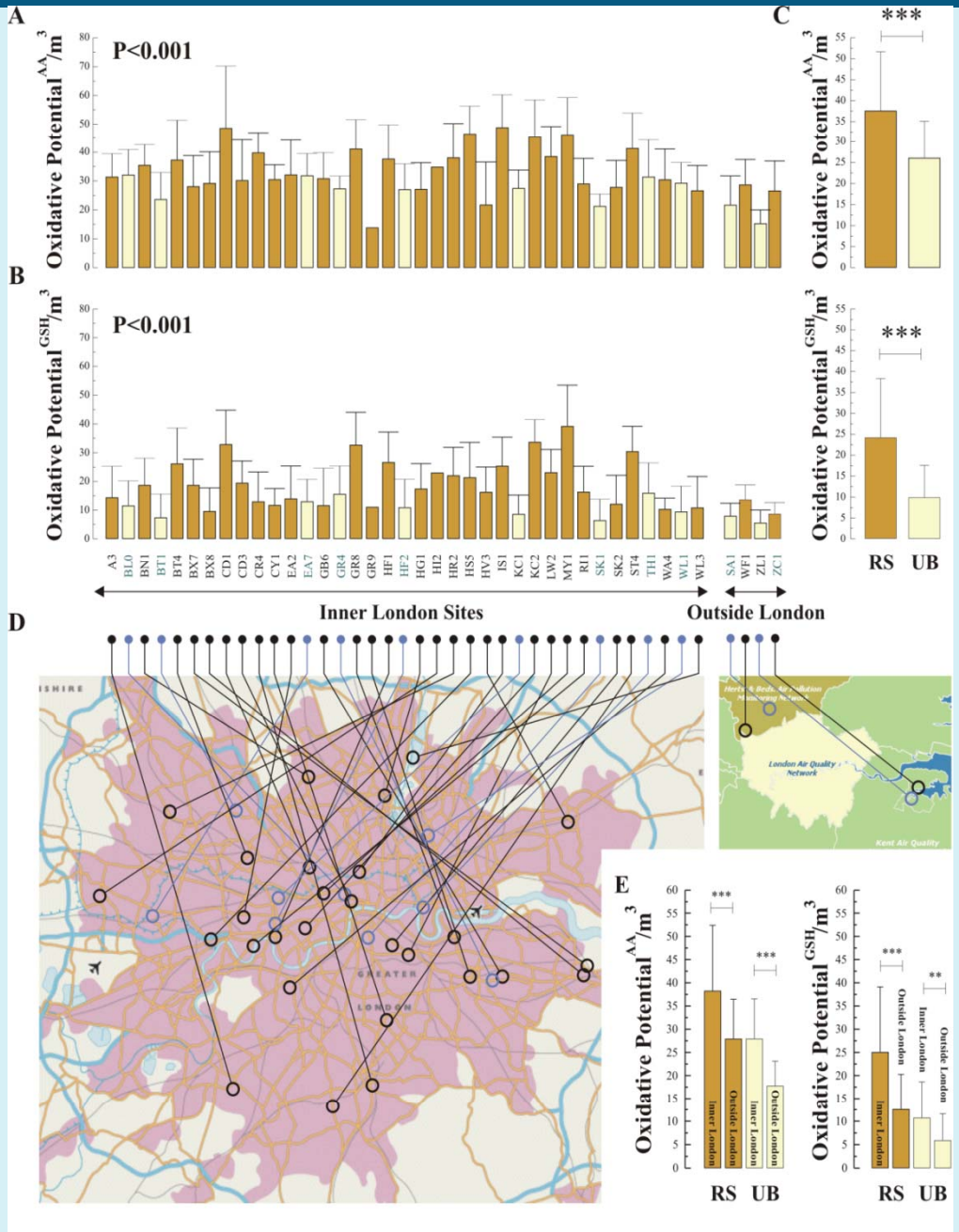


# How does $PM_{10}$ oxidative potential vary across London?

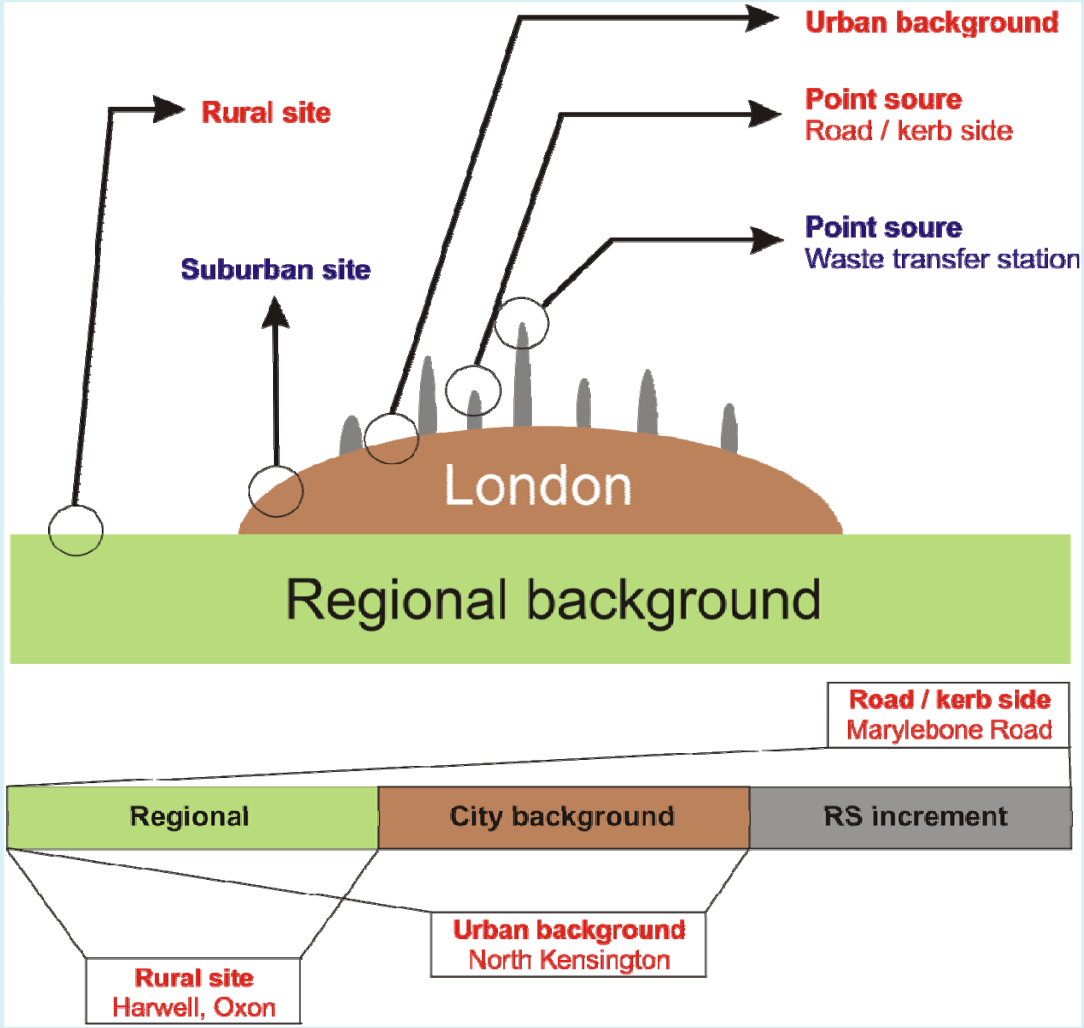
Clear roadside increment in $OP^{GSH}$, but not $OP^{AA}$ when expressed per unit mass

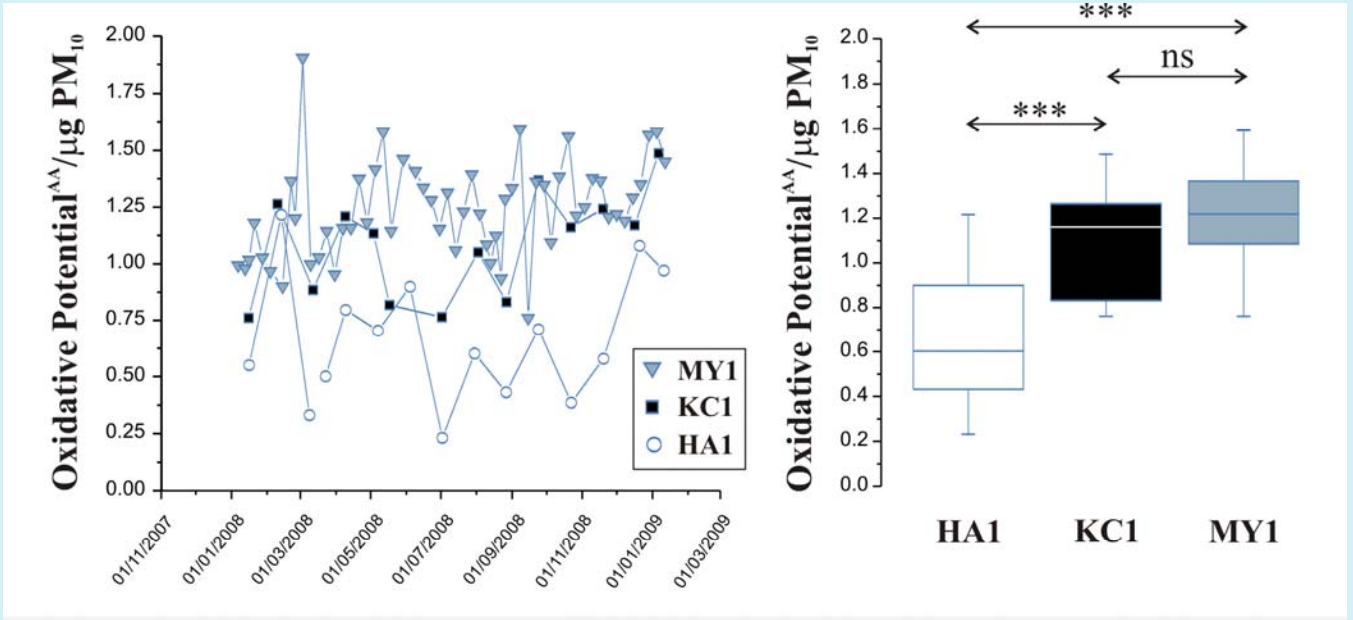
Some evidence of an enhanced London background relative to suburban locations

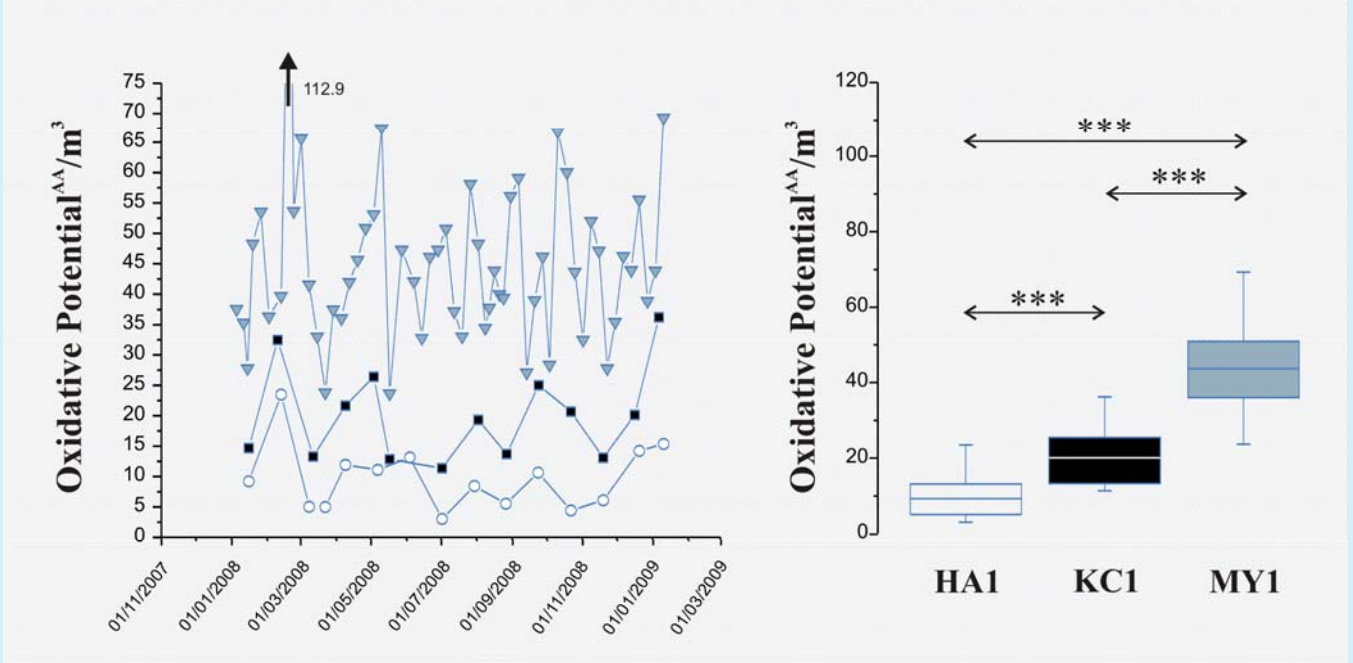
Clear variation at background sites

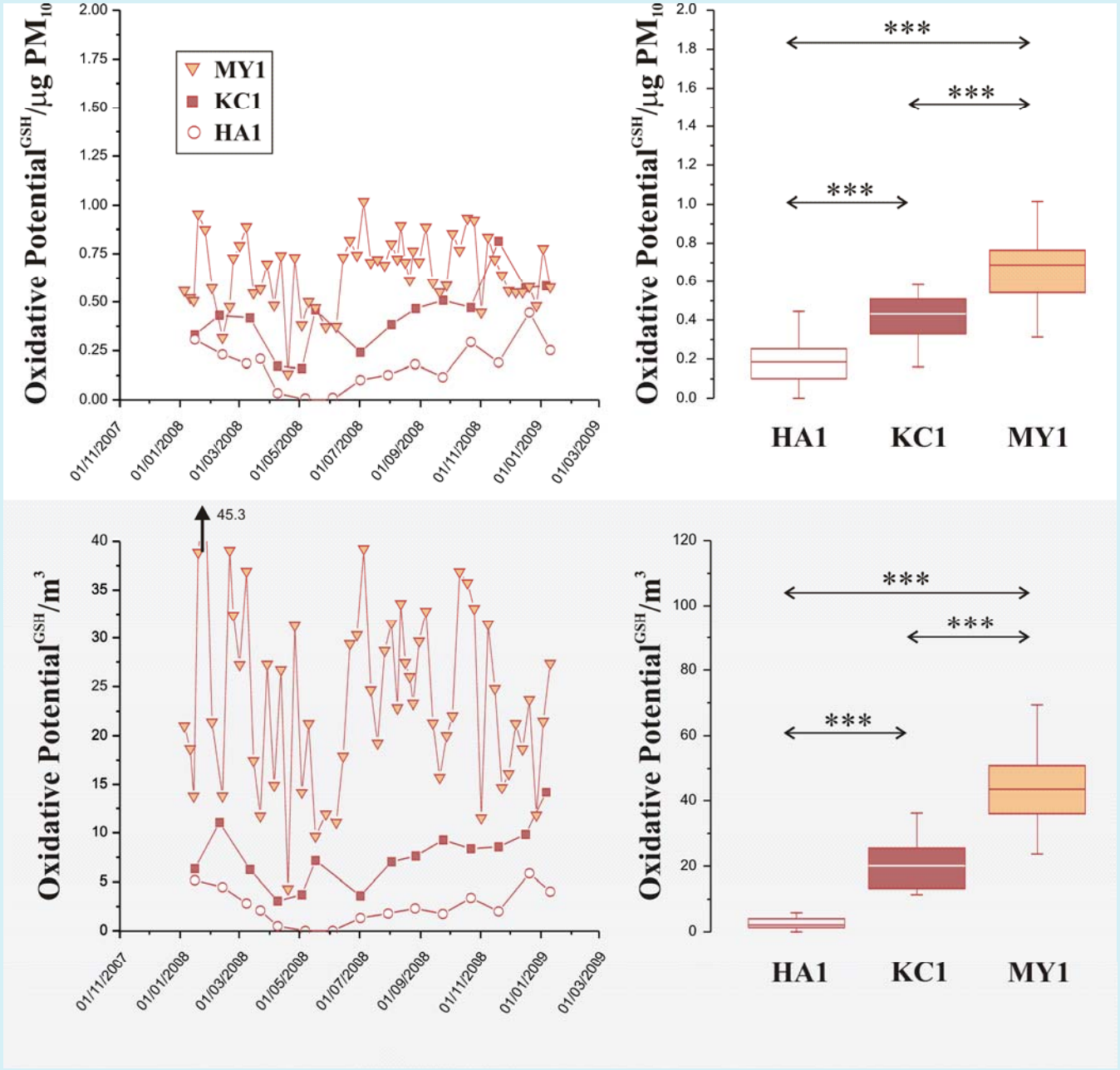


# Refining our understanding of urban $PM_{10}$ oxidative potential – the Lenchow approach

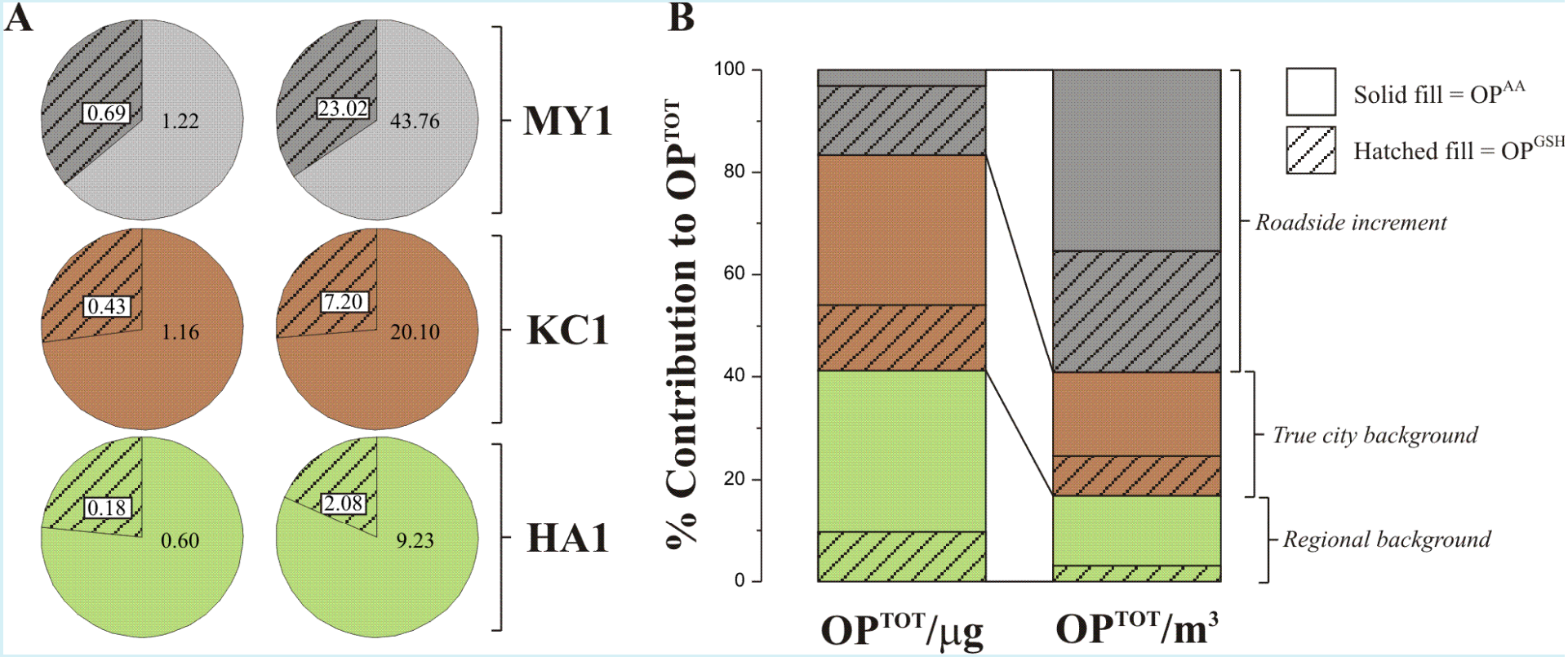



Oxidative Potential$^{AA}$/µg PM$_{10}$
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
01/11/2007
01/01/2008
01/03/2008
01/05/2008
01/07/2008
01/09/2008
01/11/2008
01/01/2009
01/03/2009
MY1
KC1
HA1
Oxidative Potential$^{AA}$/µg PM$_{10}$
***
ns
***
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
HA1
KC1
MY1

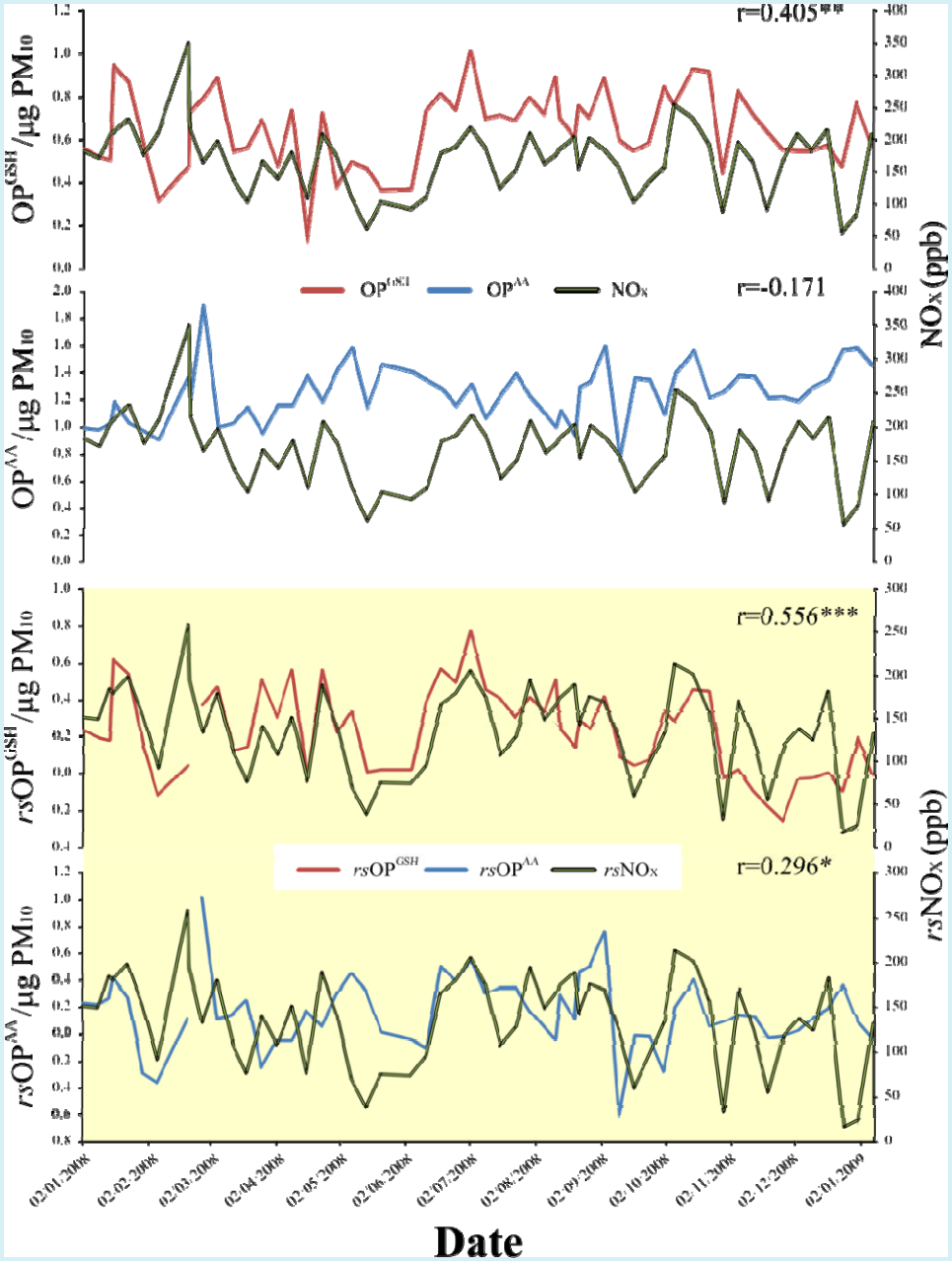

Oxidative Potential$^{AA}$/m$^3$
112.9
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
01/11/2007
01/01/2008
01/03/2008
01/05/2008
01/07/2008
01/09/2008
01/11/2008
01/01/2009
01/03/2009
Oxidative Potential$^{AA}$/m$^3$
120
100
80
60
40
20
0
***
***
***
HA1
KC1
MY1


Oxidative Potential$^{GSH}$/µg PM$_{10}$
MY1
KC1
HA1
01/11/2007
01/01/2008
01/03/2008
01/05/2008
01/07/2008
01/09/2008
01/11/2008
01/01/2009
01/03/2009
***
***
***
HA1
KC1
MY1
Oxidative Potential$^{GSH}$/m$^3$
45.3

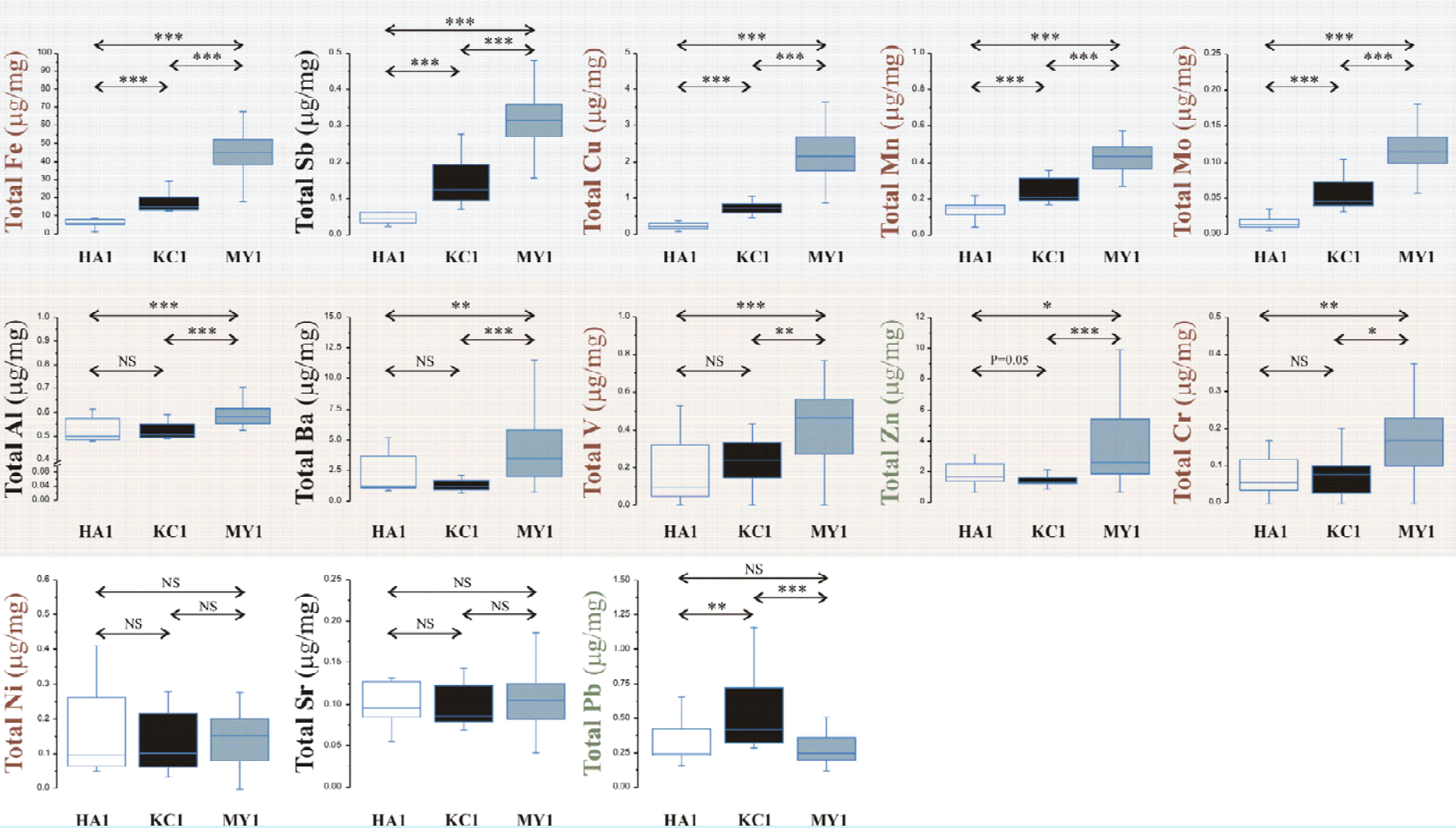
# Urban ‘total’ oxidative potential

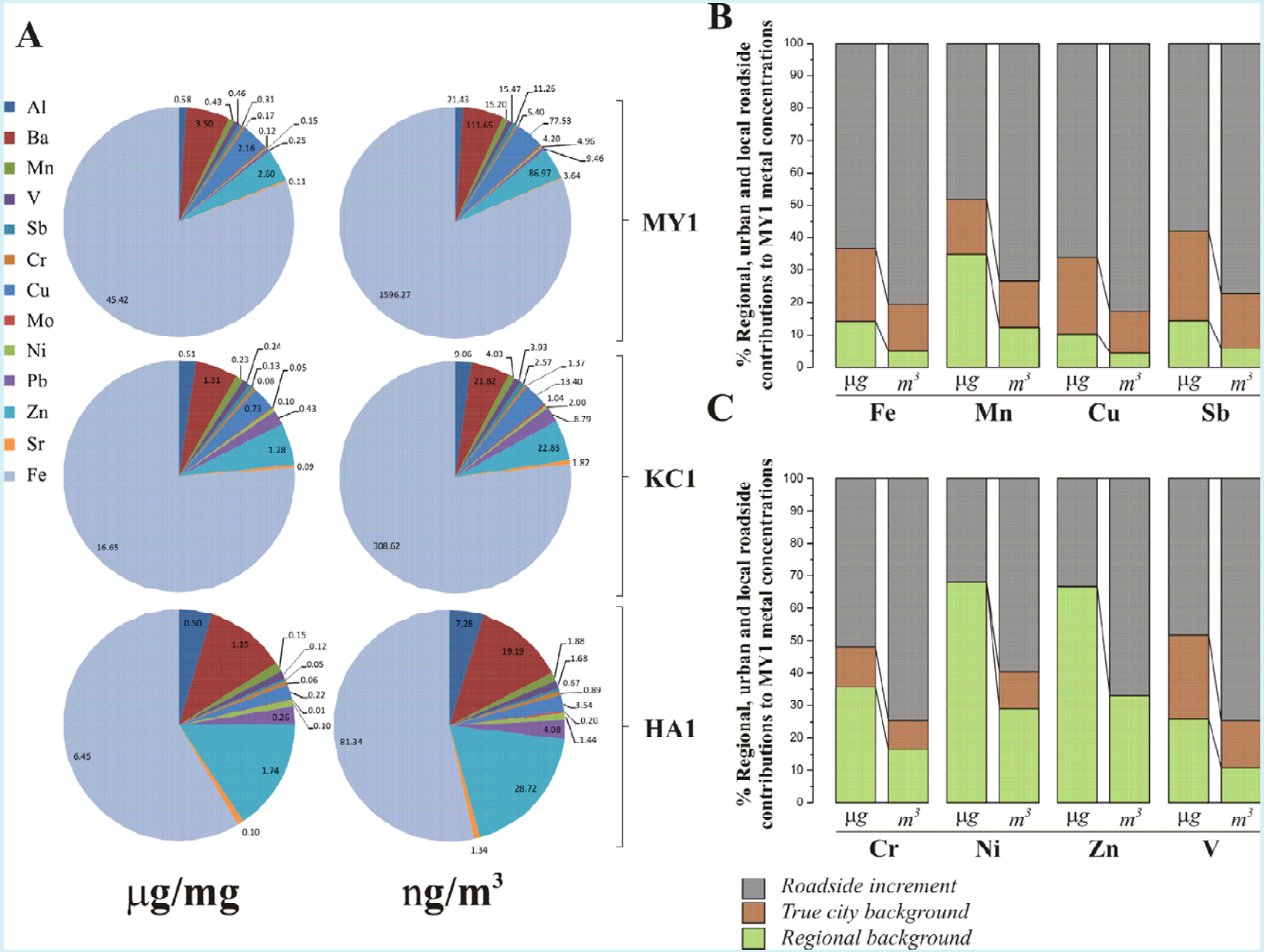


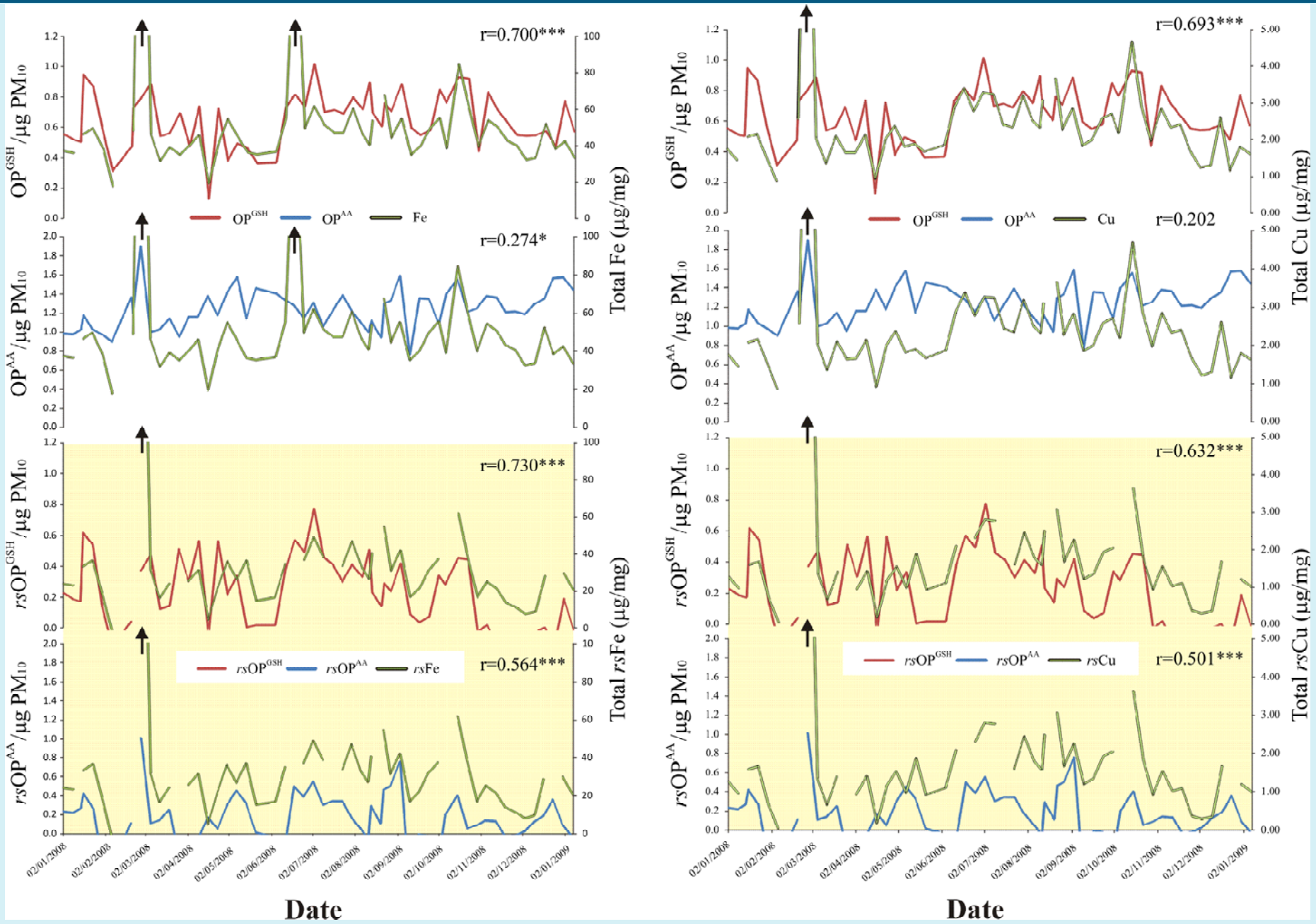
# Relationship between OP and NOx (total and RS) at MY1



# Increments in roadside PM metals




A
Al
Ba
Mn
V
Sb
Cr
Cu
Mo
Ni
Pb
Zn
Sr
Fe
MY1
KC1
HA1
µg/mg
ng/m³
B
% Regional, urban and local roadside contributions to MY1 metal concentrations
µg
m³
Fe
Mn
Cu
Sb
C
% Regional, urban and local roadside contributions to MY1 metal concentrations
Cr
Ni
Zn
V
Roadside increment
True city background
Regional background


r=0.700***
OP^GSH /µg PM10
OP^GSH
OP^AA
Fe
Total Fe (µg/mg)
r=0.274*
OP^AA /µg PM10
r=0.730***
rsOP^GSH /µg PM10
rsOP^GSH
rsOP^AA
rsFe
Total rsFe (µg/mg)
r=0.564***
rsOP^AA /µg PM10
02/01/2008
02/02/2008
02/03/2008
02/04/2008
02/05/2008
02/06/2008
02/07/2008
02/08/2008
02/09/2008
02/10/2008
02/11/2008
02/12/2008
02/01/2009
Date
r=0.693***
OP^GSH /µg PM10
OP^GSH
OP^AA
Cu
Total Cu (µg/mg)
r=0.202
OP^AA /µg PM10
r=0.632***
rsOP^GSH /µg PM10
rsOP^GSH
rsOP^AA
rsCu
Total rsCu (µg/mg)
r=0.501***
rsOP^AA /µg PM10
02/01/2008
02/02/2008
02/03/2008
02/04/2008
02/05/2008
02/06/2008
02/07/2008
02/08/2008
02/09/2008
02/10/2008
02/11/2008
02/12/2008
02/01/2009
Date

# Conclusions

1. PM oxidative potential varies on both regionally and temporally. The observations we have made are robust and repeatable. There is a clear roadside increment.

2. There is a seasonal pattern to urban background $OP^{GSH}$, which correlates well with NOx and the London specific PM fraction

3. The two OP metrics are sensitive to different sources, one regional (Cr, V, Ni) and one local (Cu, Fe, Sb) to roadside

# Acknowledgments

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