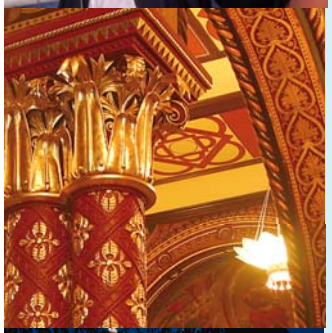

MRC-HPA Centre for Environment and Health

Imperial College London

MRC Medical Research Council

Health Protection Agency

KING'S College LONDON

The London specific component of PM_{10} <u>toxicity</u>

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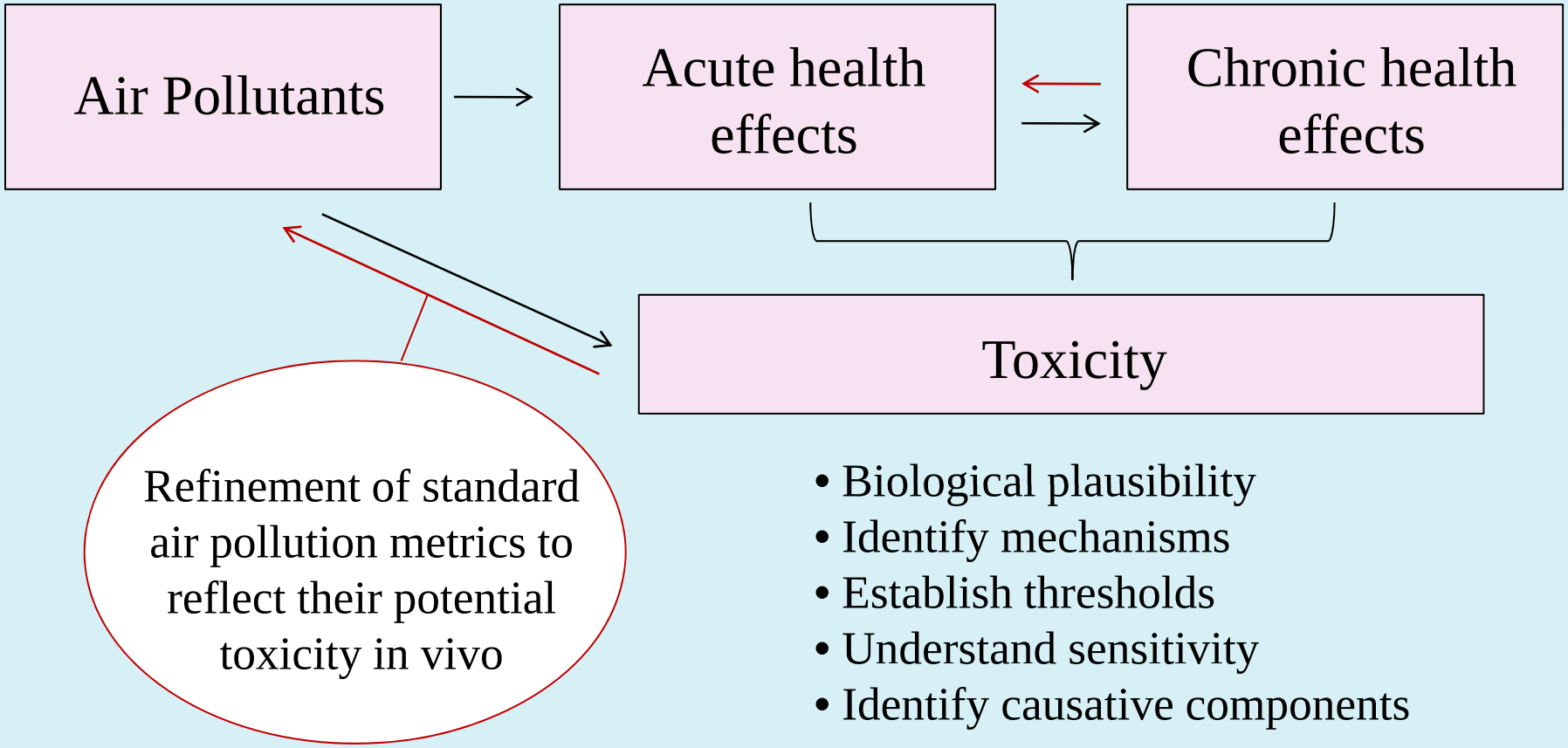
What do we mean by the London (urban) specific (informative) component (s) of PM_{10} "toxicity"?



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

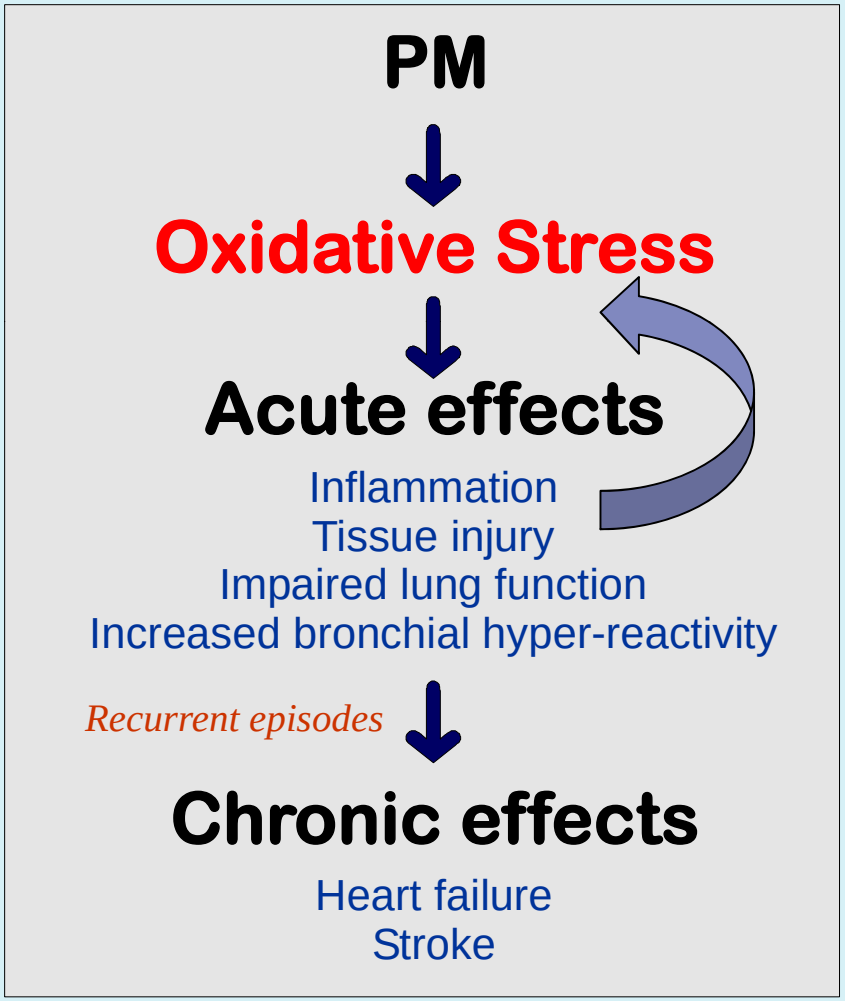
Aims

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

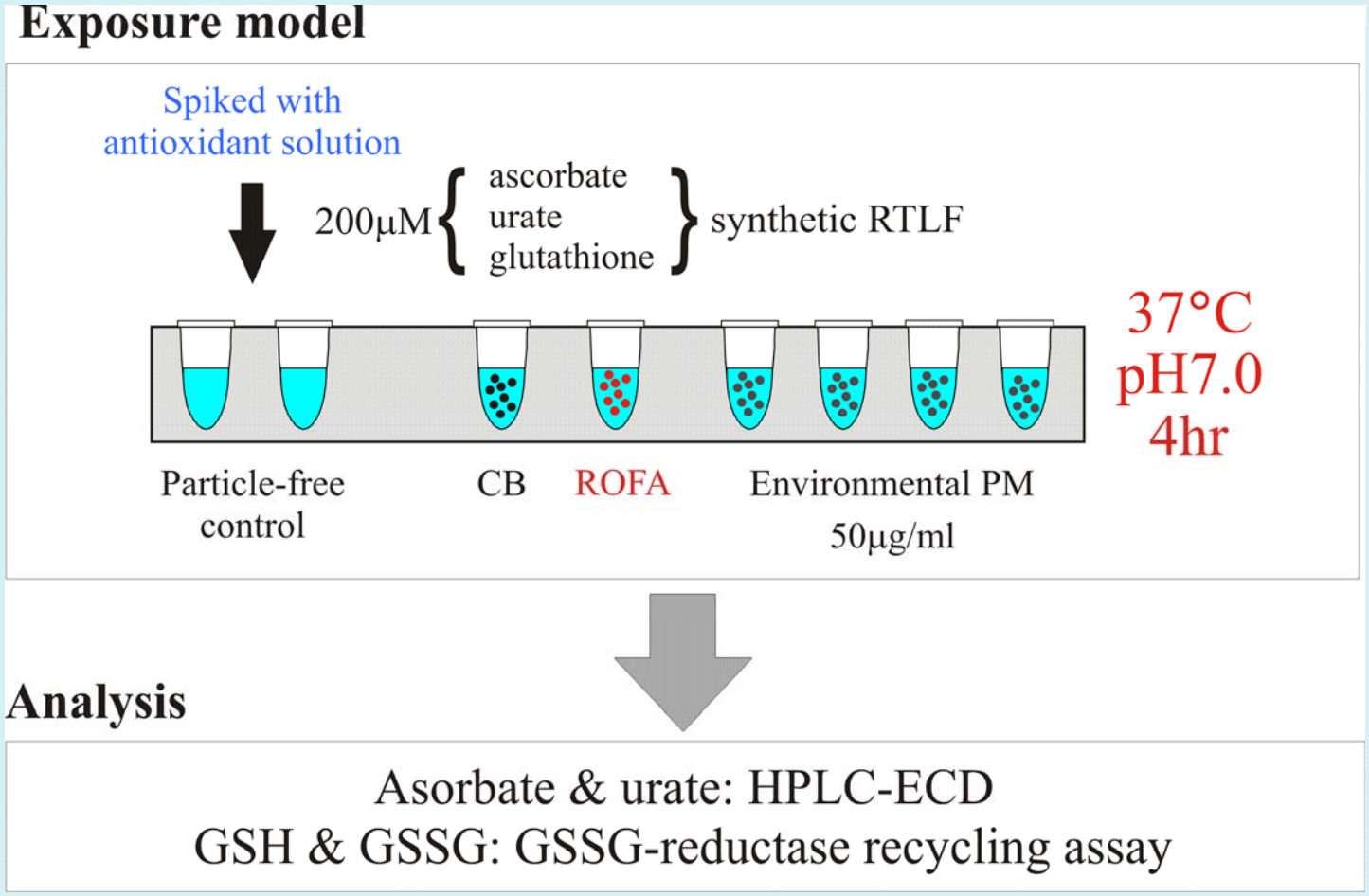
2. Outline the development of a toxicologically *'informative'* PM metric

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

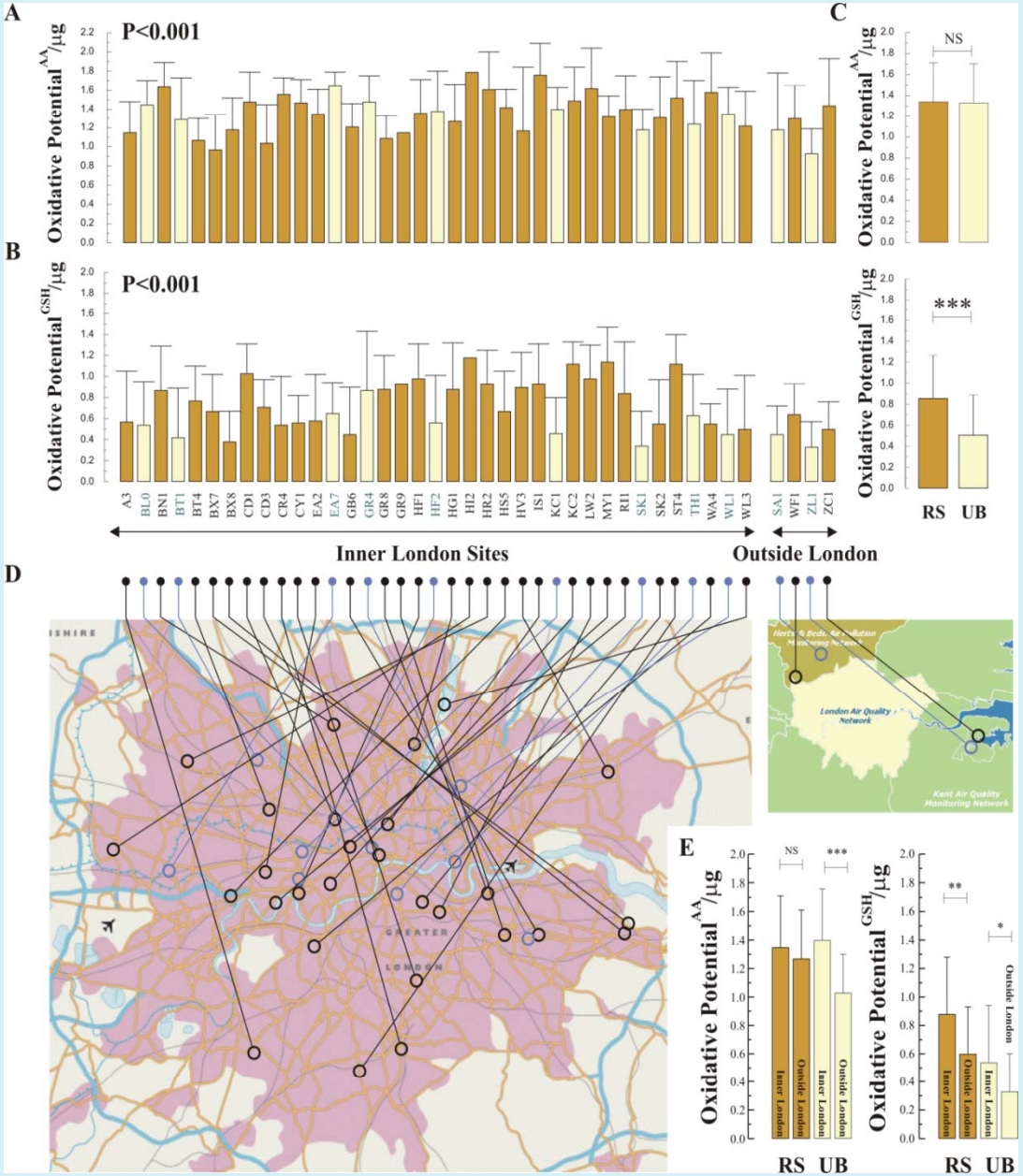
4. Somehow provide a link to NO_2 and biomass derived PM



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



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

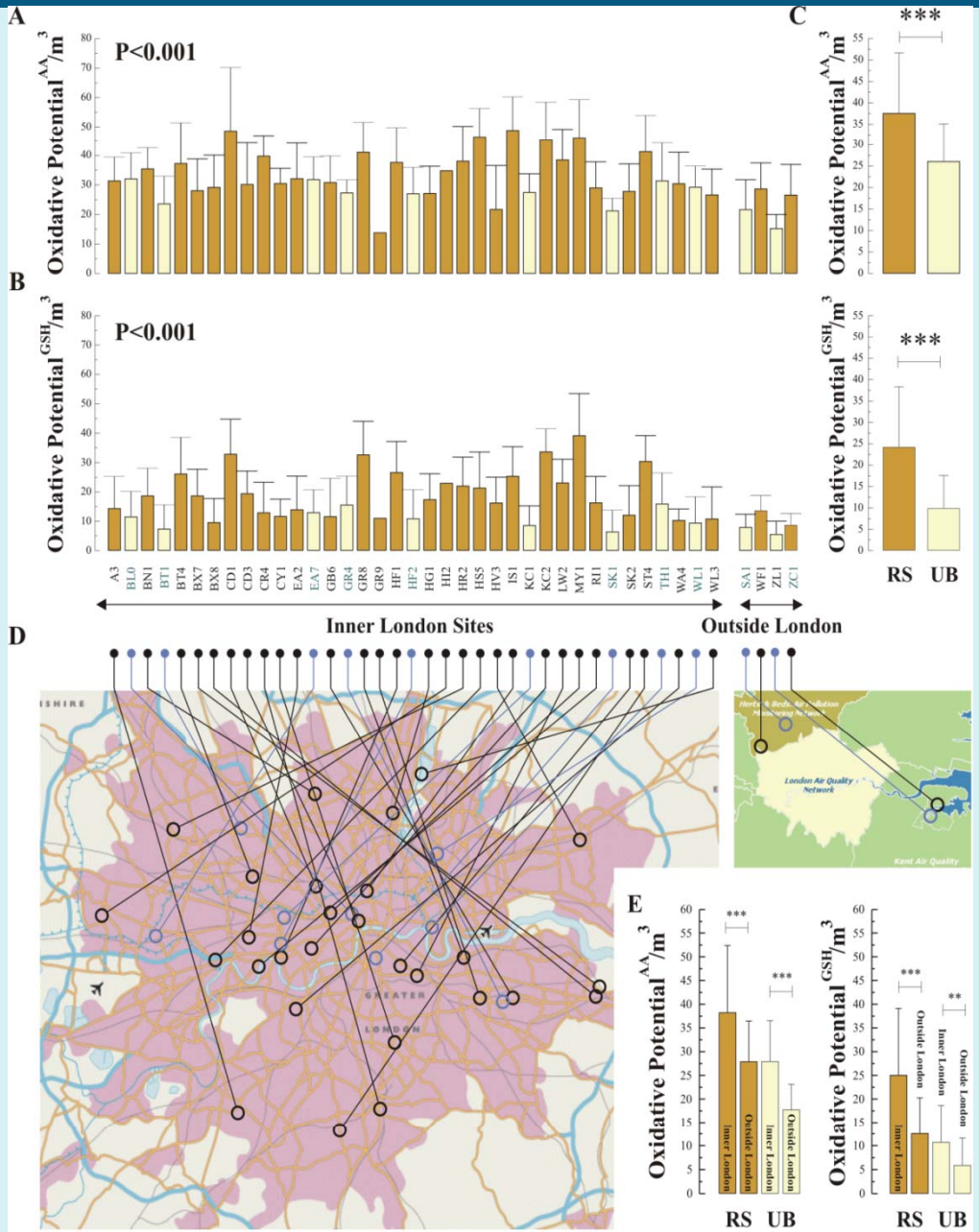


How does PM_{10} oxidative potential vary across London?

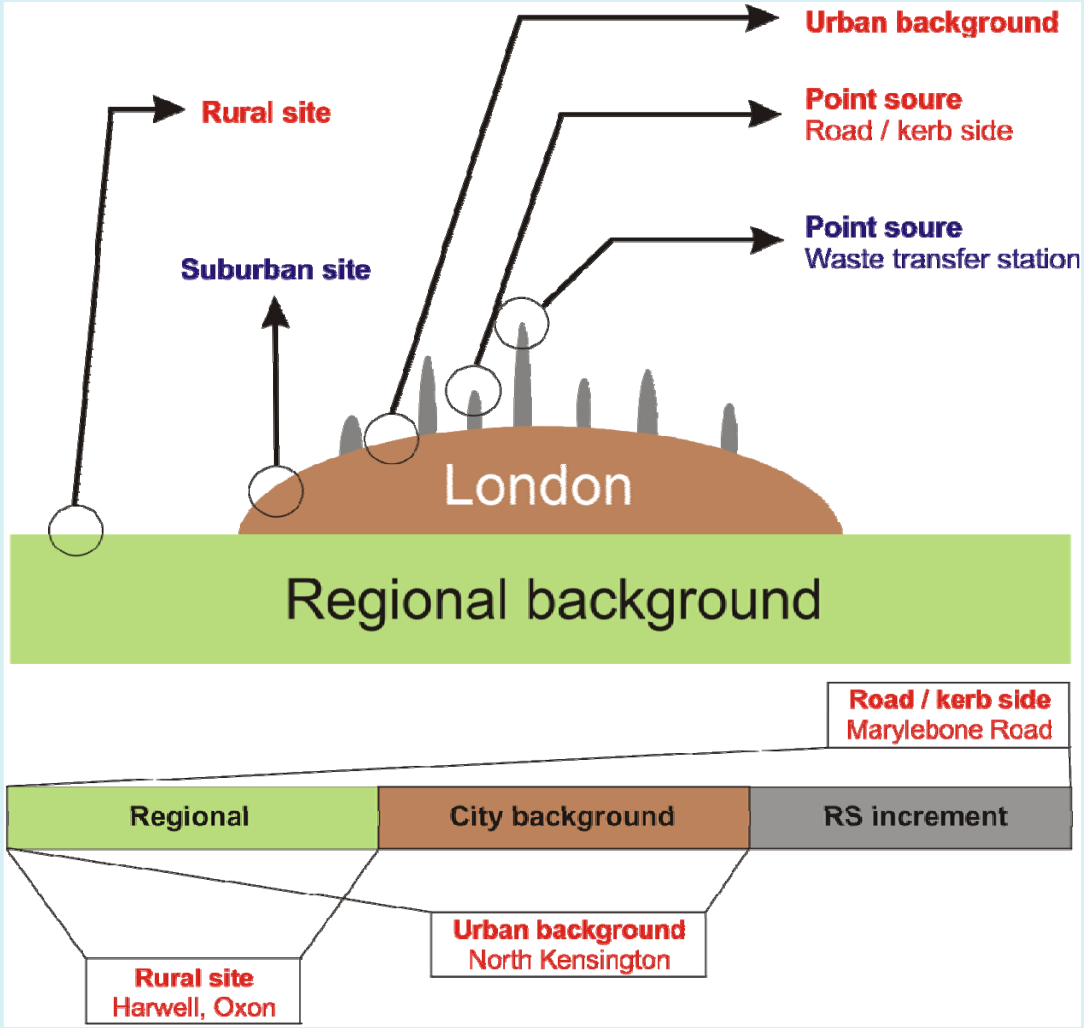
Clear roadside increment in OP^{GSH}, but not OP^{AA} when expressed per unit mass

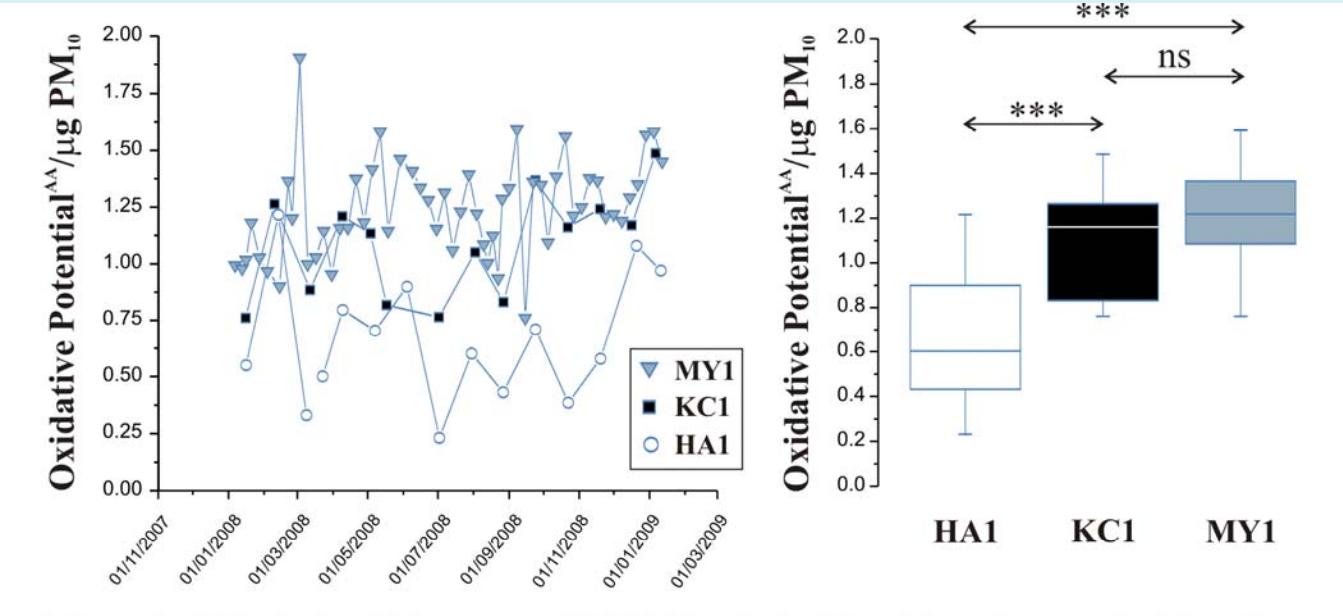
Some evidence of an enhanced London background relative to suburban locations

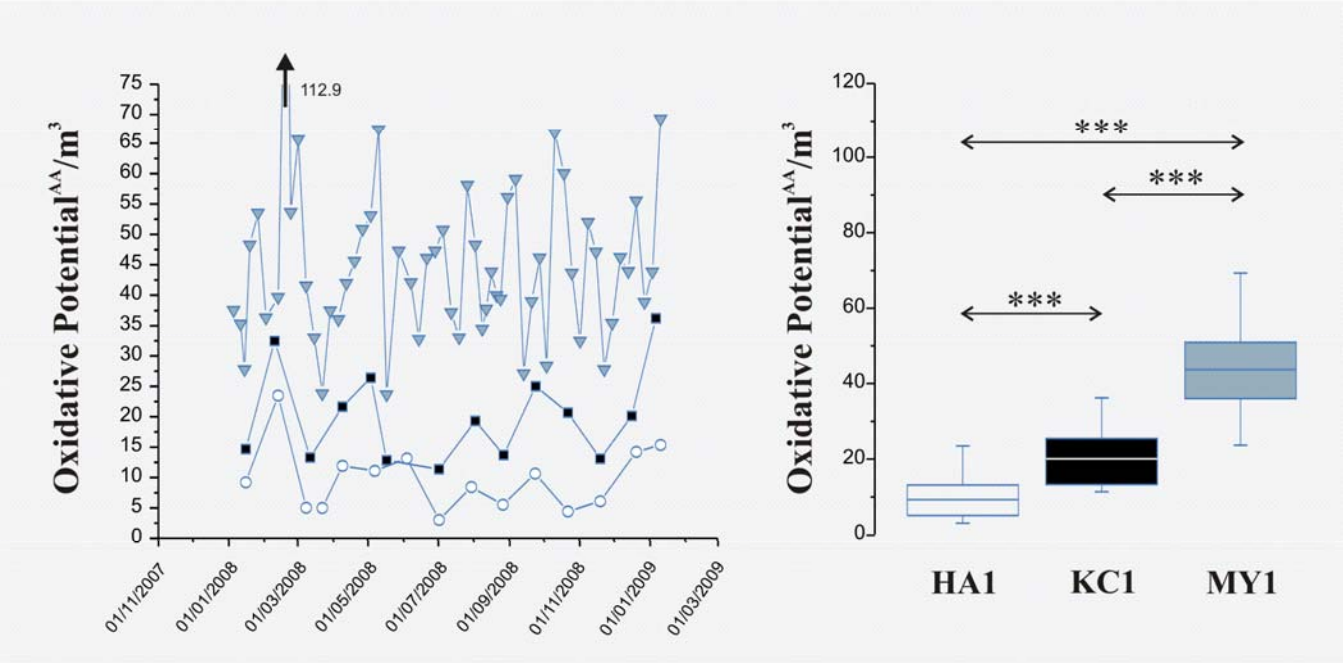
Clear variation at background sites

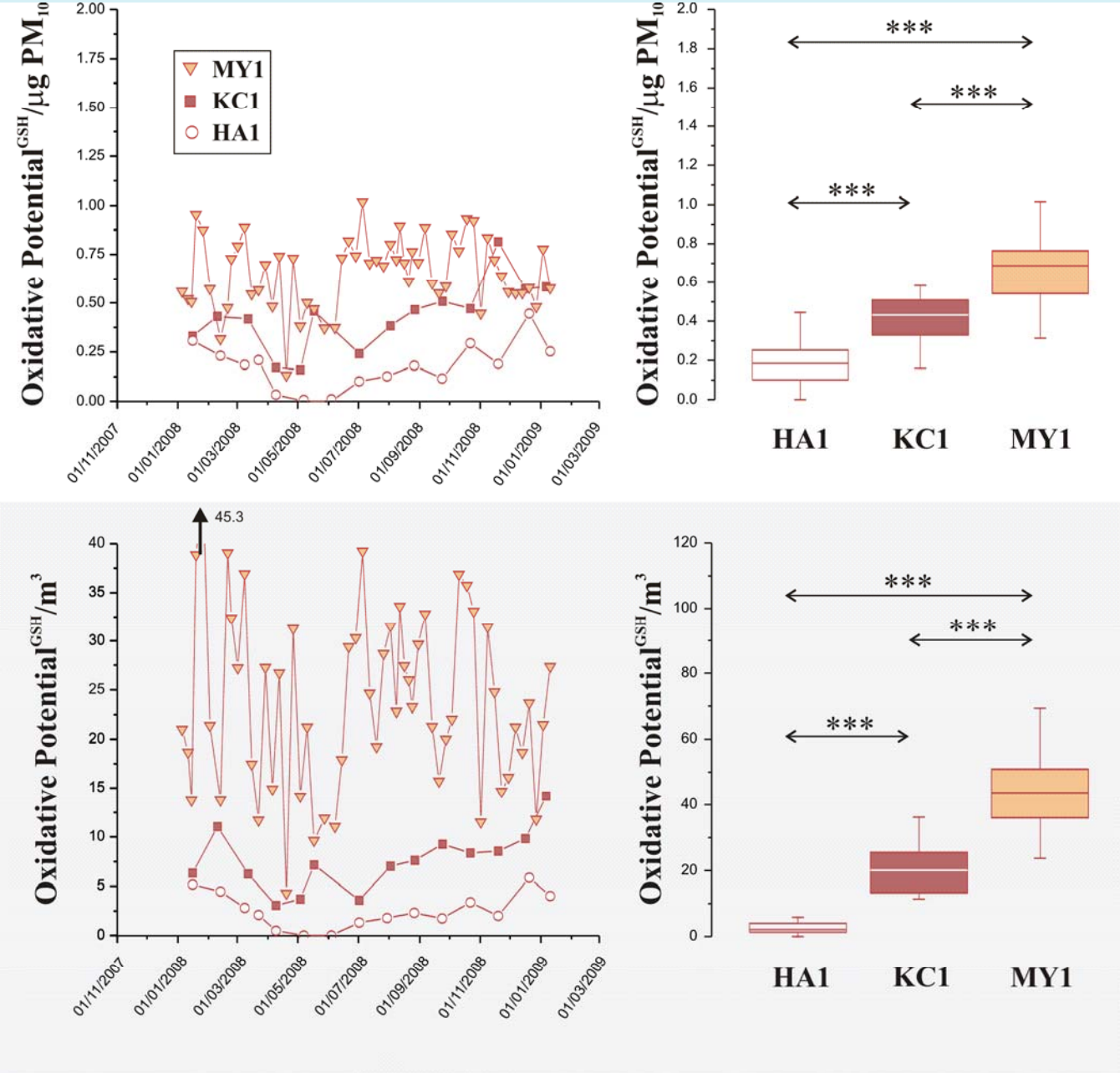


Refining our understanding of urban PM_{10} oxidative potential – the Lenchow approach

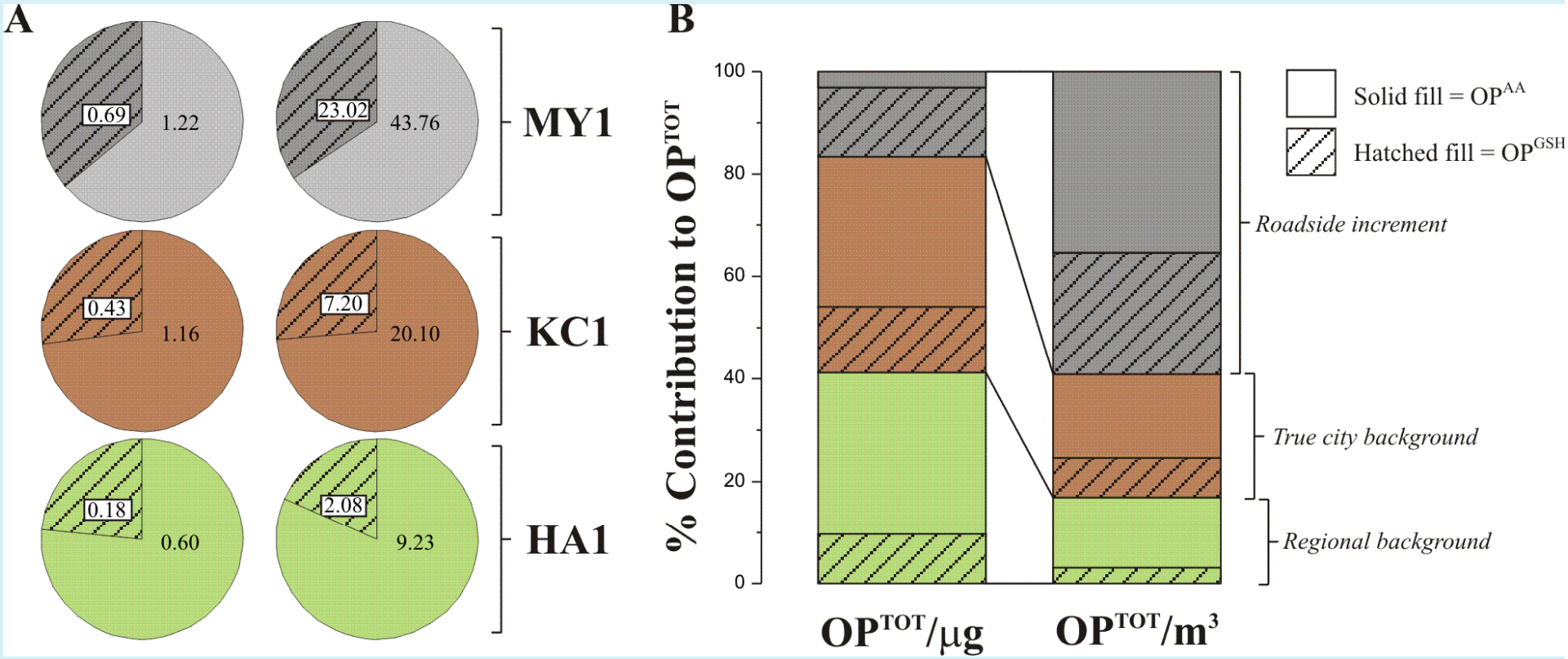



Oxidative Potential^AA/µg PM10
MY1
KC1
HA1
01/11/2007
01/01/2008
01/03/2008
01/05/2008
01/07/2008
01/09/2008
01/11/2008
01/01/2009
01/03/2009
***
ns
***
HA1
KC1
MY1

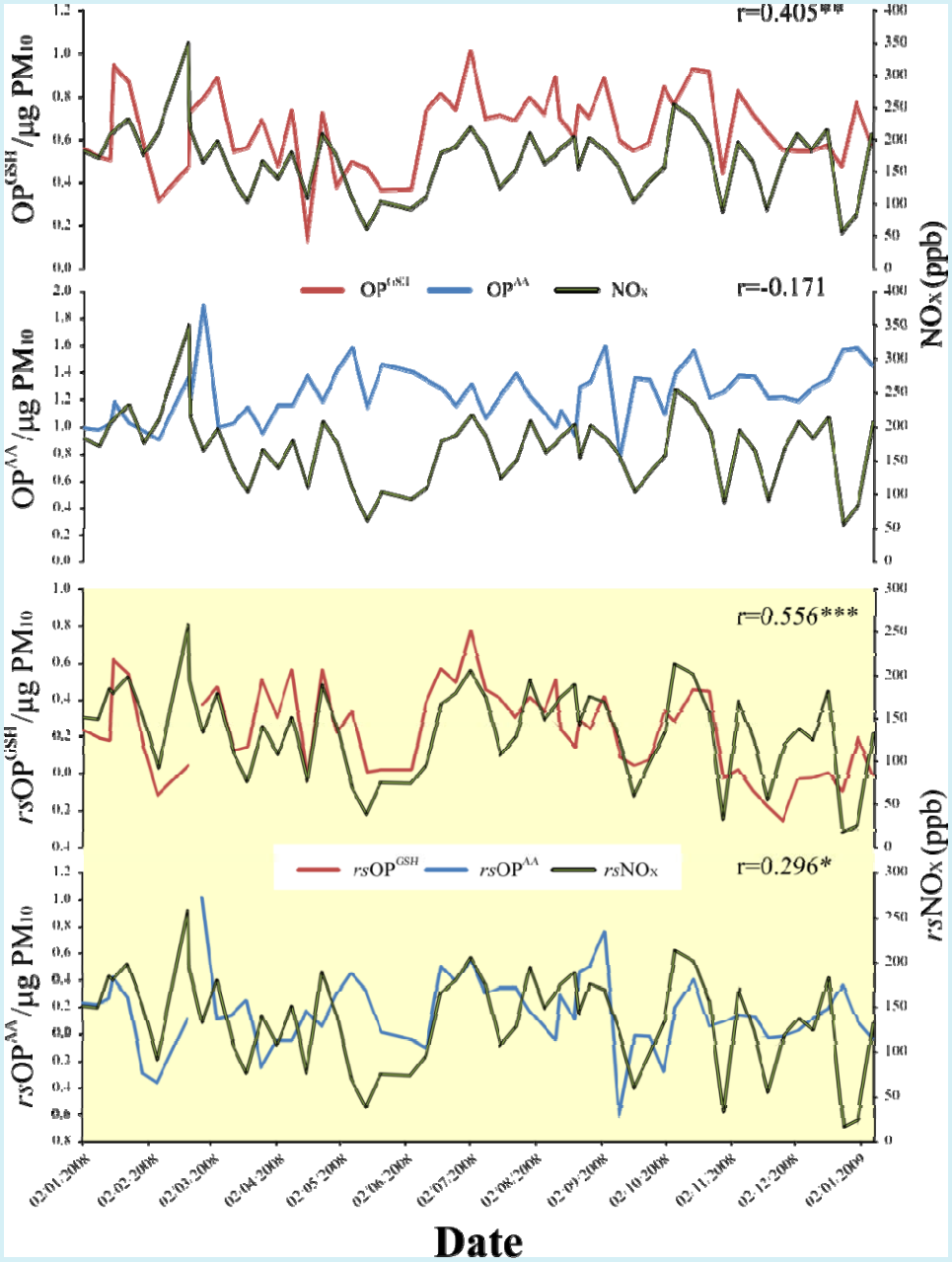

Oxidative Potential^AA/m3
112.9
01/11/2007
01/01/2008
01/03/2008
01/05/2008
01/07/2008
01/09/2008
01/11/2008
01/01/2009
01/03/2009
***
***
***
HA1
KC1
MY1


Oxidative Potential^{GSH}/µg PM$_{10}$
MY1
KC1
HA1
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
Oxidative Potential^{GSH}/µg PM$_{10}$
***
***
***
HA1
KC1
MY1
Oxidative Potential^{GSH}/m^3
45.3
Oxidative Potential^{GSH}/m^3
***
***
***
HA1
KC1
MY1

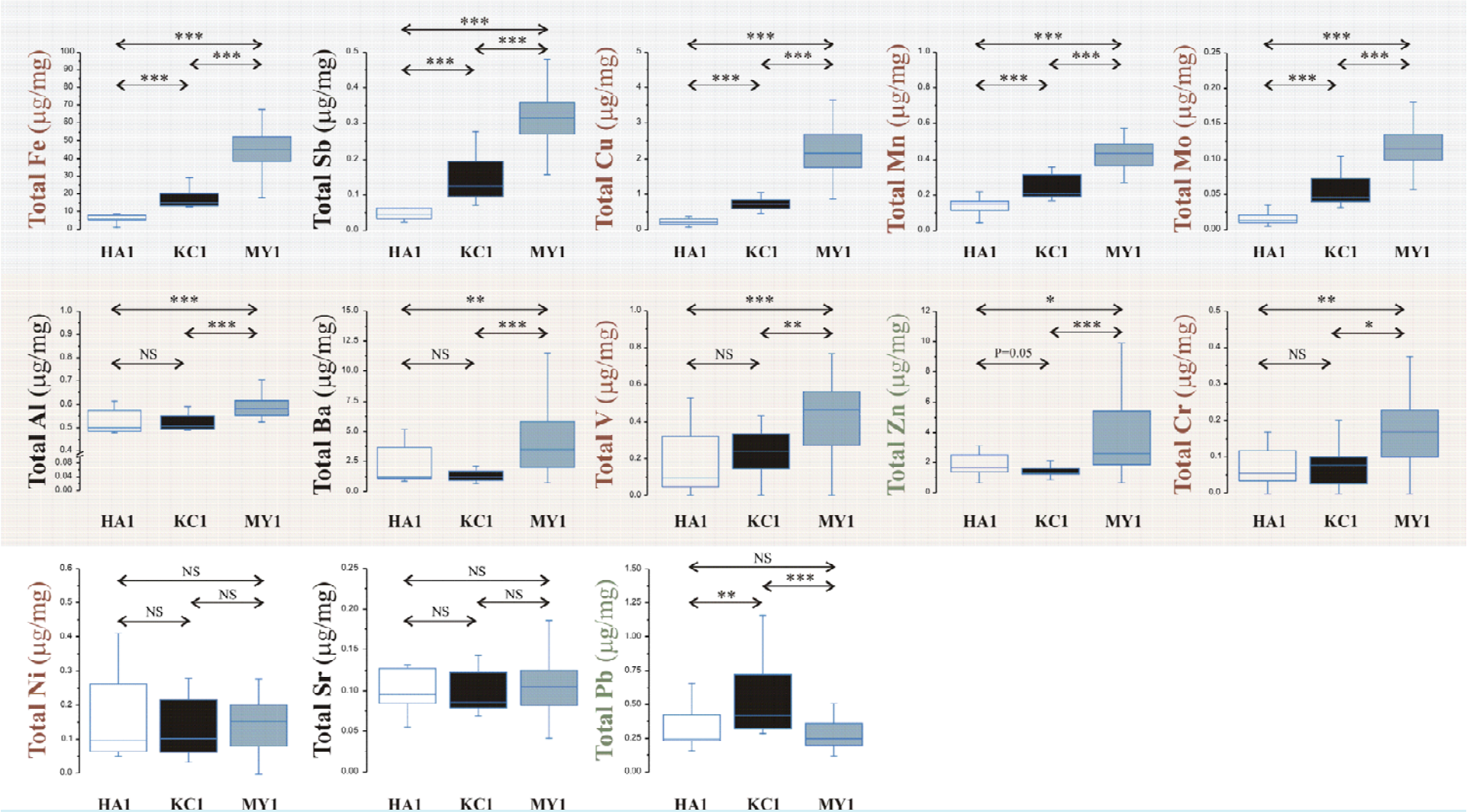
Urban ‘total’ oxidative potential

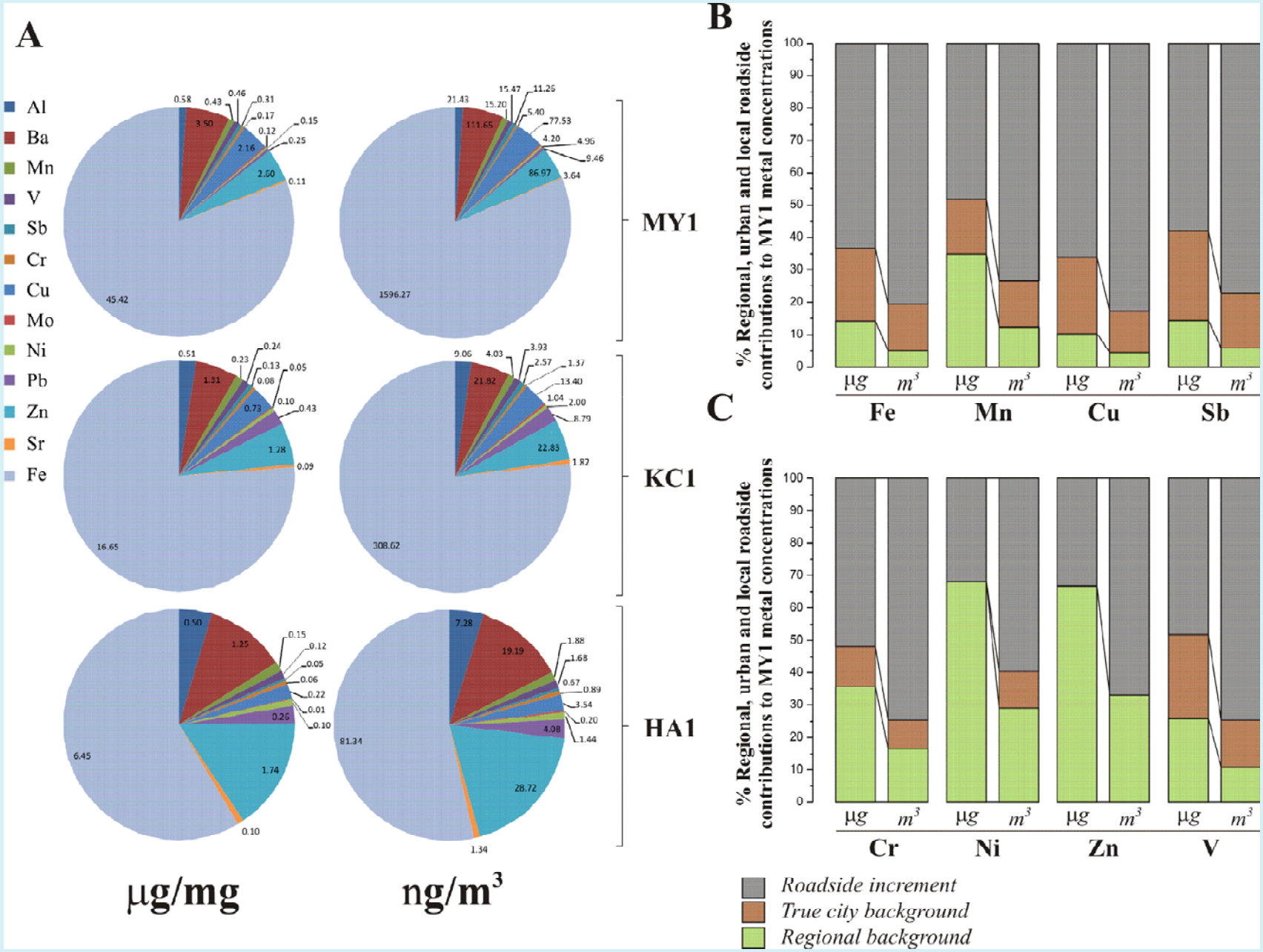


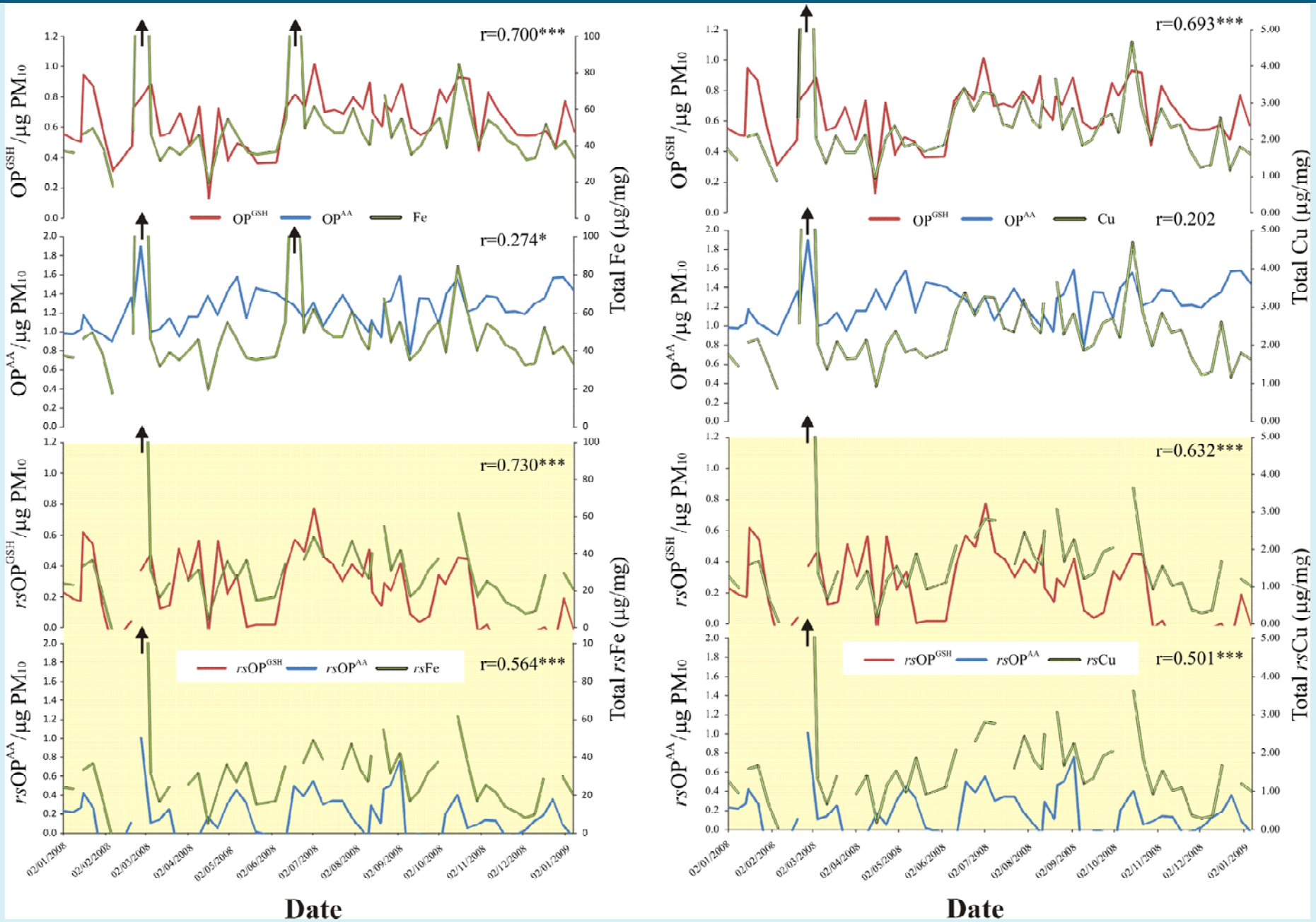
Relationship between OP and NOx (total and RS) at MY1



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
Fe
Mn
Cu
Sb
C
Cr
Ni
Zn
V
µg
m³
Roadside increment
True city background
Regional background


r=0.700***
OP^GSH
OP^AA
Fe
OP^GSH/µg PM10
Total Fe (µg/mg)
r=0.274*
OP^AA/µg PM10
r=0.730***
rsOP^GSH/µg PM10
Total rsFe (µg/mg)
rsOP^GSH
rsOP^AA
rsFe
r=0.564***
rsOP^AA/µg PM10
Date
r=0.693***
Cu
Total Cu (µg/mg)
r=0.202
r=0.632***
Total rsCu (µg/mg)
rsCu
r=0.501***

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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