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Identifying the effects of local air quality management schemes

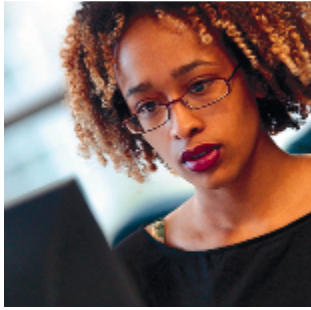
Ben Barratt, King's College London

24th April 2009



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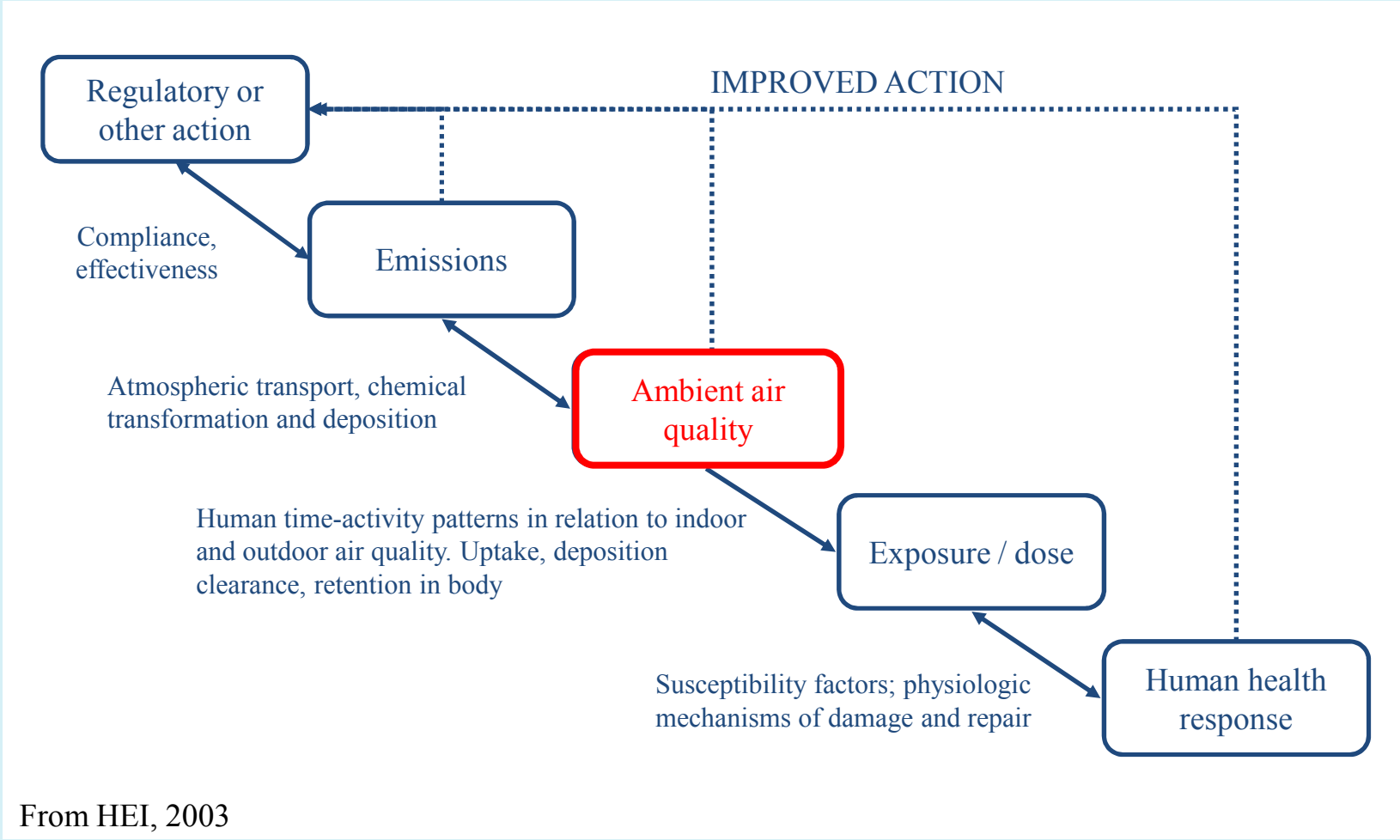
- Accountability
- Monitoring programme design
- Example analyses
- Conclusions



What is Accountability?

Why do we need Accountability?

How can we carry out an Accountability Study?



From HEI, 2003



Monitoring programme design

- Consider what area(s) are likely to experience the greatest effect, through modelling if possible.
- What are the target pollutants?
- Is there sufficient monitoring in place in these locations? (Unlikely!)
- Is there monitoring in place in representative background locations and near target receptors?
- If it is a traffic management scheme then detailed vehicle data will be beneficial from sensors located adjacent to the monitoring site(s).
- Monitoring should be carried out well in advance of the implementation date.

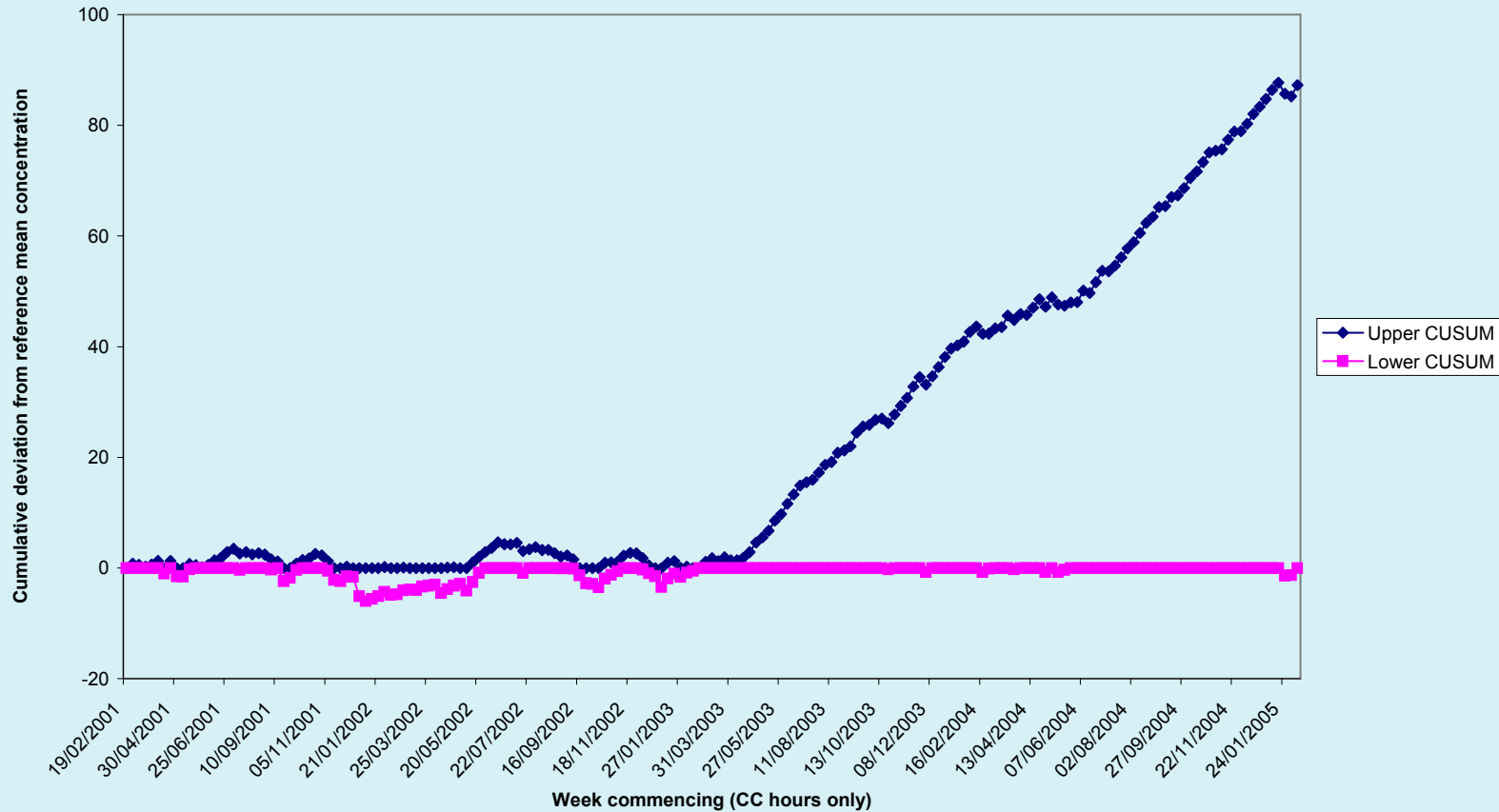


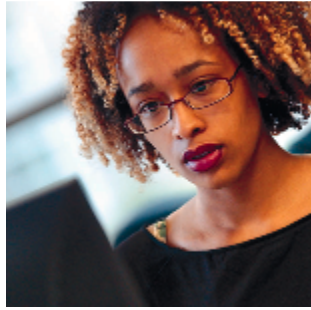
Example 1 – CUSUM charts

- Cumulative Sum – cumulative deviation from a reference mean.
- Test for the timing of sudden step changes in concentrations as the result of an intervention.
- Examples – Traffic management (including congestion charging), data ratification, industrial remediation measures.
- Advantages – quick and simple in a spreadsheet. Can identify a specific change date.
- Disadvantages – serial correlation in pollution data (principally background trends and meteorology) can blur or entirely obscure a change point.
- Method refinements - London mean, statistical forecasting.

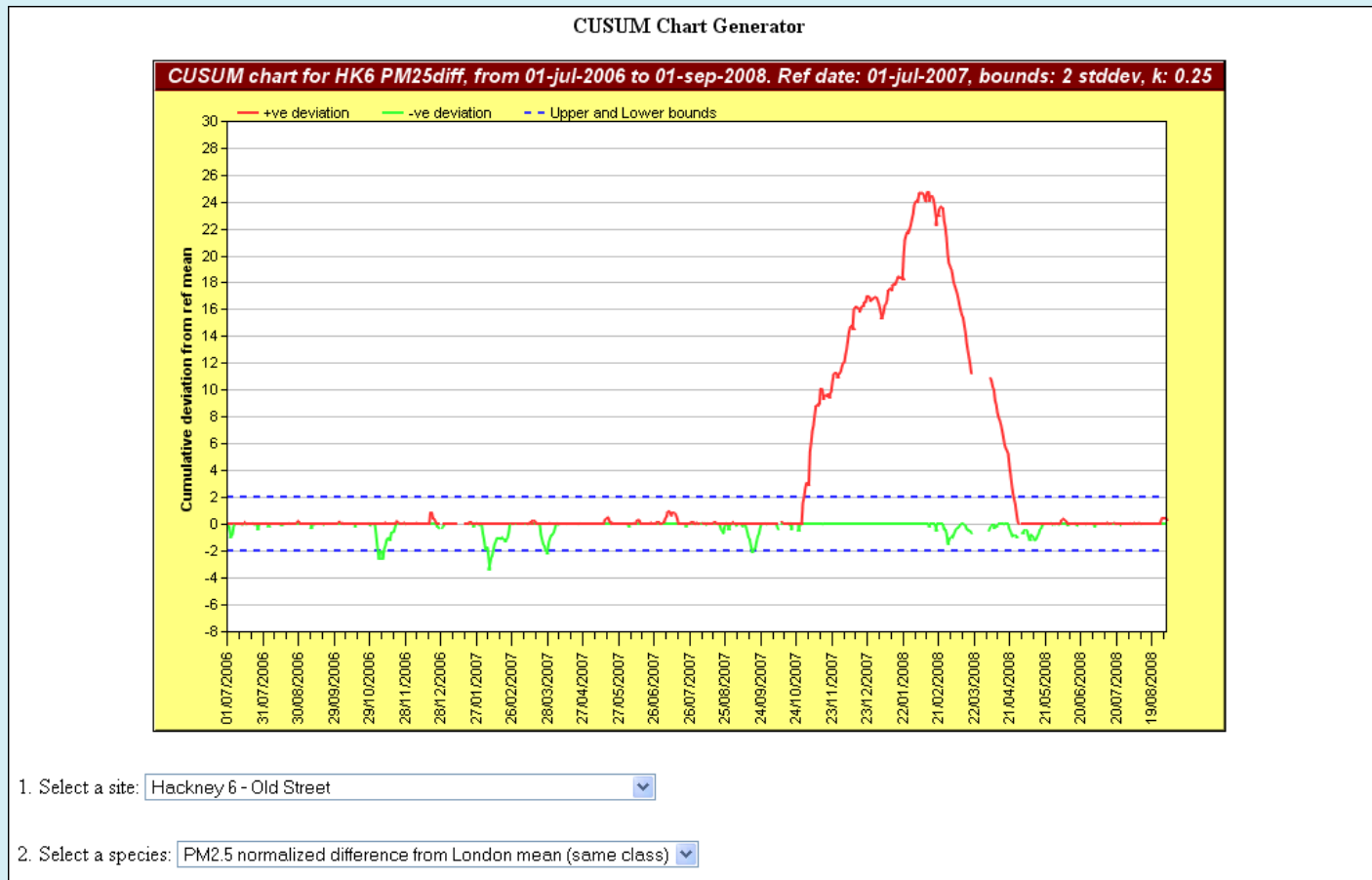


Strong step change (NO₂ at Marylebone Road)



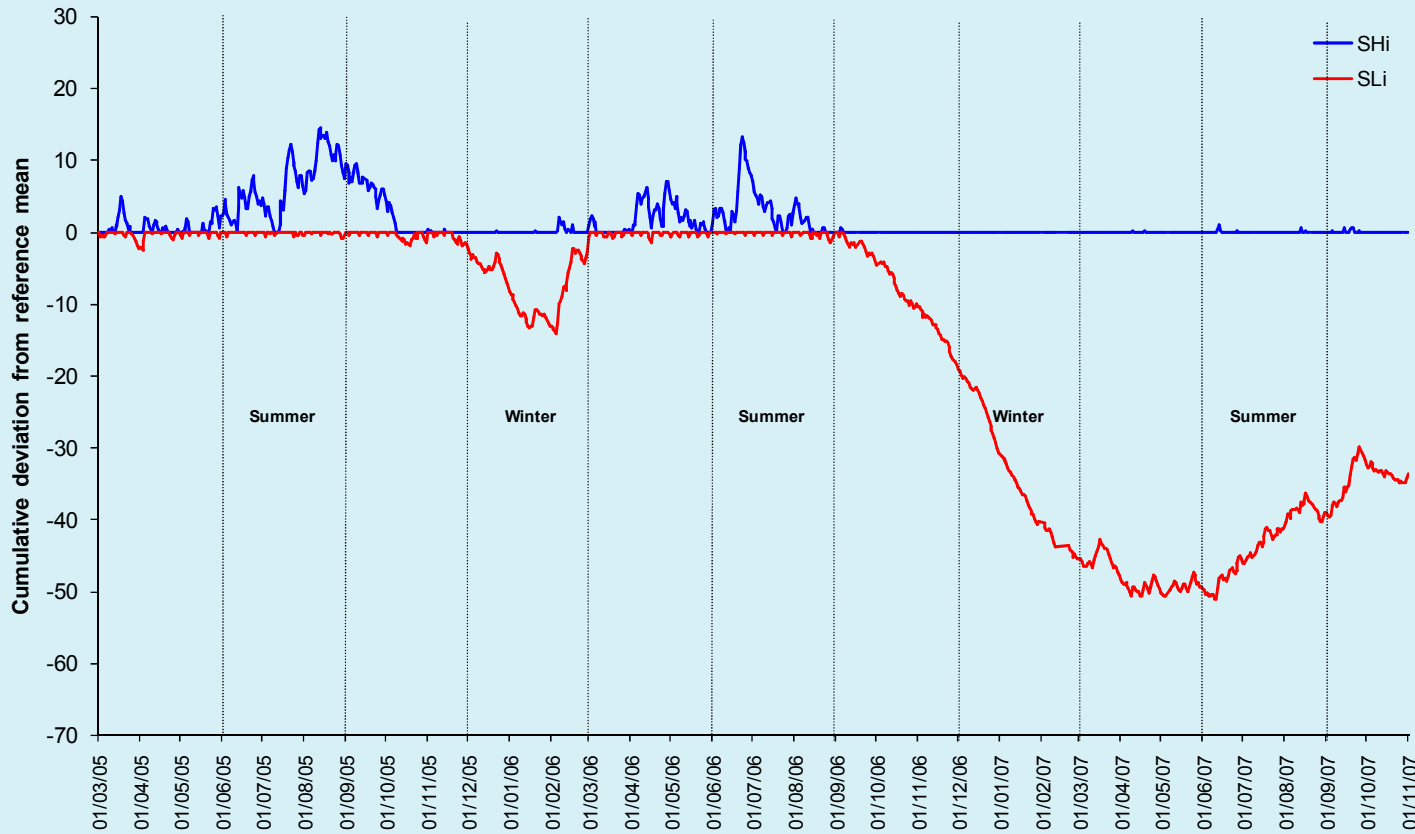


Deviation from regional mean (data ratification)



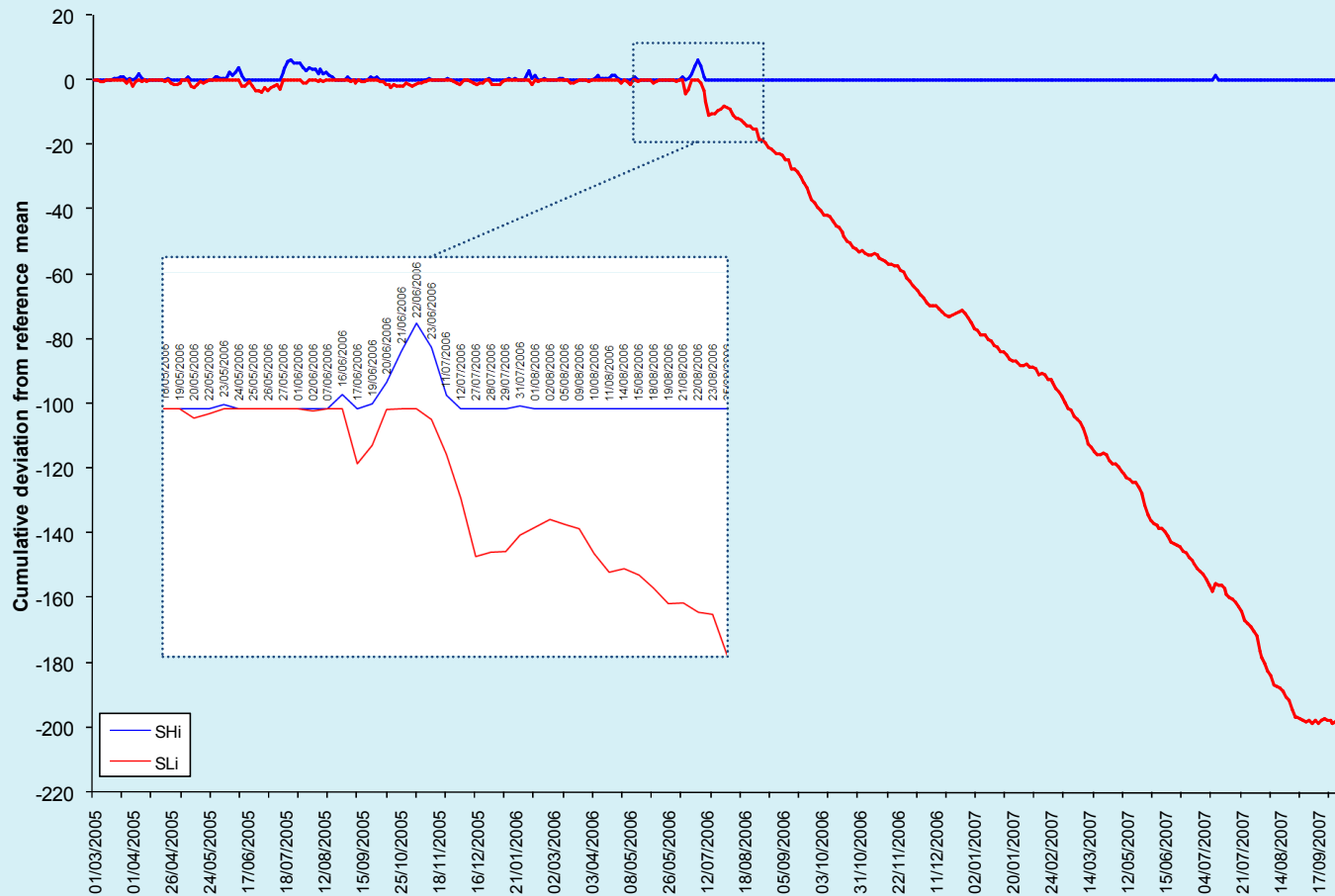


Deviation from forecast mean (industrial emissions)





Deviation from forecast mean (industrial emissions)



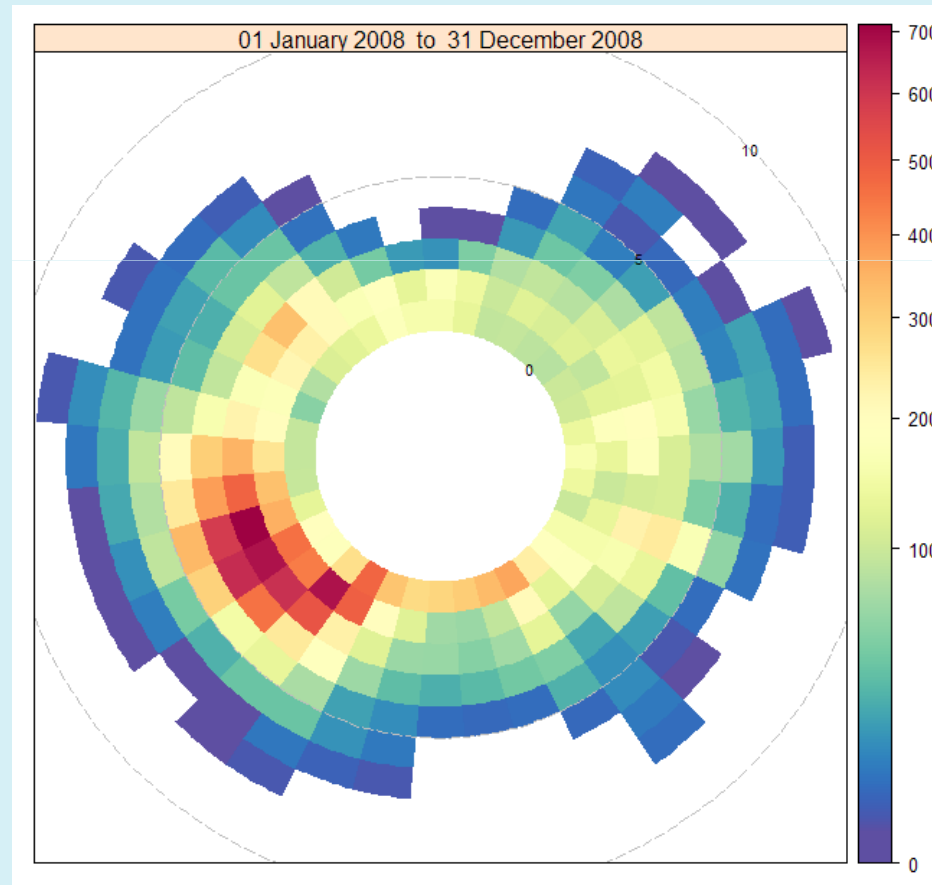


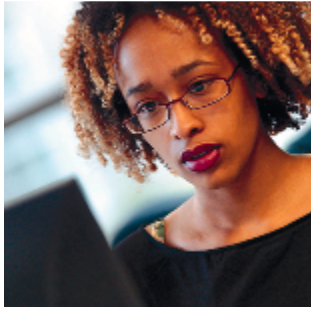
Example 2 – Bivariate polar plots

- Graphical representation of the relationship between wind and pollutant concentrations.
- Similar to a pollution rose, but includes wind speed thus providing more resolution.
- Examples – Traffic management (including low emission zones), industrial or construction emissions.
- Advantages – simple to generate, easily interpreted graphical output, very effective in identifying target emissions source.
- Disadvantages – not quantitative, requires specialist software, local wind effects.
- Refinements – varying time steps, polar annulus, dataset filtering, uncertainty.

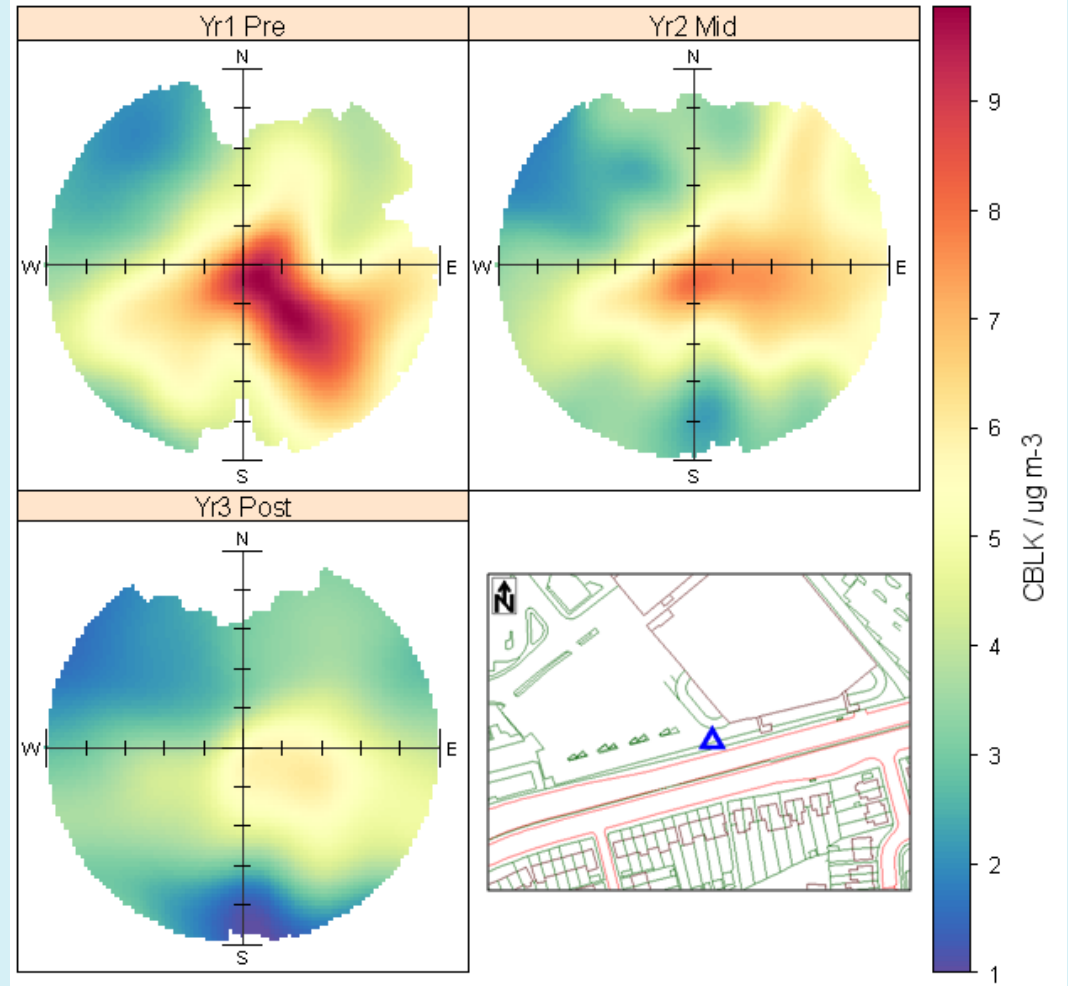


Polar plot generation (wind frequency)



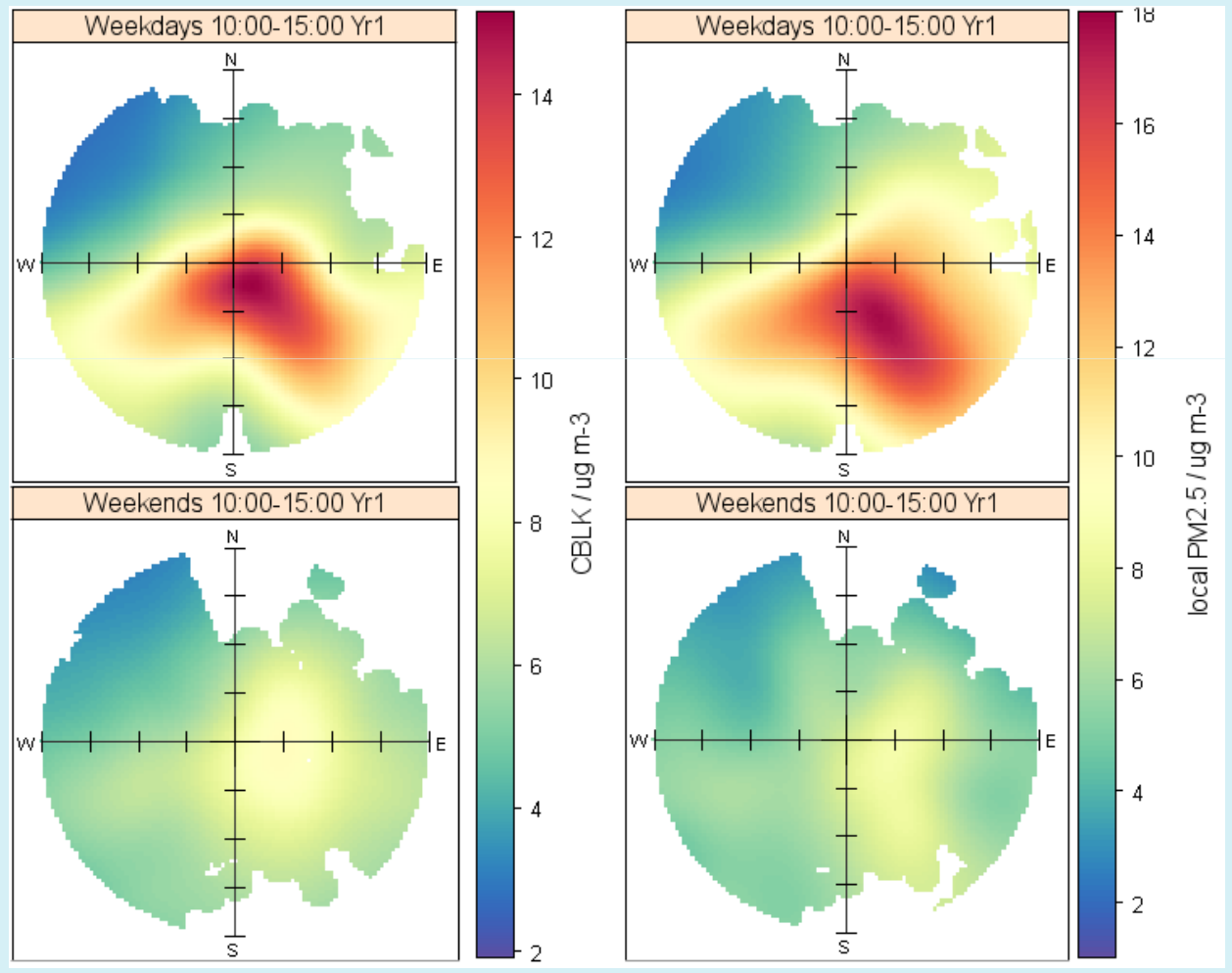


Identification of surrounding sources and change over time (CBLK at BT4)



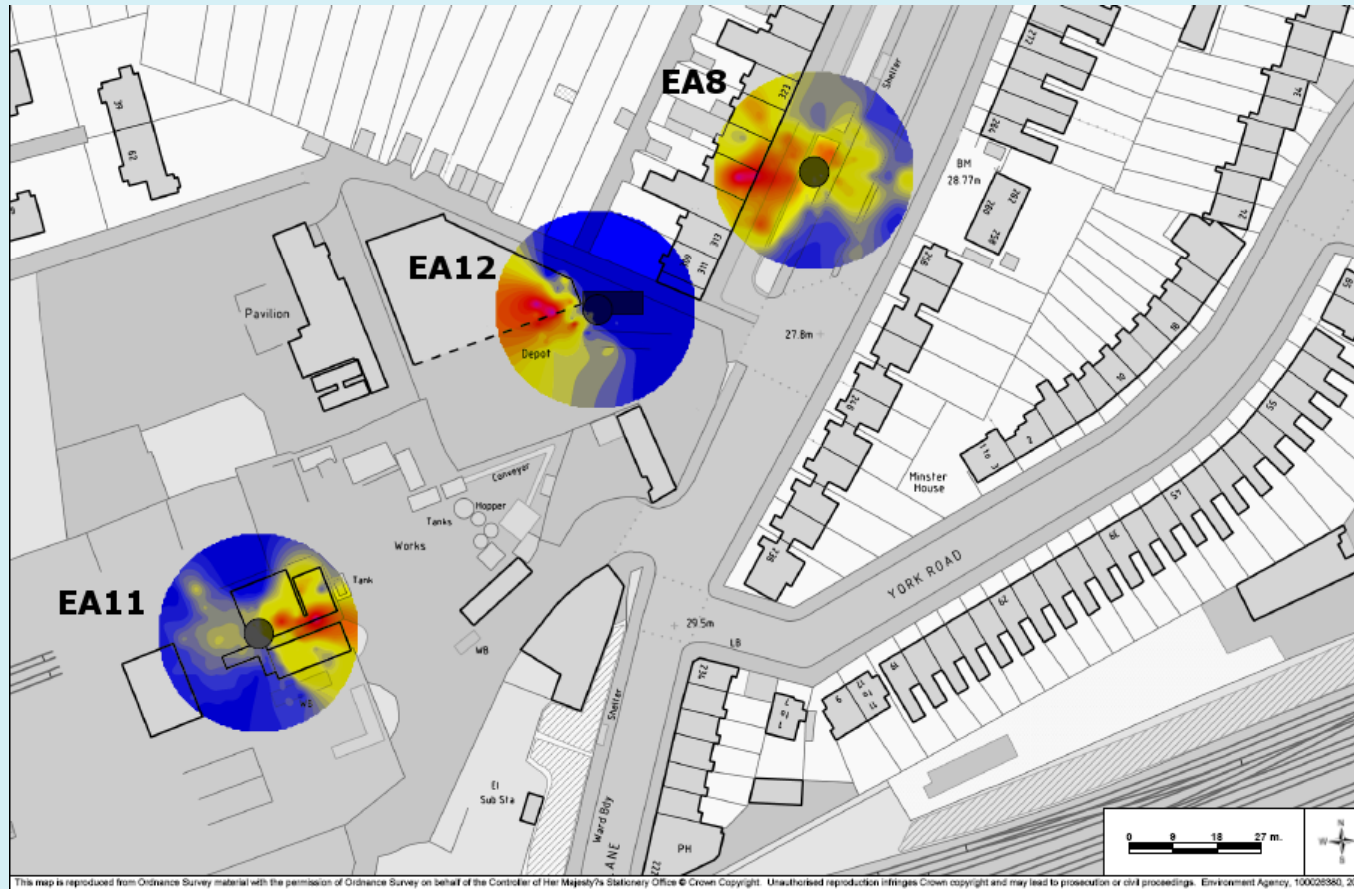


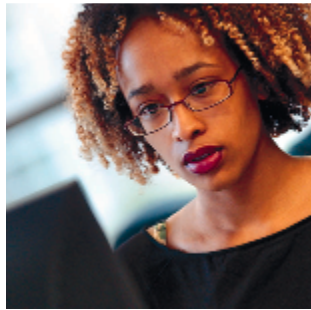
Pollutant behaviour (BT4 CBLK and local PM_{2.5})



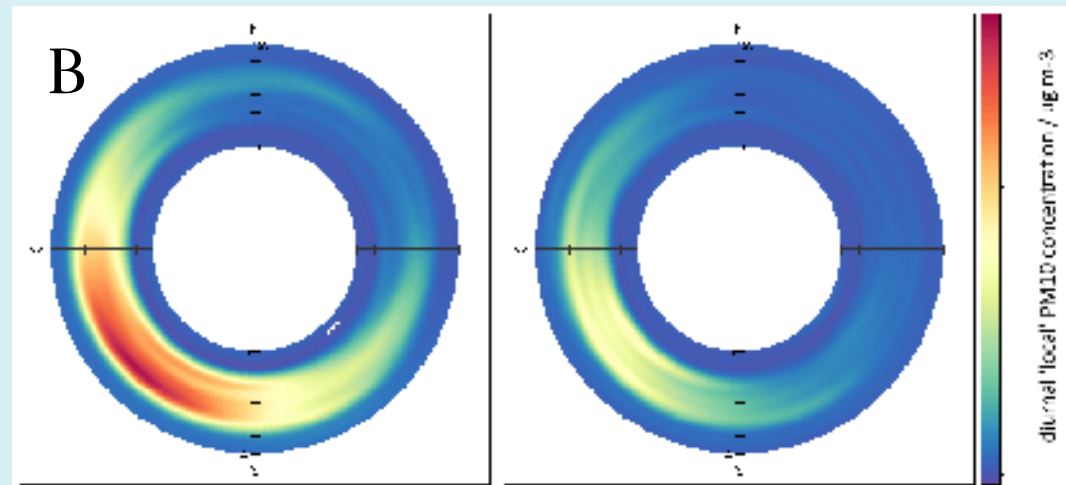
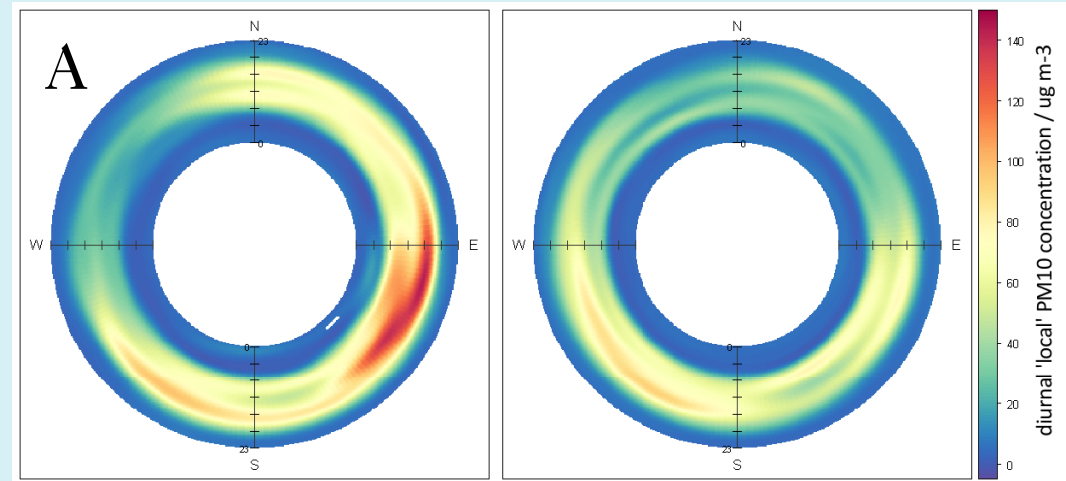
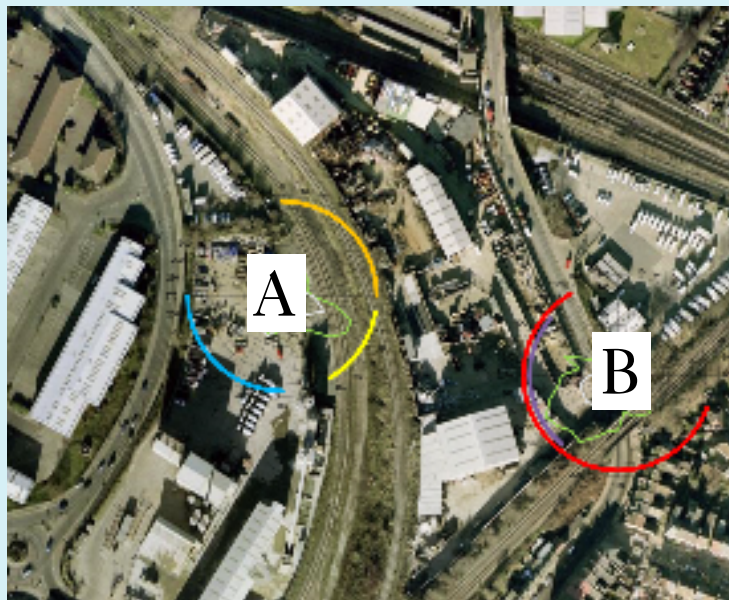


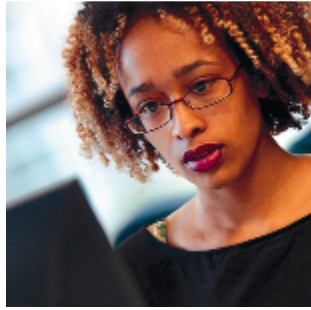
Isolation of emission sources (LBE waste transfer site)





Polar annulus plots - Industrial emissions remediation (LB Brent waste transfer site)



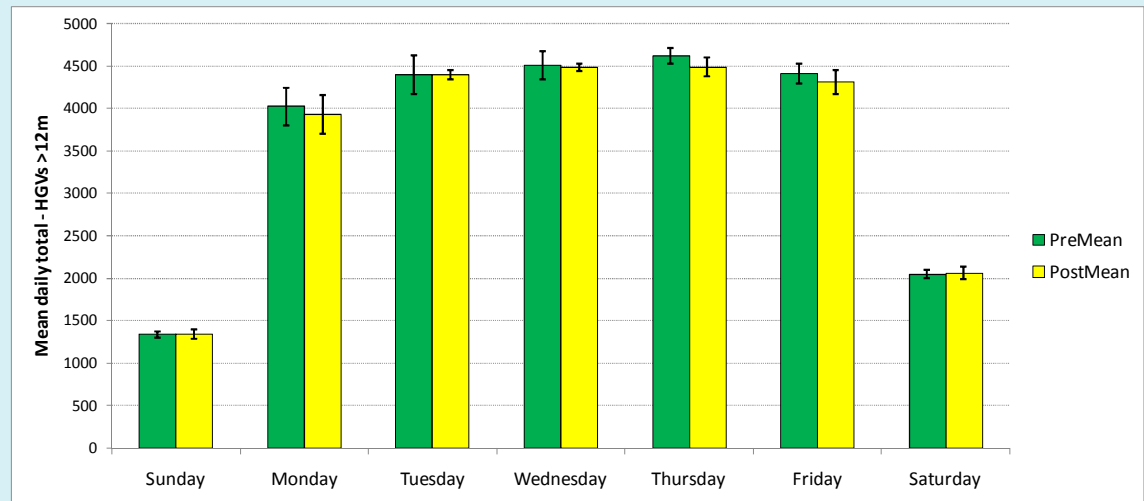
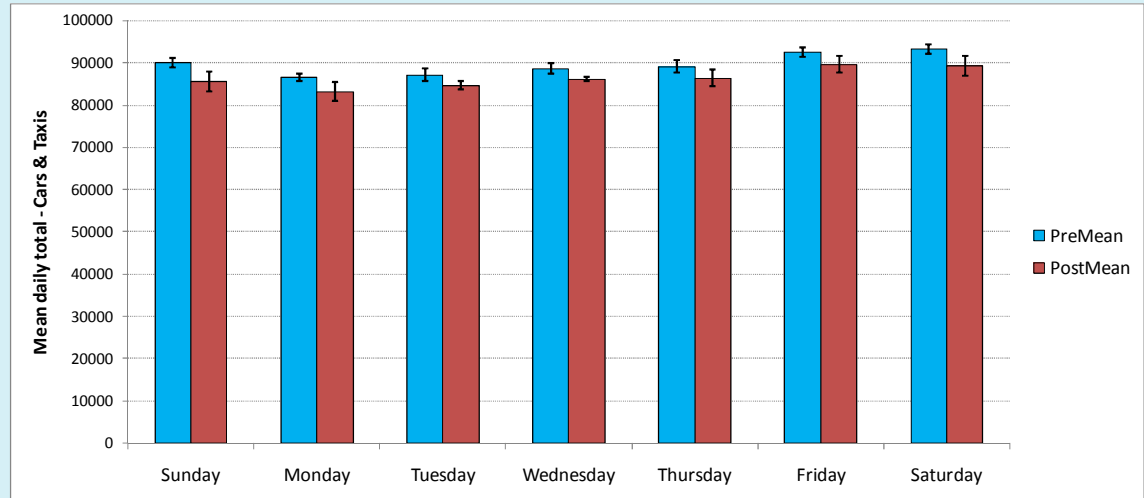


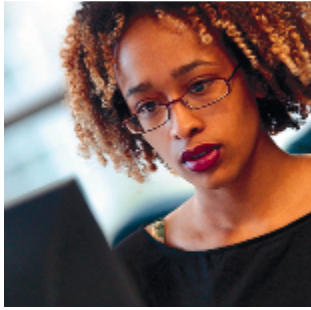
Example 4 – Traffic characterisation

- A neglected resource – difficult to robustly assess interventions without it.
- Direct connection between emissions and ambient air quality.
- A lot can be deduced from ATC data, ANPR camera data a luxury!
- Don't rely on TfL, HA etc to supply data – needs to be managed in the same way as pollution monitoring measurements.
- No chemistry, meteorology, transboundary issues so techniques can be simple – diurnal plots, pie charts etc.

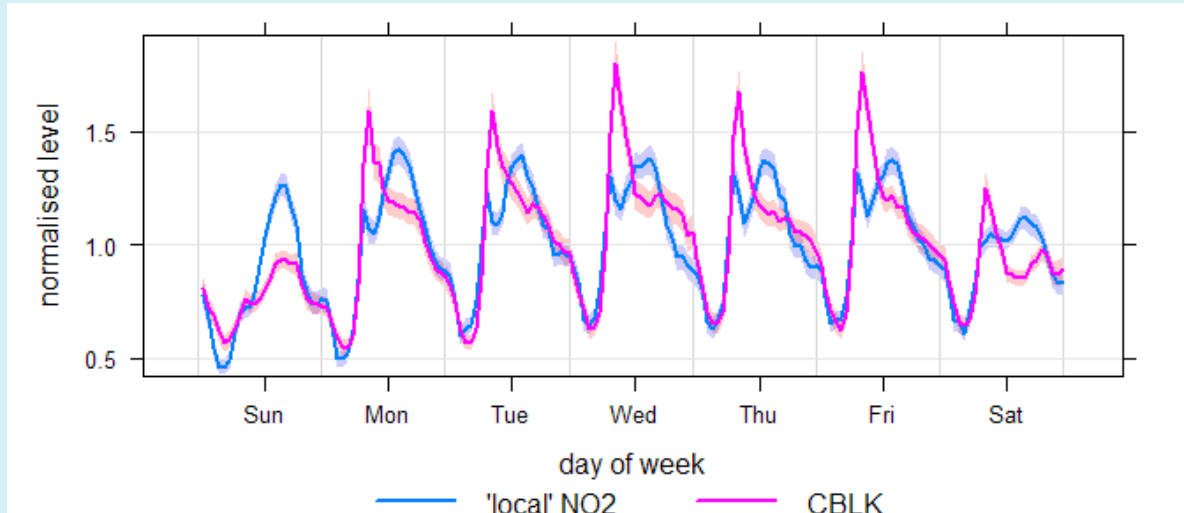
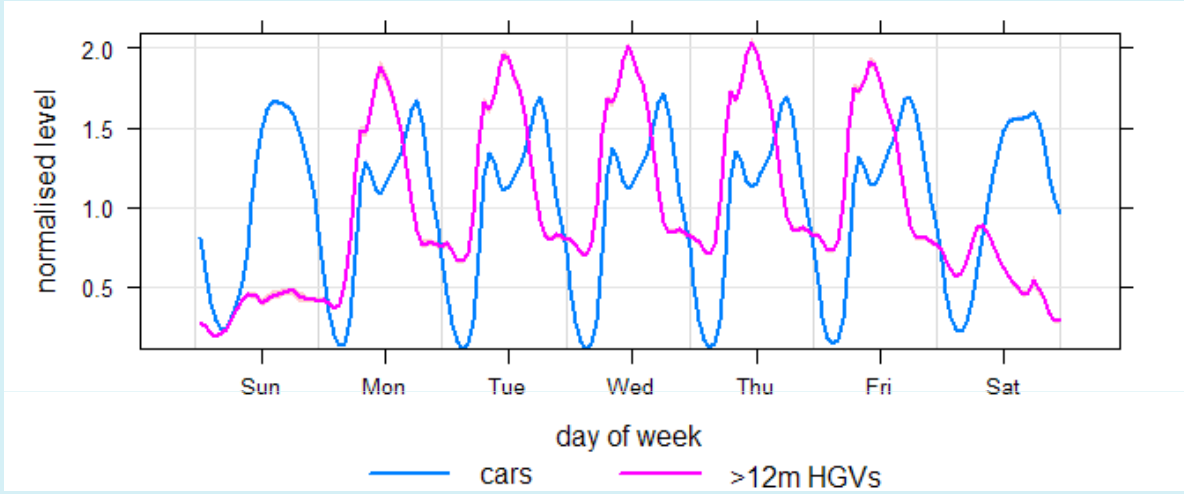


ATC data (LEZ change in vehicle flows at BT4)



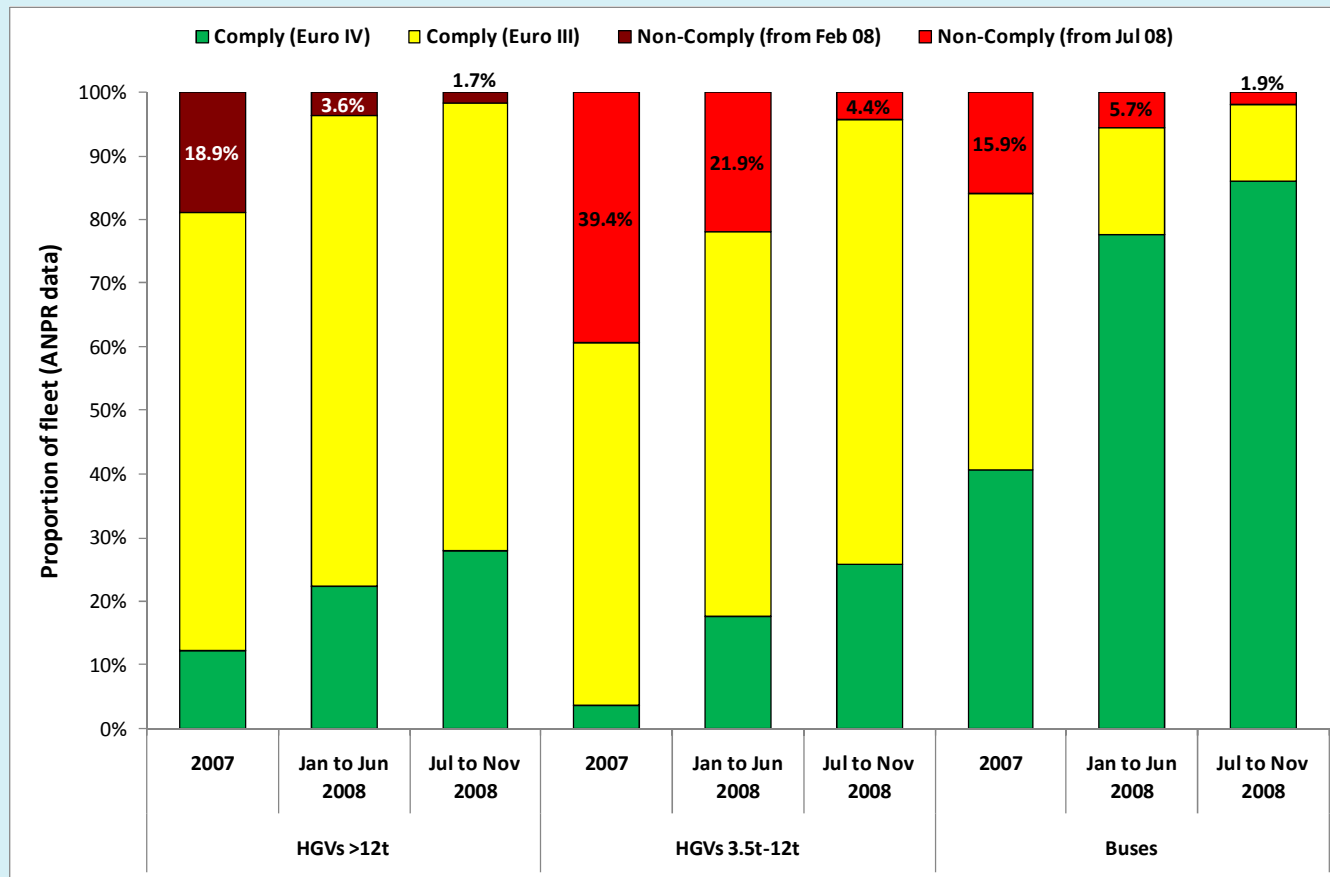


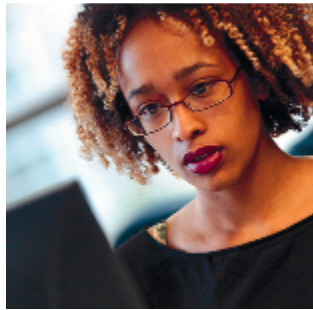
ATC data (diurnal variation at BT4)





ANPR camera data (LEZ compliance rates at BT4)





Conclusions

- LAQM process now at the action stage.
- Some measure of accountability required – efficiency improvements, effects not always as predicted.
- Body of evidence for LAQM options.
- Accountability studies must be planned in advance.
- Methods being developed to assist local government.
- Some methods powerful and accessible (some not!).
- We hope to make as many methods as possible publically accessible.



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Thank you

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