Airshed Dispersion Models (ADMs) to assess exposure & monitoring sites

Population Exposure to Air Pollution

Workshop at NIWA, Auckland

10 November 2006

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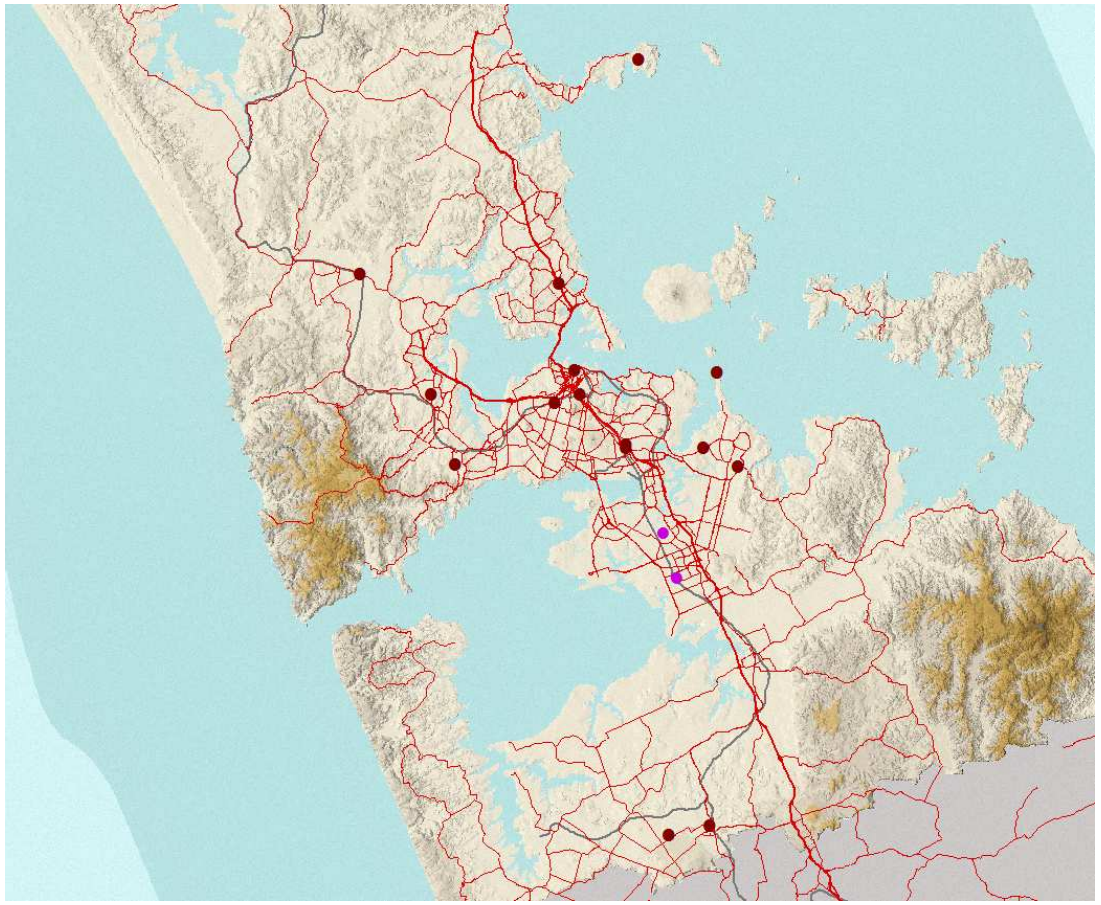
Where to monitor air quality?



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Airshed Modelling – why?

- Assistance with site selection for NES compliance monitoring and/or population exposure monitoring (high concs. and/or exposure)
- Combines effect of emissions spatial density with local meteorology
- Help to establish background monitoring sites (cold areas) and hot areas/suburbs/CAUs etc

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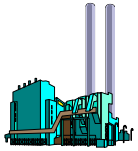
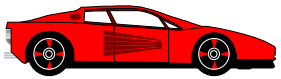
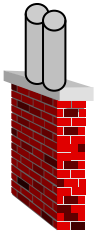


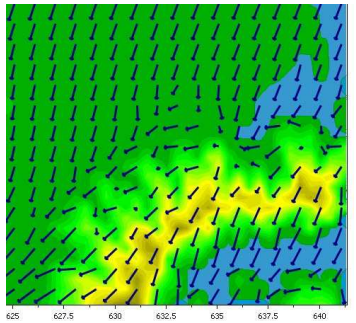
Point sources



Line sources

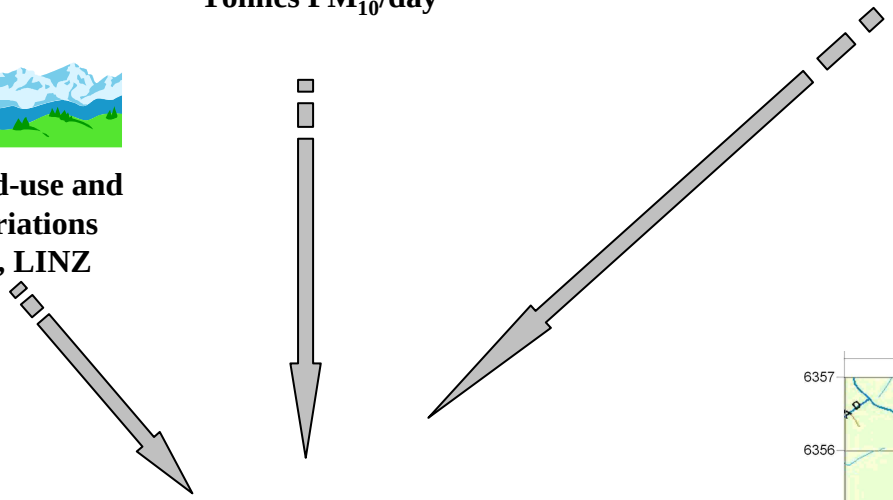


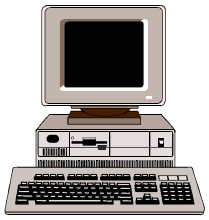
area source

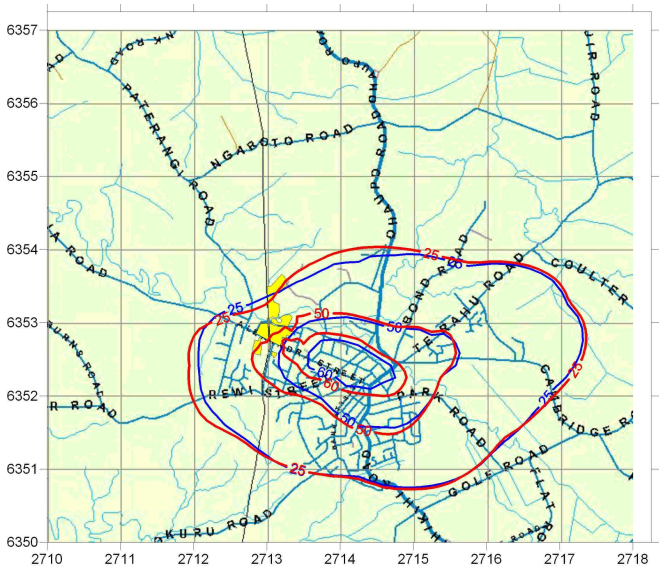


Emissions
Tonnes PM_{10}/day

Spatial Land-use and terrain variations Terralink, LINZ







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Population Exposure (p x conc.)

Application of modelled concentrations to population exposure – where are the people? Examples:

a. **Concentration 'weighted' by population density over some exposure period. Variation on (a). Count of population exposed to mean concentrations over some threshold (example from Gimson/Scoggins)**

a. **Stochastic models – random population sampling in spatially varying concentrations, to get distribution of exposure (e.g. median 20 µg m^{-3}, 90th %-ile 60 µg m^{-3})**

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Timescales of conc. (exp. potential)

- ‘Acute’ – hours, daily - immediate health effects. Models can be used for these cases.
- ‘Chronic’ – Annual or multi-annual effects. Models can now be used here too
- HAPINZ – long-term concs.
- NES – short term concs.
- Monitoring locations for acute vs chronic exposure concs.

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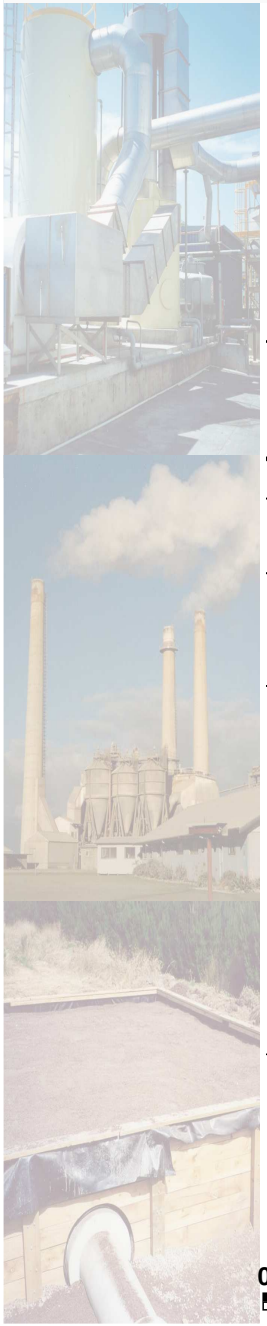
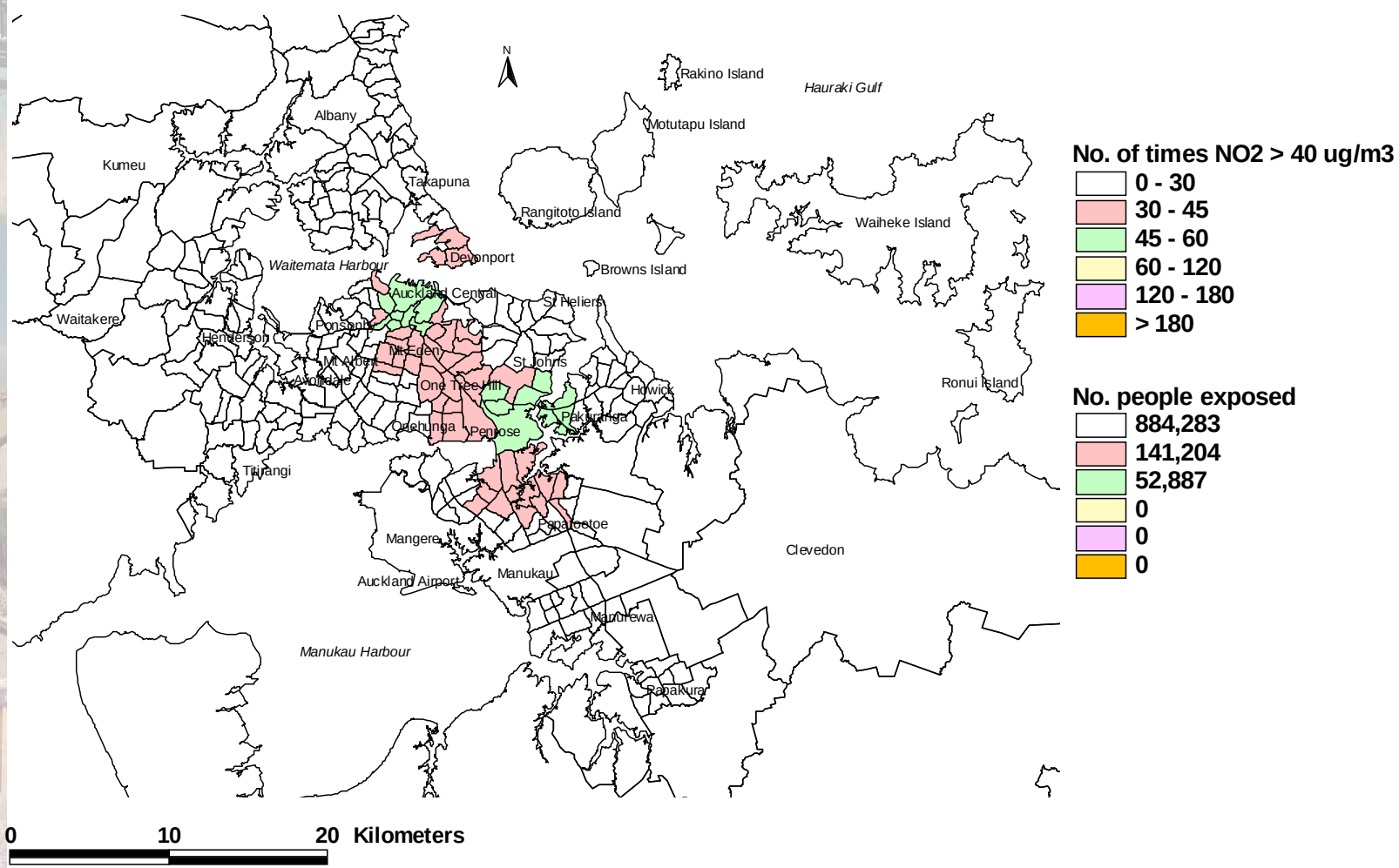


CALGRID NO_2 MODELLING – Auckland - winter



No. of times NO2 > 40 ug/m3

- 0 - 30
- 30 - 45
- 45 - 60
- 60 - 120
- 120 - 180
- > 180

No. people exposed

- 884,283
- 141,204
- 52,887
- 0
- 0
- 0

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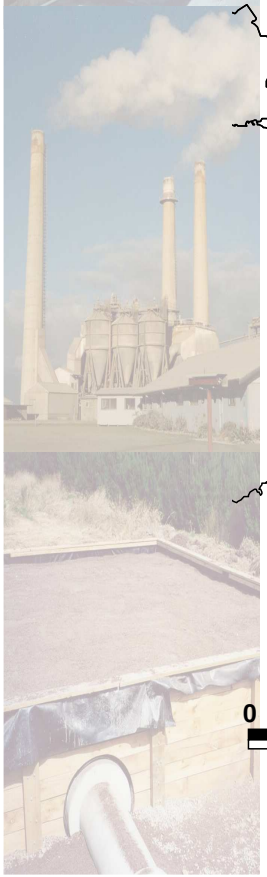
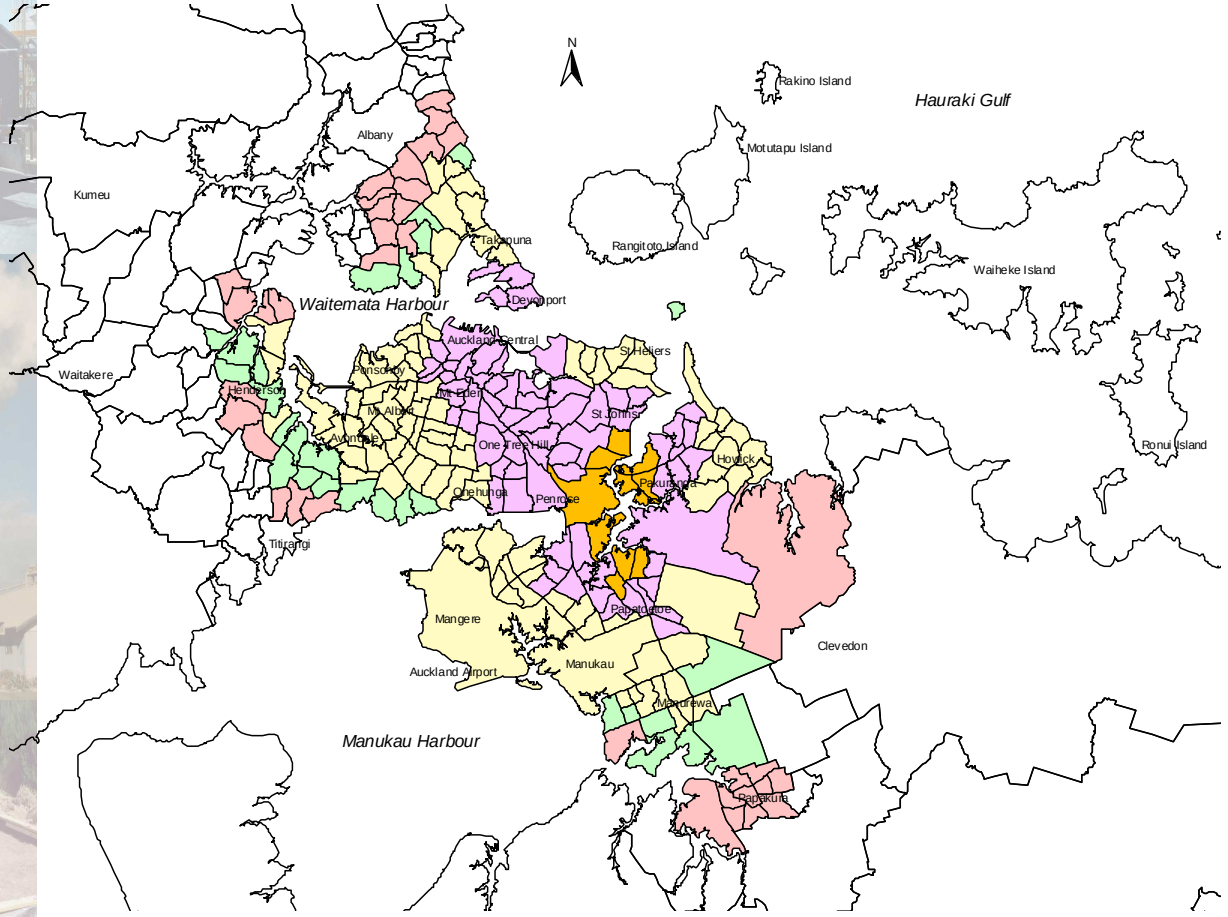


CALGRID NO_2 MODELLING – Auckland - summer



No. of times NO2 > 40 ug/m3

- 0 - 30
- 30 - 45
- 45 - 60
- 60 - 120
- 120 - 180
- >180

No. people exposed

- 242,679
- 123,909
- 108,762
- 343,182
- 216,393
- 43,449

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Source

- Taken from Gimson & Scoggins (CASANZ conf. 2002)
- Results used with hospital admissions data to associate pollution levels with health effects down to suburb level. (Scoggins, A.; Kjellstrom, T.; Fisher, G.; Connor, J. Gimson, N. 2004: Spatial analysis of annual air pollution exposure and mortality. Science of the Total Environment 321(1-3): 71-85.
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- Since then, two year-long model runs have been carried out, with NO_2 and PM_{10} outputs used in a similar way.

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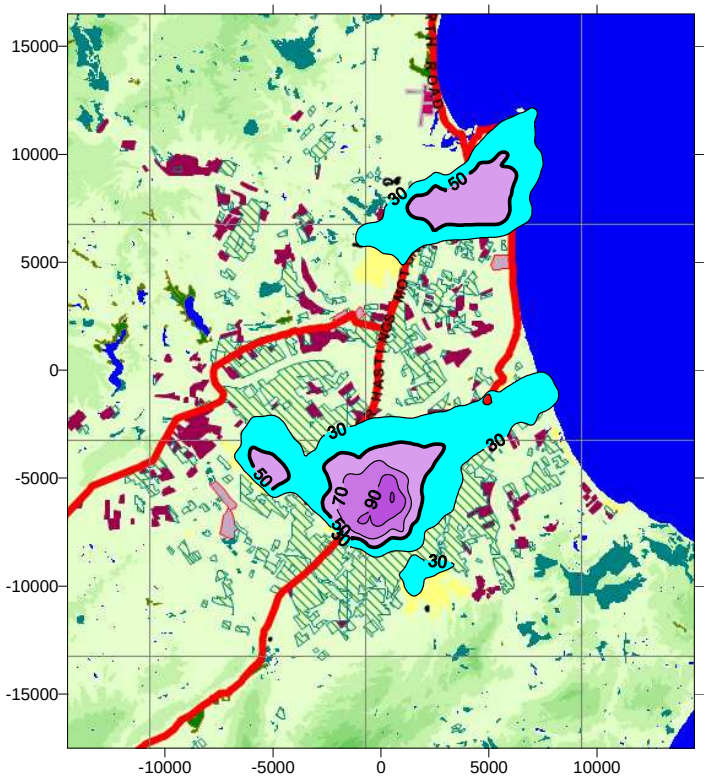
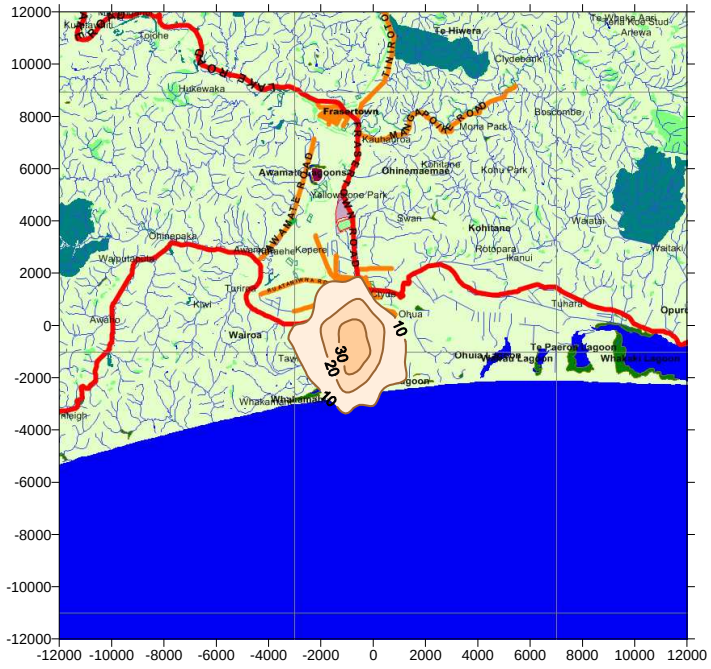
Airshed Modelling of PM_{10} – Hawke's Bay. Using TAPM



Hastings & Napier



Wairoa

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Comments so far..

- Airshed models to give ‘big picture’ of pollution hotspots (by suburb, CAU)
  - ‘background’ = pollution from surrounding urban area, not individual sources
  - HAPINZ study
- Identify background areas and high conc. areas (Regional Scale)
- Model-types reflect emissions resolution, contaminant type and aim of ambient monitoring
- For more detail variations within the suburb/CAU scale – need refined model and emission information (Street-Scale)
- Monitoring data + air shed modelling results support evaluation

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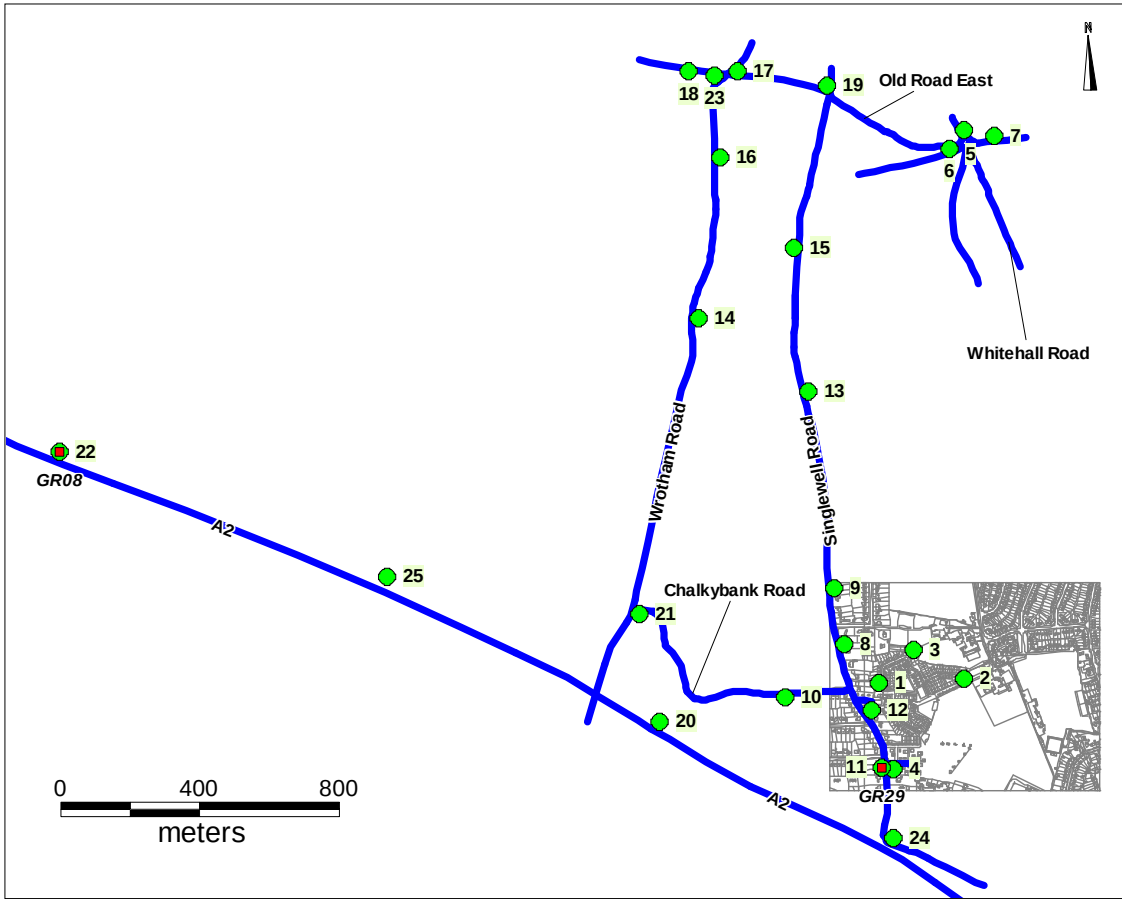
Hot & Cold Spots – Looking at the Street Scale (London)



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NO_2 variation at street scale

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Discussion