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Predicting air pollution – applications of dispersion modelling to NES implementation

Air Quality Management Workshop

Meteorological Society of NZ

Neil Gimson

Kingett Mitchell Ltd

University of Canterbury - 20 November 2006

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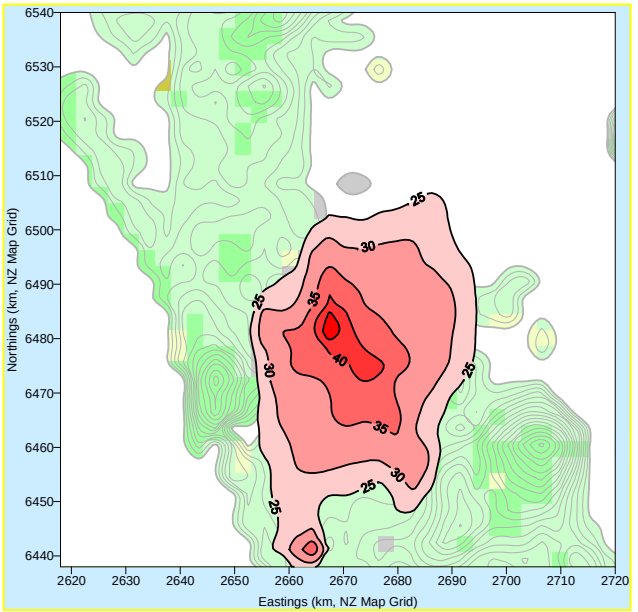
Models to complement monitoring

Filling in the Gaps –

From a handful of monitoring sites, to ➔ ➔ ➔



(Modelled max. NO_2 in Auckland)

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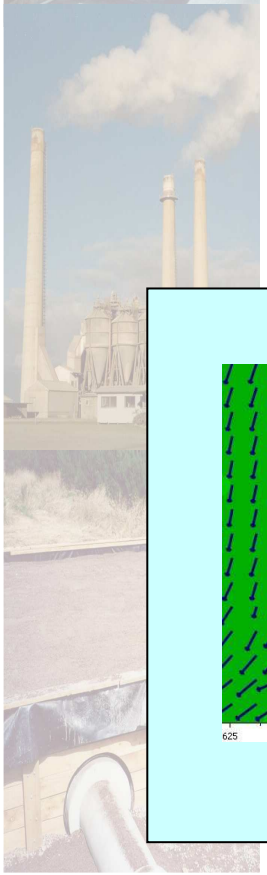
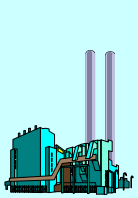
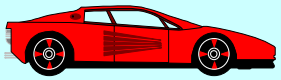
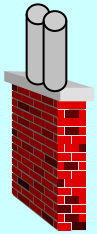




Point sources

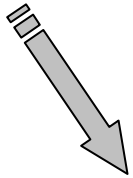


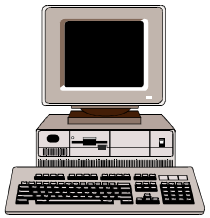
Line sources

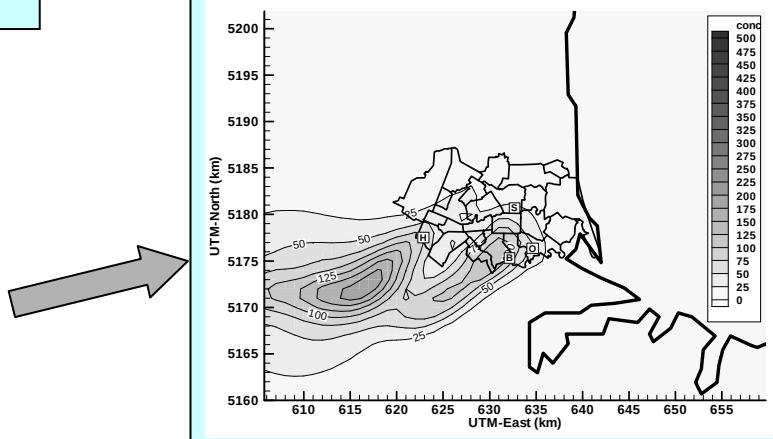


Area sources

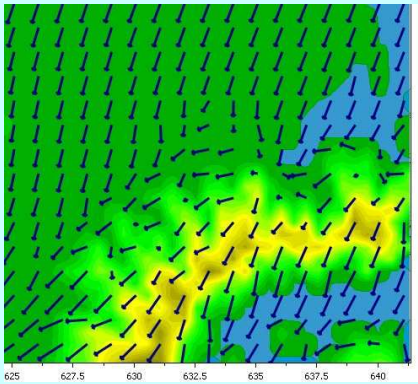
Emissions







Modelled Pollution Dispersion



Meteorology

Dispersion Modelling

(converting emissions to concentrations)

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Air Quality Science + Applications

- **Fundamental Science**
  - **Assessing model performance**
  - **Validation – comparison with observations**
  - **Complex geography and meteorology of New Zealand**
  - **Dispersion / chemistry in the urban boundary layer**
  - **Develop trust in model; use to predict pollution levels where data are sparse / absent**
  - **Watch this space … (i.e. next talk)**

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- **Application to air quality management in NZ**
  - **Standard for PM_{10} (50µg/m^3 24-hour avge.)**
  - **Is it being attained now?**
  - **Will it be attained by 2013?**
  - **What will happen in the interim (SLiP)?**
    - **dependence on emissions and meteorology**

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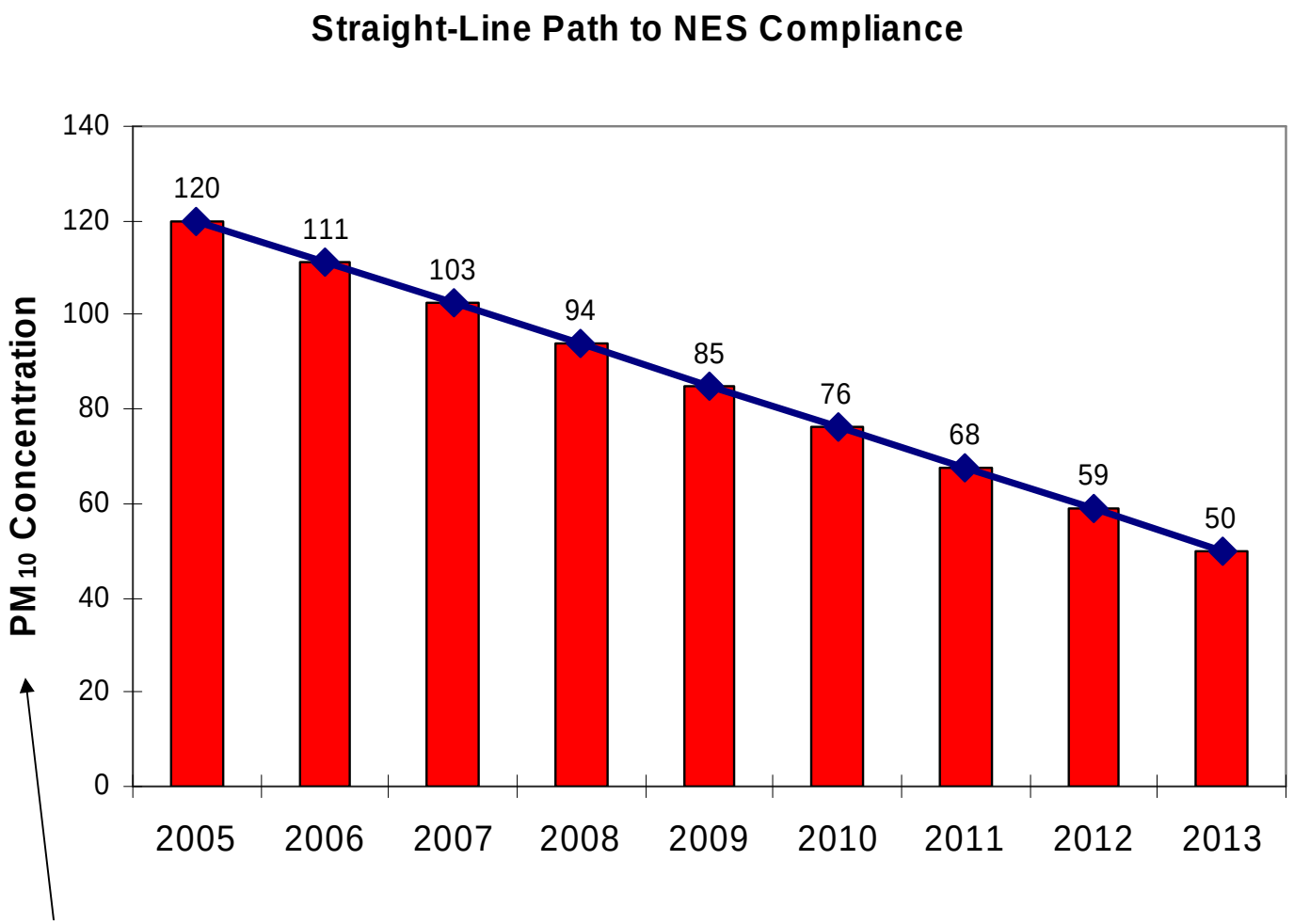
The Straight-Line Path (SLiP)



(e.g. 24-hour average, 2nd-highest)

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Start-point of SLiP = ??

- Current / historical observed PM_{10} levels
- Are they the worst possible, if record is short? – worst-case meteorology
- Could PM_{10} levels be worse away from monitoring site?
  - or in general, what might PM_{10} levels be like elsewhere?

End-point of SLiP = 50 µg/m^3

- What changes in emissions are needed to attain this?
  - changes according to source-type

Can use dispersion models to help answer these questions (so long as they perform OK!)

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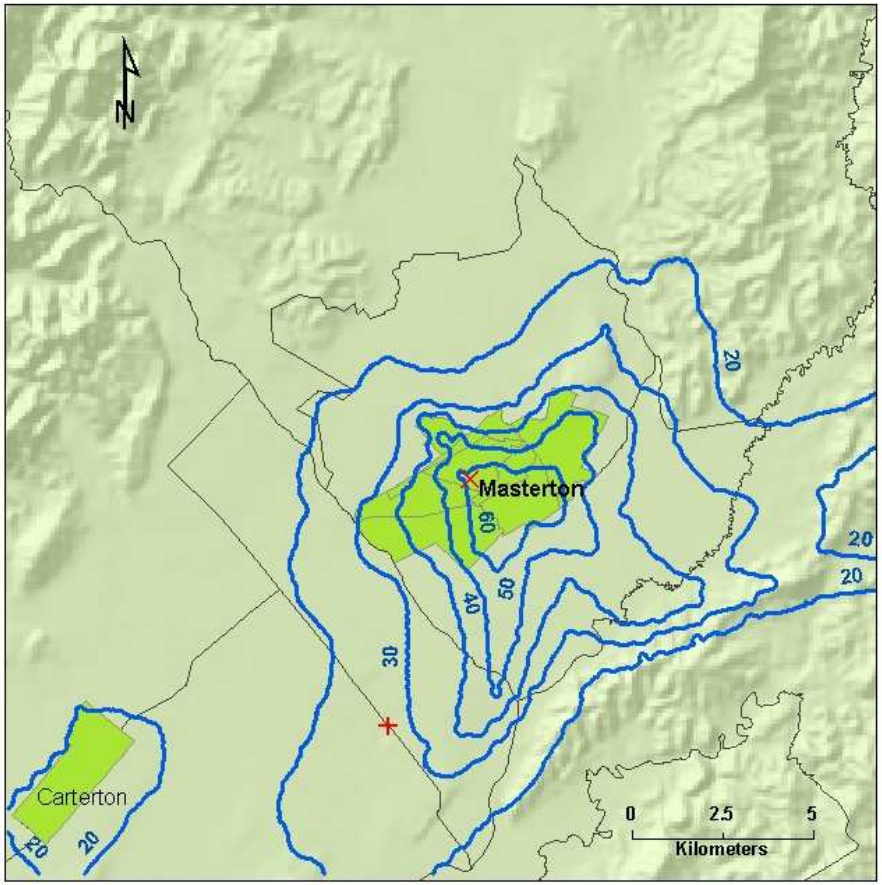
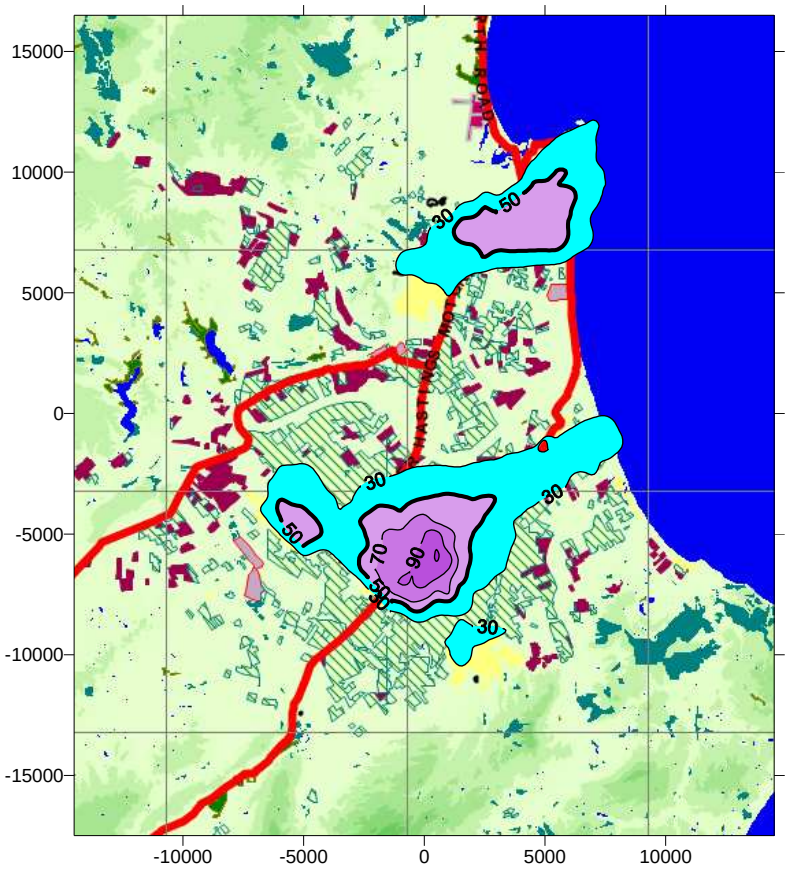
Case 1 - Masterton



- TAPM model: winter PM_{10} max. 2003
- Model performance good
- Max modelled PM_{10} located near monitoring site
- Area of exceedence of 50 µg/m^3 OK

Case 2 – Napier / Hastings



- TAPM model: winter PM_{10} max. 2004
- Model performance good
- BUT
  - max. conc. not at location of AQ sites
  - AQ worse in 2005 and 2006
- Should start-point of SLiP be taken from model results in preference to observations?

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Summary

- Non-technical introduction to dispersion modelling
- Focus on use of modelling in implementation of NES – e.g. SLiP determination
- Other uses:
  - Assistance in siting of monitors
  - Population exposure and public-health effects
  - Testing whether pollution-mitigation options would 'work'
  - Back-calculation to assess source strength
- Warnings:
  - Just an approximation to reality – don't expect miracles
  - Interpret results carefully
  - Don't give model results priority over observations