

GENERALISED LINEAR MODELLING OF THE ASTHMA HOSPITALISATION RISK AND CO CONCENTRATION IN PERTH

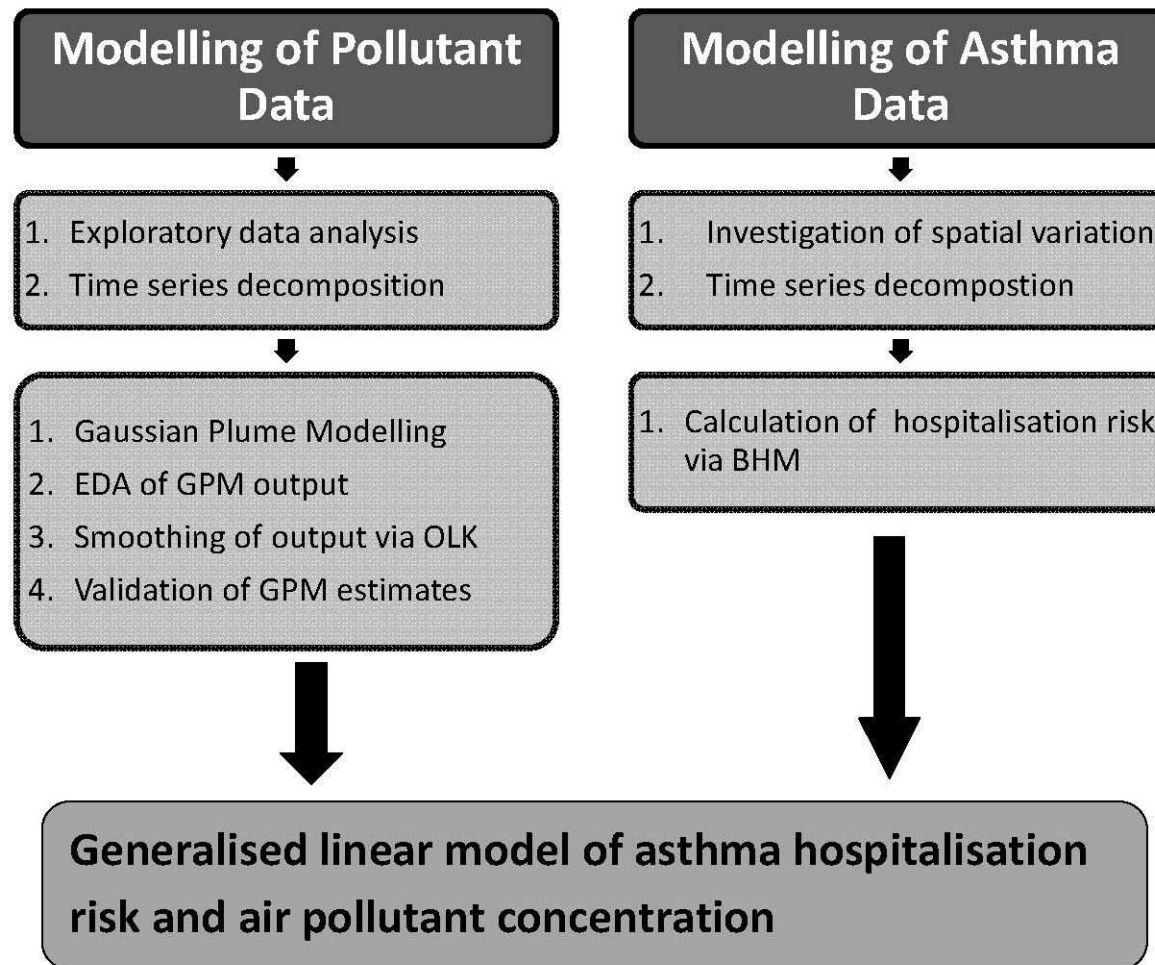
**Yuichi Yano, Ute Mueller & Andrea
Hinwood**

Edith Cowan University, Perth

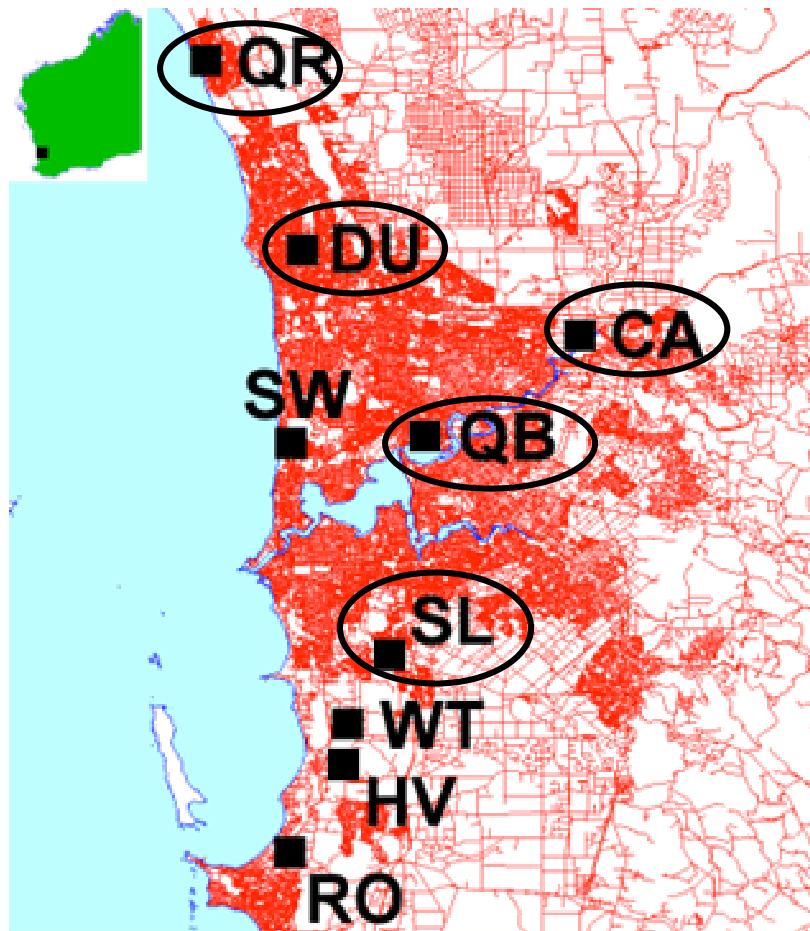
Background

- Previous studies of the relationship between asthma hospitalisation and pollutant concentration for Perth used logistic regression or case cross-over analysis
- No studies considering the spatial distribution of the pollutant concentrations are available for Perth

Workflow



Pollution Concentration



- Five locations with measured concentrations of CO, NO₂, PM2.5 and PM10
- Emission inventory data for 2006 to provide better spatial resolution (grid size 3km by 3 km)
- Monitored data were used to assess quality of fit
- Data for years 2000-2005 and 2007 were obtained through scaling using regional scaling factors

Gaussian Plume Model

The GPM is a point source plume dispersion model

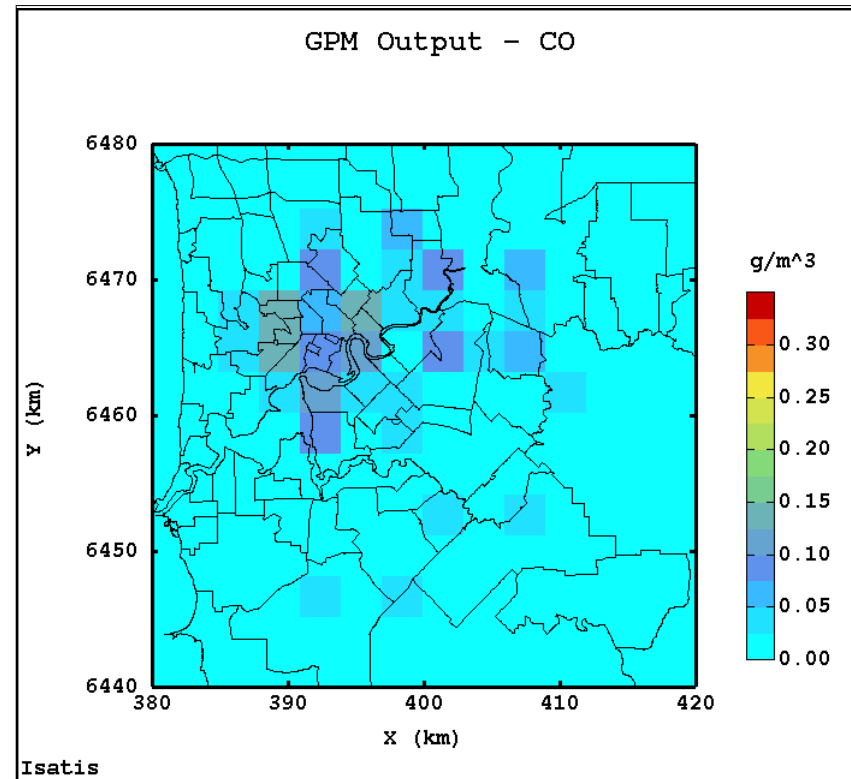
$$C(x, y, z) = \frac{Q}{2\pi\sigma_y\sigma_z u} \left\{ \exp\left(-\frac{(y)^2}{2\sigma_y^2}\right) \right\} \left\{ \exp\left(-\frac{(z+h)^2}{2\sigma_z^2}\right) + \exp\left(-\frac{(z-h)^2}{2\sigma_z^2}\right) \right\}$$

- Q emission strength
- σ_y horizontal dispersion parameter
- σ_z vertical dispersion parameter
- y horizontal distance from the source
- z vertical distance from the source
- h stack height

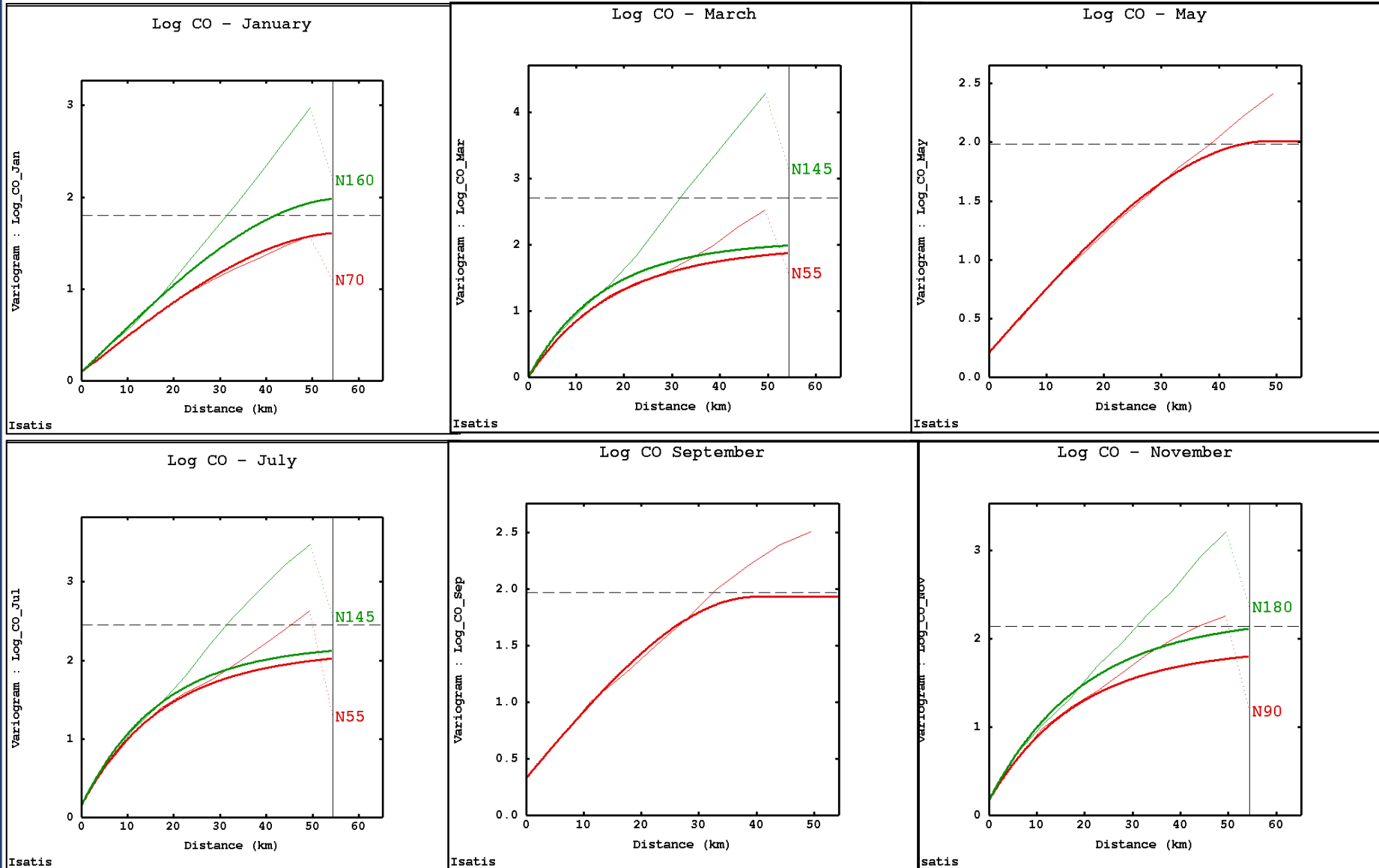
Gaussian Plume Model

Inputs

- Wind data at 12 locations
- Monthly strength of solar radiation
 - strong: Dec-Feb;
 - moderate: Mar-May, Sep-Nov,
 - slight: Jun-Aug
- Emission inventory

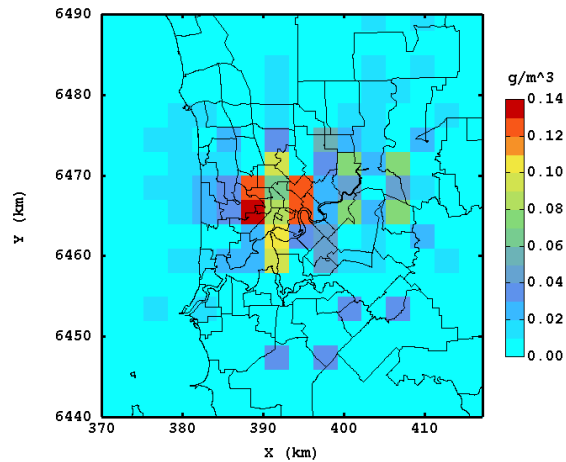


Lognormal Kriging



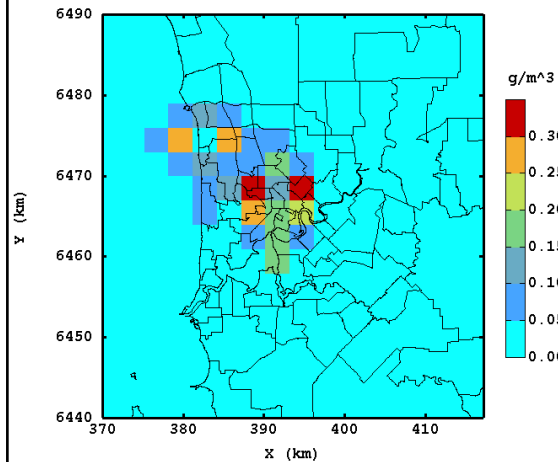
Lognormal Kriging

CO Estimate - January 2006



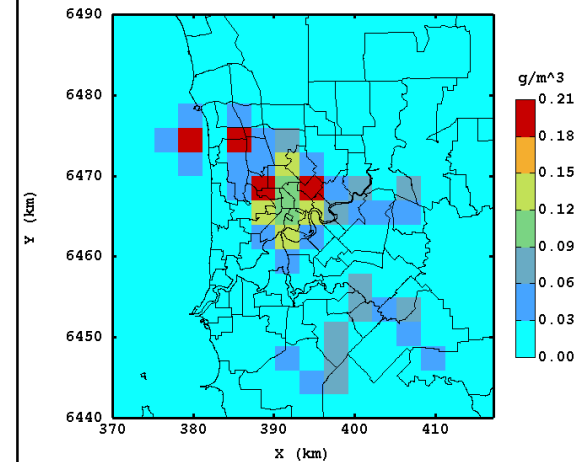
Isatis

CO Estimate - March 2006



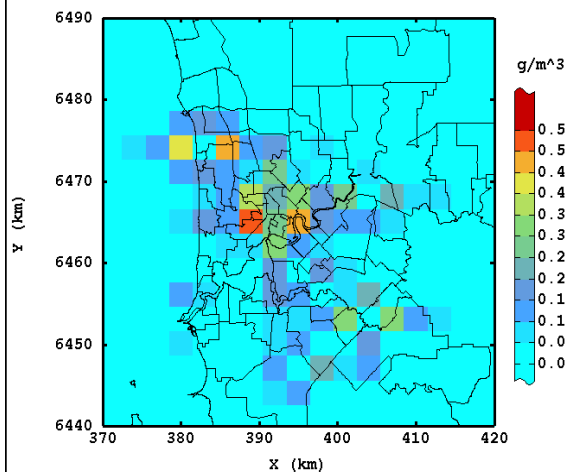
Isatis

CO Estimate - May 2006



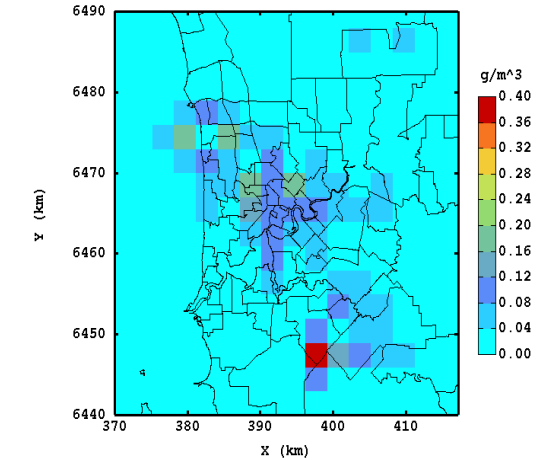
Isatis

CO Estimate - July 2006



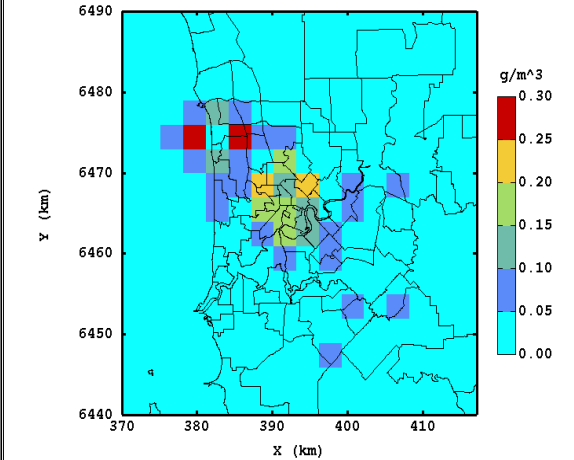
Isatis

CO Estimate - September 2006



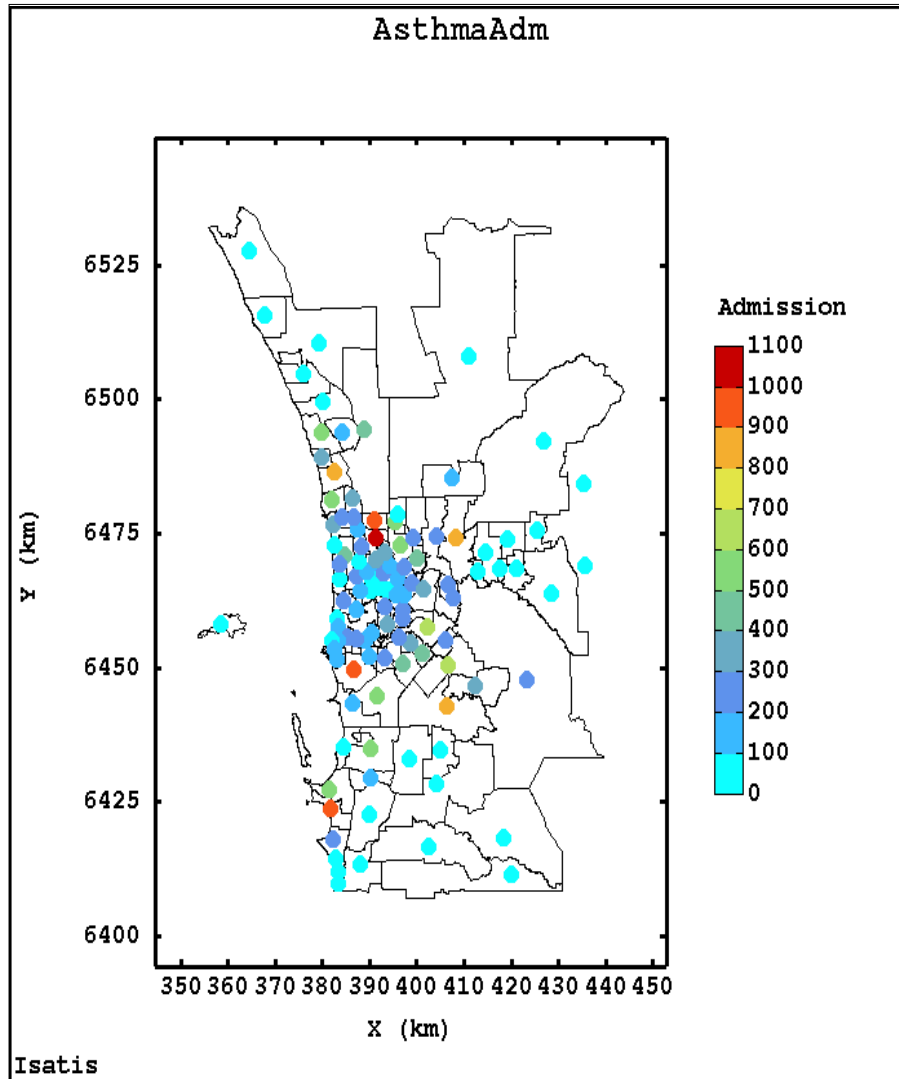
Isatis

CO Estimate - November 2006

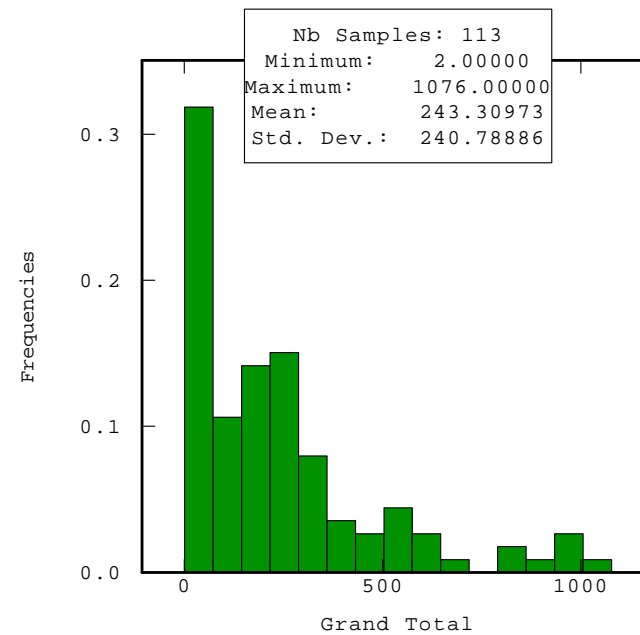


Isatis

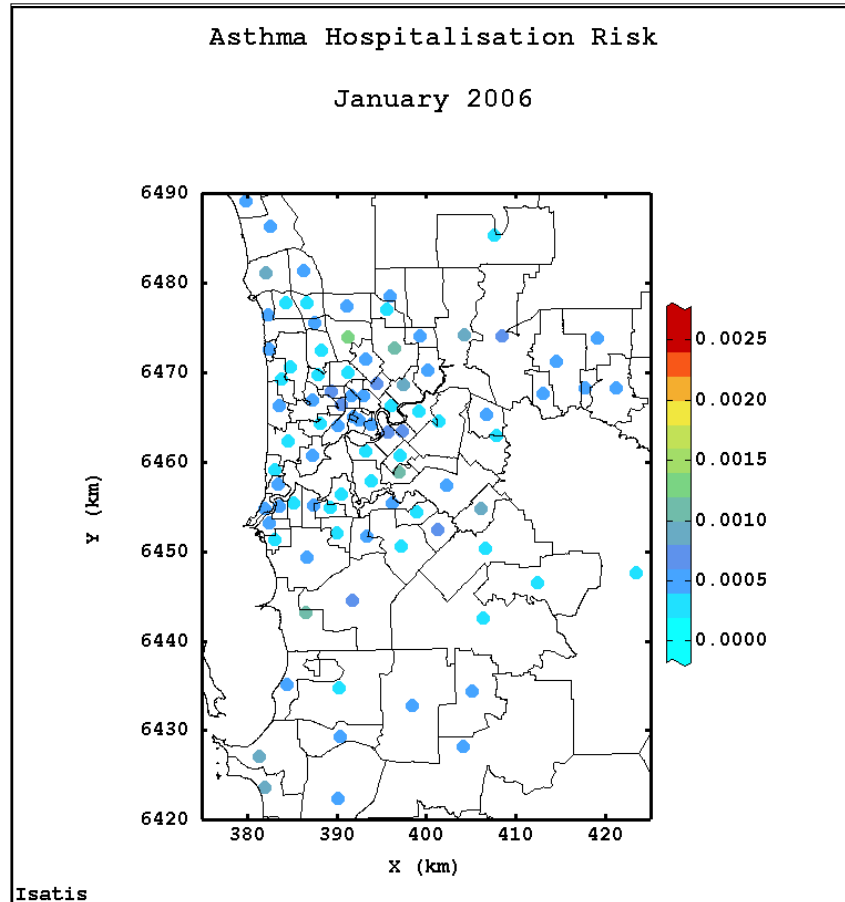
Asthma Data



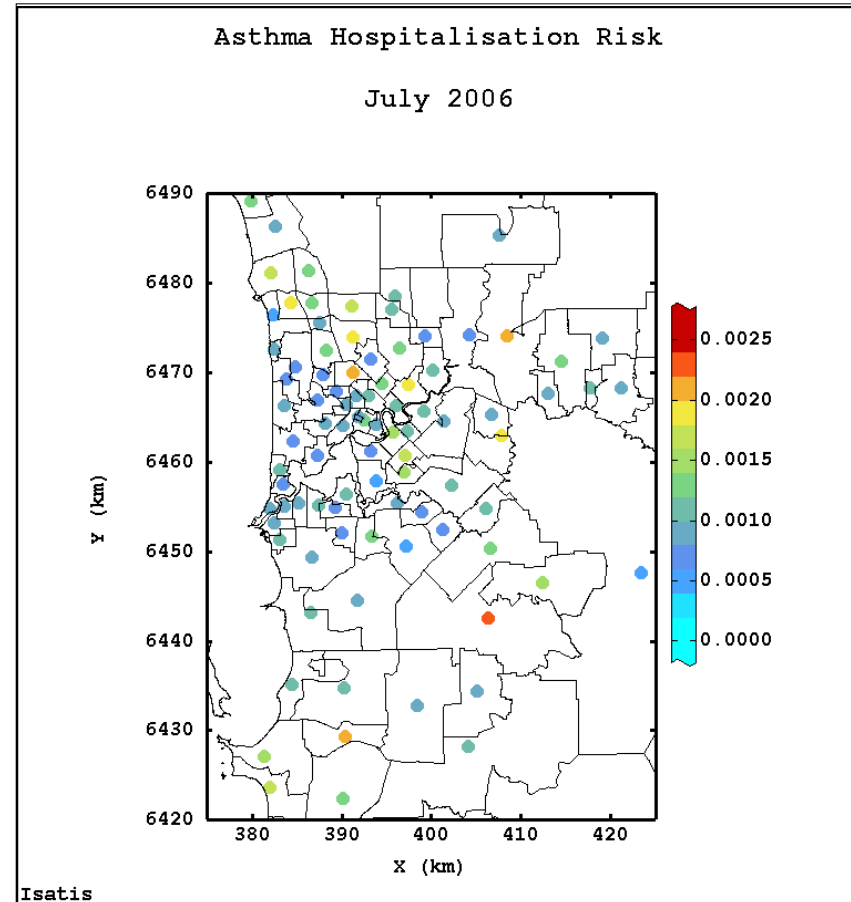
- Counts of admission smaller in central Perth metropolitan



Regional Hospitalisation Risk



January 2006



July 2006

GLM

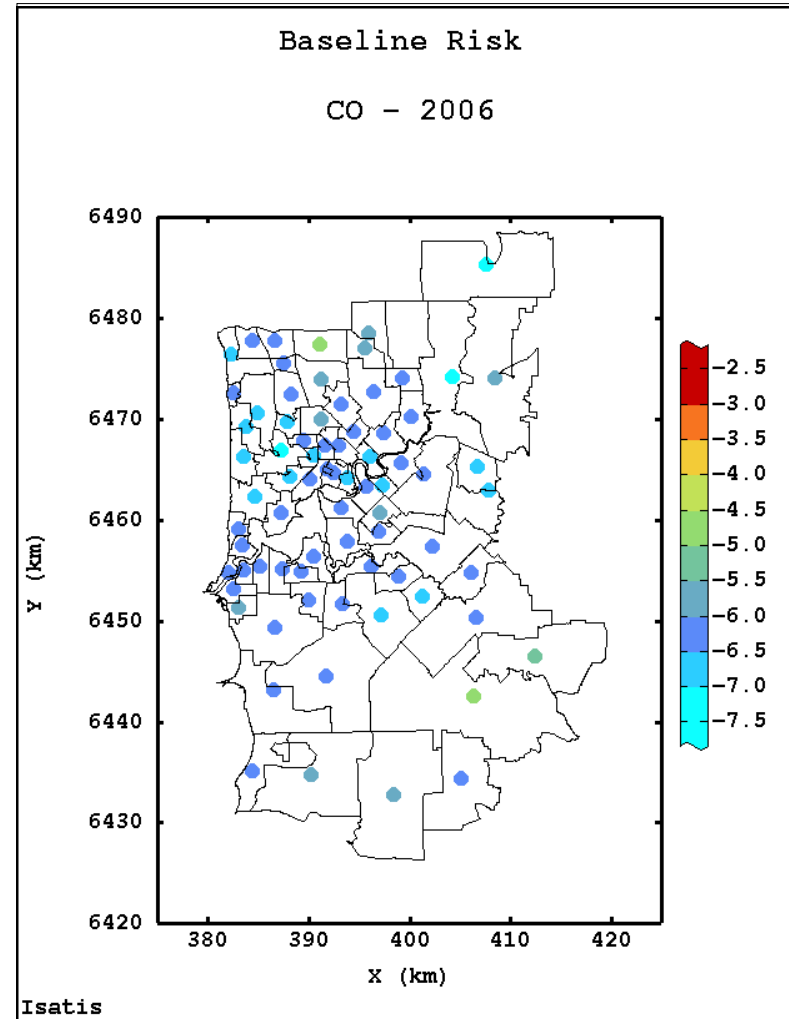
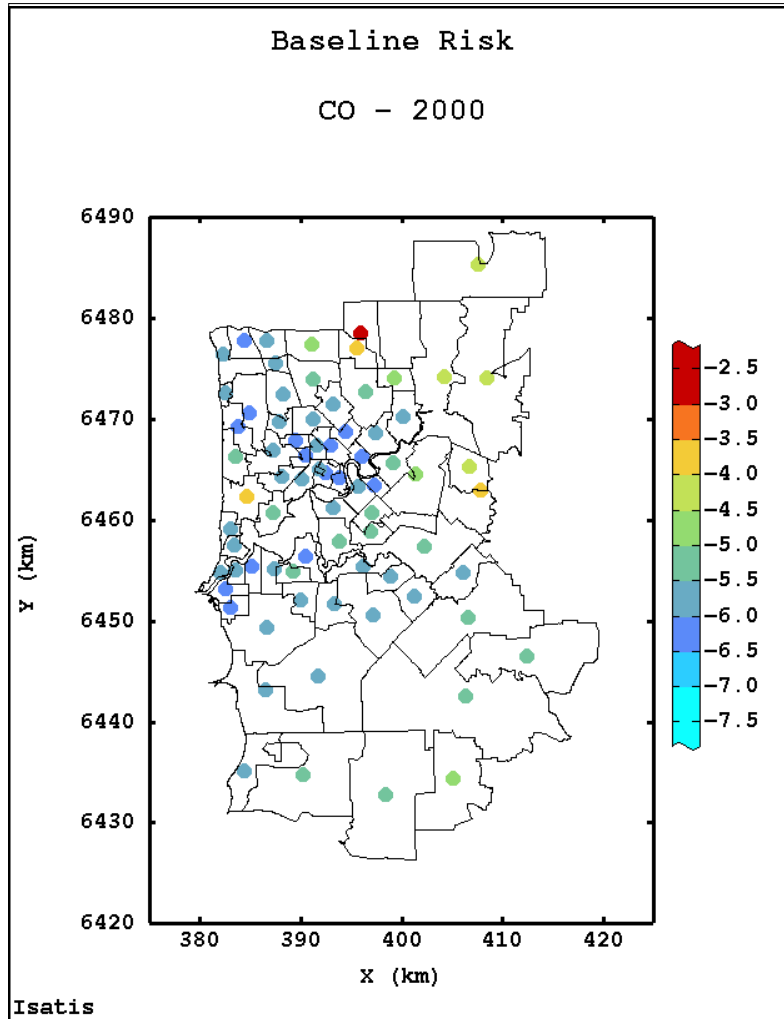
Input data

- CO estimates
- Hospitalisation risk

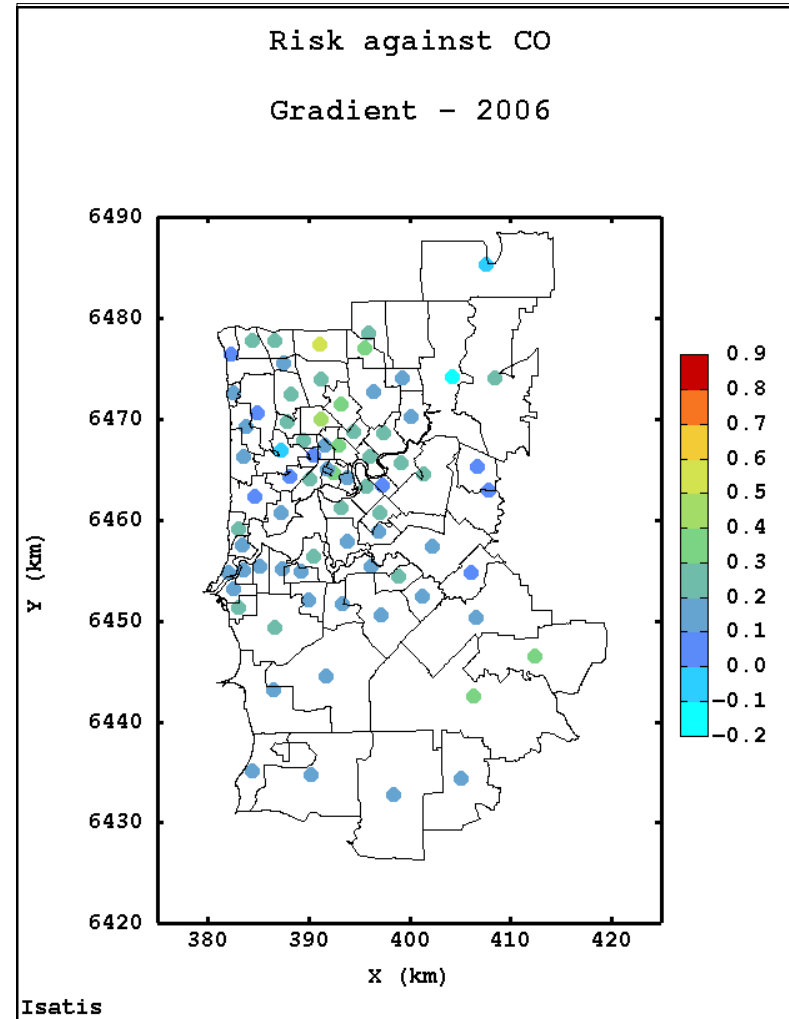
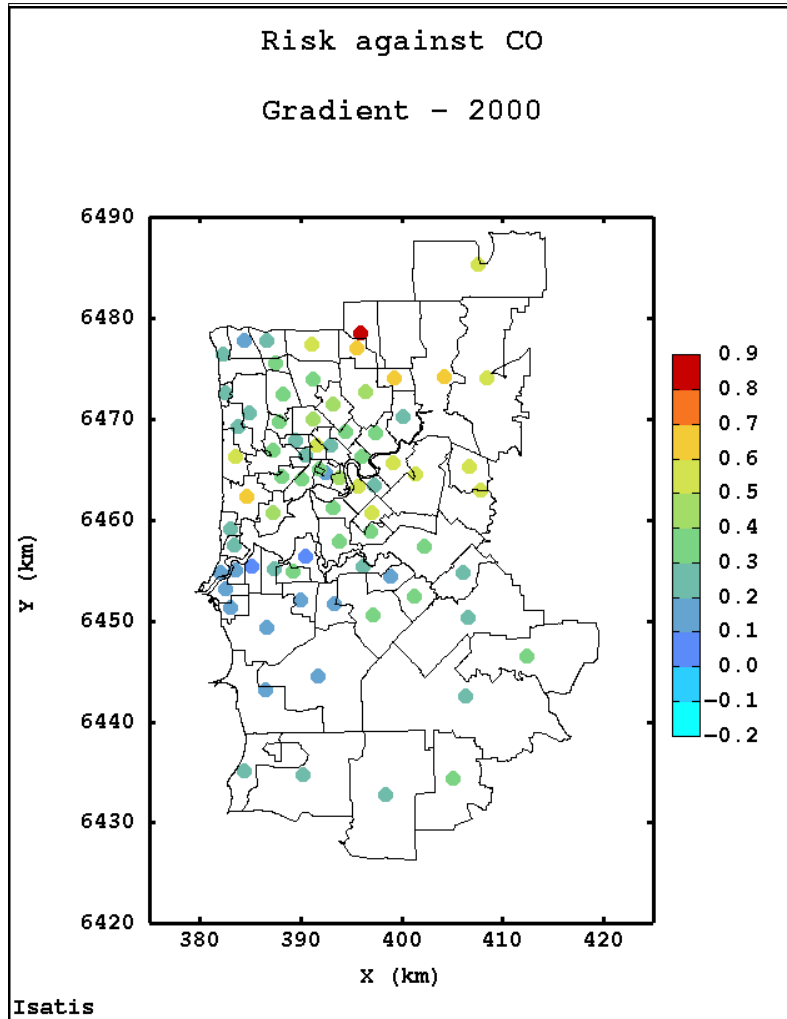
$$\log(E(Y)) = \beta_0 + \beta_1 X_{CO} + \log(e)$$

- $E(Y) = \theta e$: denotes the count of asthma hospitalisations,
- Θ : risk of hospitalisation
- e : the total population at risk
- β_0 : baseline risk
- β_1 : strength of pollutant influence

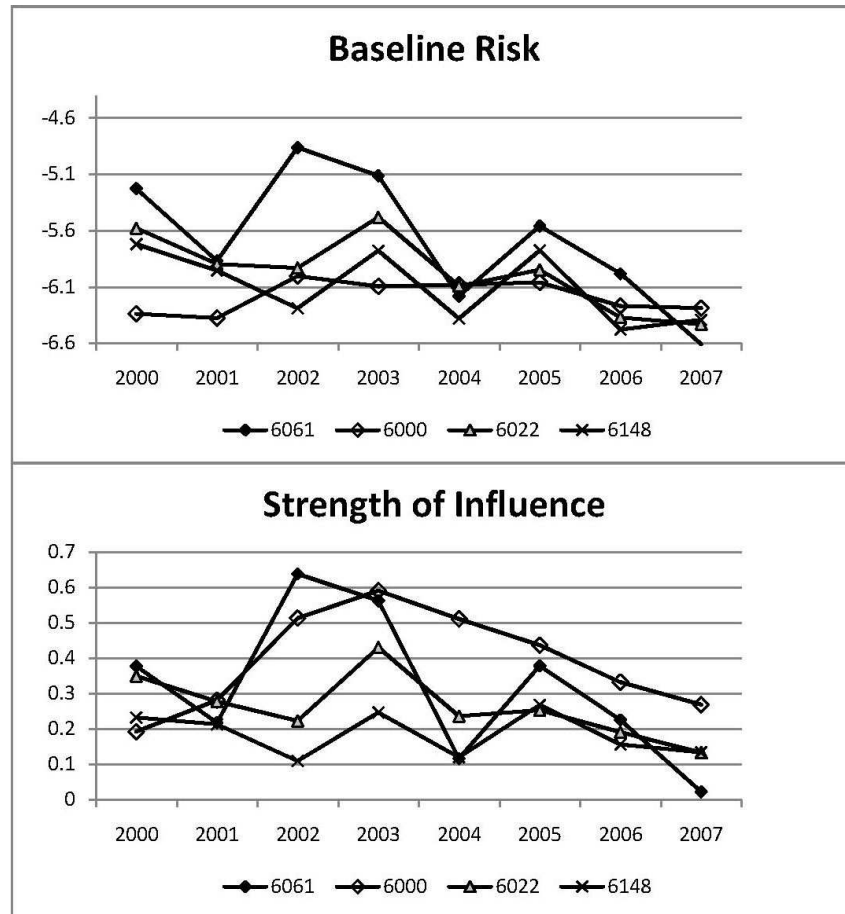
Baseline Risk



Strength of Pollutant influence



GLM Output by Post Code



- Baseline risk and strength of influence differ over time as well as by post code
- Intercept is usually statistically significant
- Strength of influence only statistically significant for some of the post codes

Thank You

