Simplified models for integrated Air Quality Management in urban areas

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A GIS based AQM system

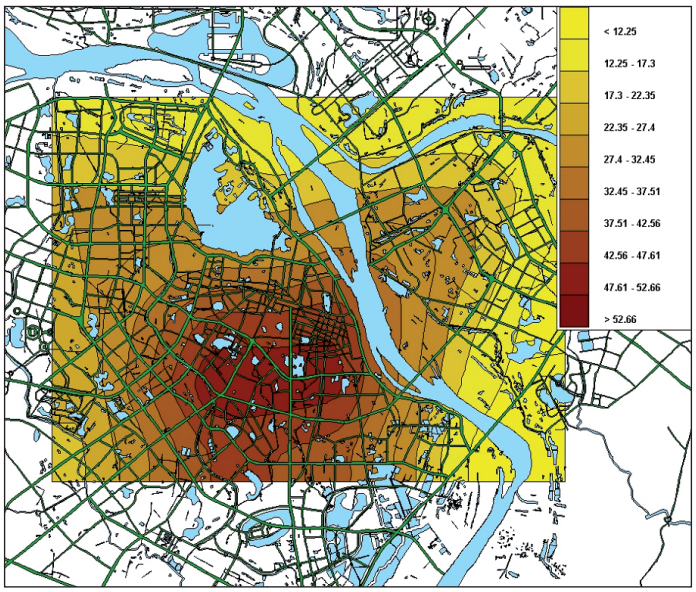
NILU has developed the AirQUIS GIS based air quality management and dissemination system to perform integrated assessment and planning for improving air quality (www.nilu.no/airquis). A comprehensive management system such as AirQUIS requires large specific datasets. There is therefore a need to develop simple interactive decision support tools assist local authorities to carry out screening processes and take appropriate decisions and actions for air quality management, especially in developing countries where available data and resources are limited.

The concept developed by NILU can be summarised in three stages: estimation of top-down emission inventory, calculation of ambient concentrations using dispersion modelling and evaluation of health effects, management options and related costs.

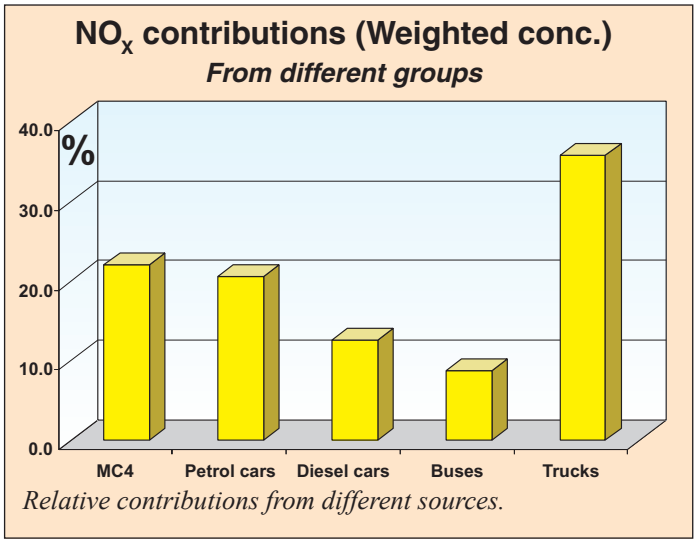
Emissions

For estimating emissions for a specific area, NILU uses a similar integrated approach as in the Simple Interactive Model for Better Air Quality (SIM-AIR) presented by the World Bank (*Shah and Saikawa, 2005*). Where detailed emission inventory is not available, estimates of emissions are performed as a top down approach. In NILU's approach, the emissions are estimated for a defined gridded domain, with user defined resolution, covering the area being studied. Input data for the modelling system include;

1) Population data,
2) Meteorological data,
3) Emission data,
4) Emission factors for source categories,
5) Dose response functions *and*
6) Cost estimates.



NO_X concentration distribution ($\mu g/m^3$) due to emissions from vehicles in Hanoi, 2005.



Relative contributions from different sources.

Model results

The models generated concentration distributions of NO_X, PM_{10} and SO_2 over the city of Hanoi (*Sivertsen and Dudek, 2006*). Figure 1 shows an example of the concentrations of NO_X (mg/m^3) estimated for all sources in Hanoi 2005.

As a first estimate/surrogate for the total population exposure the estimated concentrations have been used together with the population distributions to estimate the person-weighted concentrations.

Relative contributions

The relative contribution from each of the vehicle categories has been estimated for NO_X, PM_{10} and SO_2.

NO_X exposure due to traffic emissions is caused by truck emissions (36%), motorcycles (22%), petrol driven cars (20%), diesel cars (12%) and about 8% due to buses. A similar estimate for the PM10 contributions indicated that the total population exposure in Hanoi is due in 23% to traffic sources; 15% to industrial sources and 62% to other undetermined sources (including "background").

Decision support and planning

Simple decision support systems of this kind may also help stakeholders and participants in the generation of air quality management plans or action plans in better assessing the different options.

References

Shah, J. and Saikawa, E., 2005, Interactive Database for Emission Analyses (IDEA-Hanoi) Version 1. (Developed in the East Asia Region of the World Bank).
Shah, J. and Saikawa, E., 2005, Interactive Database for Emission Analyses (IDEA-Hanoi) Version 1. (Developed in the East Asia Region of the World Bank).

Sivertsen, B. and Dudek, A., 2006, Support for the Review of Air Quality Management Sub-component for the Hanoi Urban Transport and Development Project. Modelling air pollution in Hanoi. Kjeller (NILU OR 83/2006).