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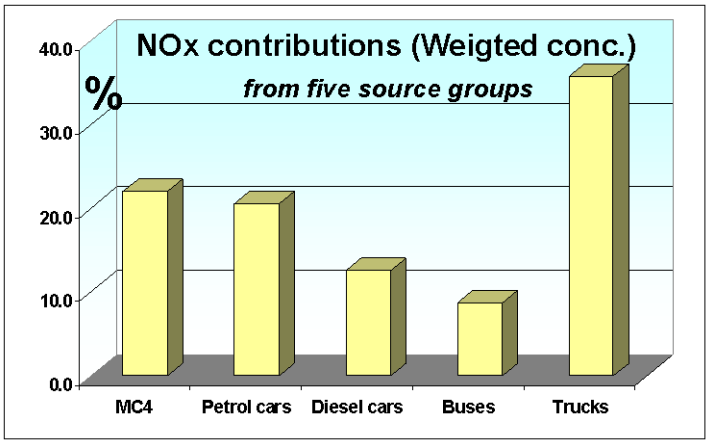

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SIMPLIFIED MODELS FOR INTEGRATED AIR QUALITY MANAGEMENT IN URBAN AREAS

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Abstract
The Norwegian Institute for Air Research, NILU has been requested by the World Bank to support the Hanoi Urban Transport and Development Project (HUTDP) with the Urban Air Quality Management Subcomponent primarily executed by Hanoi's Department of Natural Resources, Environment and Housing (DONREH). As part of the evaluation NILU has performed air quality modeling in order to assess the importance of air pollution from mobile sources in Hanoi. For this purpose, NILU has combined two models; the NILU developed air quality modelling planning system AirQUIS and the Simple Interactive Model for Better Air Quality (SIM-Air) developed by the World Bank.
AirQUIS was used to simulate the computation of an emission inventory for key pollutant and estimate the impact of the sources on air quality. SIM-Air will be used to assess and evaluate health effect impact, and allowed for various policies measures, economic and technical options to be evaluated for their environmental and health impacts and cost effectiveness. This model uses simple mathematical and financial tools to evaluate different air quality management options. All the management options are linked to cost and health impacts based on percentage change in the considered option.

1. INTRODUCTION

NILU has developed the AirQUIS GIS based air quality management and dissemination system to perform integrated assessment and planning for improving air quality (http://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 to assist local authorities to 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.

2. SYSTEM APPROACH

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.
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.

3. RESULTS AND DISCUSSION

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

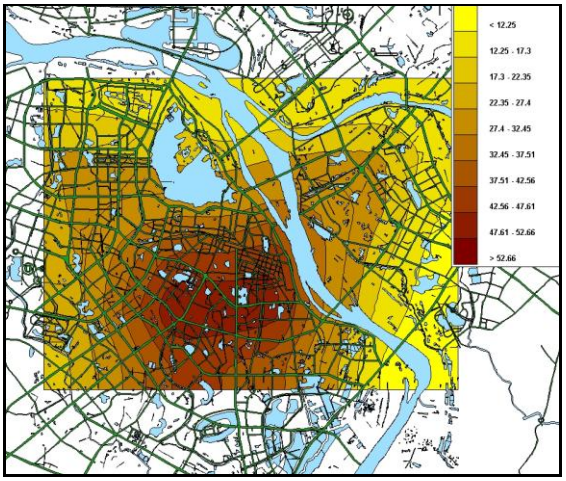

Figure 1. NOx concentration distribution ($\mu g/m^3$) due to emissions from vehicles in Hanoi, 2005.

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.

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

This simple integrated decision support tool meets the requirement of a first screening of air pollution problems in defined areas and requires less computing power than existing advanced air quality management tools including complex dispersion models. Simple decision support systems of this kind may also help stakeholders air quality management planning or action plans and easier assessment of different options.

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