

Impact Assessment System for Urban Air Pollution and Population Exposure

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AIRNET
A Thematic Network on
Air Pollution and Health



Network for Environmental Risk
Assessment and Management

Introduction

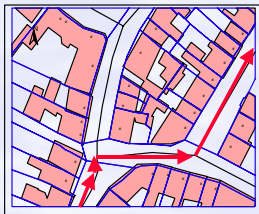
Numerous studies have shown associations between air pollution exposures and morbidity and mortality and the related social costs. AirGIS¹ is a human exposure model system that estimates ambient air pollution levels at very high temporal resolution (hourly) and spatial resolutions (address level). The system is continuously under development to support impact assessment of air pollution on human exposures and health. Pollutants include: NO_x, NO₂, O₃, CO, benzene and PM10. Particle numbers and PM2.5 will also be included in the future.

AirGIS - Human Exposure Model System

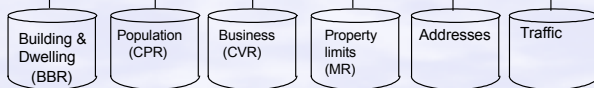
The concentrations at street levels are estimated with the Danish OSPM model². Emission estimation at individual road links is based on information about traffic intensity from external traffic models and an emission model integrated into the OSPM model. The physical dimensions of the street is estimated e.g. building heights in various wind sectors.

The OSPM model requires urban background air quality and meteorological data. The Danish UBM model estimates urban background concentrations based on a 1 x 1 km² emission grid. The emission grid is generated based on a geographical distribution of national emissions based on various geographical weight themes. The regional contribution to the urban background is based on the Danish large-scale model DEHM that relies on the European EMEP emission inventory. The model system has been validated against air quality monitoring data.

Furthermore, AirGIS comprises detailed technical and cadastral digital maps and Danish national administrative databases on buildings, cadastres and populations. It applies a Geographic Information System (GIS).



Digital maps



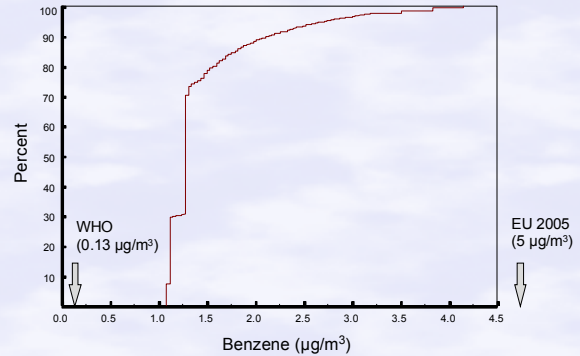
National and local databases

AirGIS is an exposure model system for estimation of exposure at address level or for personal exposure provided that route information is available describing the transport behaviour of an individual.

Urban Air Quality Assessment

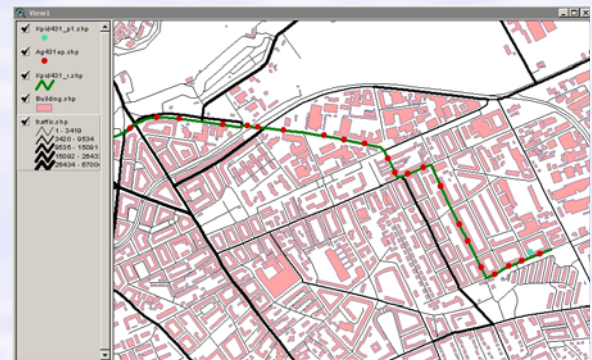
The model system is under implementation for the Greater Copenhagen region as a case study that includes 1.8 million inhabitants out of 5.3 millions in Denmark.

The system can be used in urban air quality management. Mapping and scenario results can be compared with air quality limits and impact assessment of traffic air pollution abatement measures can be carried out like evaluation of environmental zones in cities, particle filters on heavy vehicles and road pricing.



Percentage of people exposed to ambient benzene levels (µg/m³) with the residence address as exposure indicator. Example from the Municipality of Middelfart, Denmark with 10,000 addresses (1996). Similar results will be obtained for the Greater Copenhagen Area.

Air Pollution Epidemiology



Air pollution epidemiology examines the relationship between air pollution and health effects. AirGIS can provide exposure data at address level or personal exposure provided that route information is available. Example of route is illustrated.

Health Impact Assessment

The link between exposures and health impacts is under development based on existing exposure-response relationships. The development of this linkage will enable crude health impact assessment and social cost estimates.

Acknowledgement

Funded by the Centre for Transport Research on Environment and Health Impacts and Policy under the Danish Strategic Environmental Research Programme 2000-2004. Further details on <http://www.akf.dk/trip/projekter/32proj.PDF> and <http://www.akf.dk/trip/projekter/33proj.PDF>

References

- 1) Jensen, S.S., Berkowicz, R., Hansen, H. Sten., Hertel, O. (2001) A Danish decision-support GIS tool for management of urban air quality and human exposures. Transportation Research Part D: Transport and Environment, Volume 6, Issue 4, 2001, pp. 229-241.
- 2) Berkowicz, R. (2000) OSPM - A parameterised street pollution model. Environmental Monitoring and Assessment, Volume 65, Issue 1/2, pp. 323-331.

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