EXPERIENCES WITH USING AN INTEGRATED AIR QUALITY MANAGEMENT TOOL, AIRQUIS, FOR AIR QUALITY MODELING AND EXPOSURE ASSESSMENT IN URBAN AREAS IN POLAND

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Summary

One of the main challenges today is to have timely and appropriate access to relevant and good quality environmental data. This was one of the reasons to create the AirQUIS tool, which is a modern, GIS based, air quality management system developed by Norwegian Institute for Air Research (NILU). Relations between emissions, air quality and health impact were the basis for the case studies for two cities in Poland, Katowice and Kraków.

This poster highlights NILU Polska experiences using the AirQUIS (www.airquis.com) system to perform dispersion calculations for these cities. More details: The scope of this work, exemplary results and evaluation of the calculation preformed are given in the paper. For additional information, please visit web page.

The Air Quality Management System AirQUIS

The AirQUIS system is a flexible tool and specifically constructed for air quality, surveillance and planning. It consists of separate modules, and can easily be customized to meet any special requirements as specified for the installation site.

The system can be used for monitoring and to estimate environmental impacts from planned measures to reduce air pollution.

The AirQUIS system contains the following modules:

- Automatic Data Acquisition System
- Measurement Module
- Statistical and Graphical Presentation Tools
- Emission Inventory Module
- Models
  - *Emission Model*
  - *Wind Field Model*
  - *Dispersion Model*
  - *Exposure Model*
- Map Interface (GIS)

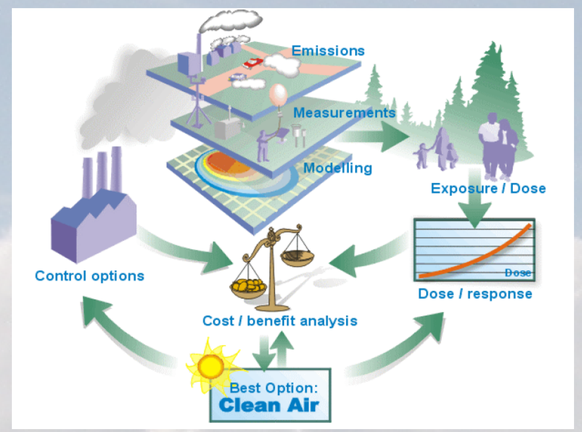

Figure 1: Elements of an AQM System [Laupsa & Fløisand,2005]

AirQUIS was developed as a tool for decision makers in range of air quality management, which is aimed at making it easy to use and include a Geographical Information System (GIS) tool for data presentations and analysis, as well as the ability to handle with the ADACS including quality control of transferred data.
Modeling of emission takes into account all the three categories of sources: area, line and point sources.

- GIS makes it easier to search for geographical linked data in the database
- GIS presentation of area distributed consumption and emission data gives a good overview of where to expect high impact of air pollution
- Viewing the measurements station on a map together with the pollution sources will give an idea of what concentrations one expect for different wind directions and the representativity of the stations
- Display the model results on a map gives a visual presentation of the geographical distribution of air pollution and regions with high impact
- Display the model results on a map can be used for public information on pollution levels in different parts of a city

Concept of Geographical Information System (GIS):

- Visualization information
- Showing relationships
- Creating and updating data
- Solving problems
- Presenting results

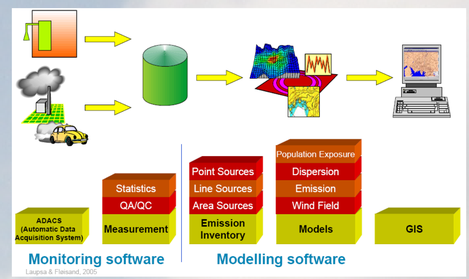

Figure 2: The AQM System [Laupsa & Fløisand, 2005]

Experiences with air quality modeling

NILU Polska applied the AirQUIS system for air quality modeling in two urban areas in Poland. The most comprehensive cases carried out were Katowice within the scope of dispersion and exposure calculation for URBAN EXPOSURE project and Kraków within the scope of dispersion modeling for JRC Project: *From toxic emissions to health effects: An integrated emissions, air quality and health impacts case study in Krakow.*

The computational domain for the Katowice district was 400 km² (20×20 km) and the spatial grid resolution was 0.25 km² (500×500 m). In vertical, 10 grid layers were defined and the total depth was 2.8 km [Piątek R., 2006]. All three types of emission sources: area, point and line may play important role in the Katowice area and had to be considered. Many of the stacks, which have impact on city air quality is localized outside of the domain. However, these sources were included in the dispersion calculations.

Calculations were performed for two selected periods, from 02 to 09 February 2002 and from 09 to 16 July 2002 (a week in heating season and a week out of heating season). Exemplary results of the modeling and comparison with measurements are showed in Figure 3 and Figure 4.

Based on experiences with URBAN EXPOSURE project for Katowice, NILU Polska took part in JRC Krakow Integrated Project. Wind field was calculated using meteorological observations from Krakow Czyżyny Station. Dispersion calculations were performed for: PM_{10}, $PM_{2.5}$, SO_2. The model domain for Krakow was 35x25 grid cells, with spatial resolution of 1 km² and with similar vertical layers as for Katowice. Point sources outside the model area have also been taken into account in the calculations. Calculations were carried out for a limited period during the heating season in 2005. Exemplary results of PM_{10} modeling are showed in Figure 5.

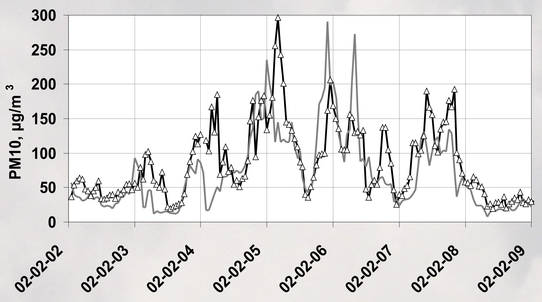

Figure 3: Comparison of the PM_{10} modeling and observation for the station of Katowice- Kossutha (heating season)

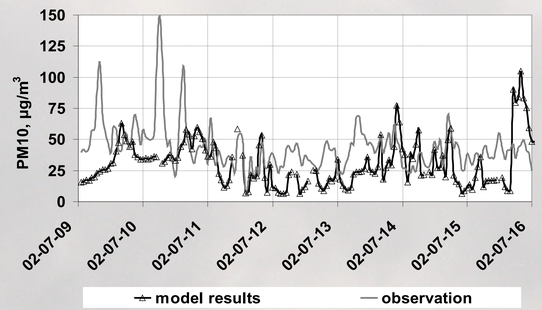

Figure 4: Comparison of the PM_{10} modeling and observation for the station of Chorzów (out of heating season)

Results of modeling

Experiences of NILU Polska indicate that results of modeling for the city of Krakow are satisfactory, but more detailed analysis and improvement of the input data are necessary in future. A correlation coefficient of 0.7 is very good results, particularly as a preliminary study. The results can be a good input for the exposure modeling and some exposure estimates were done.

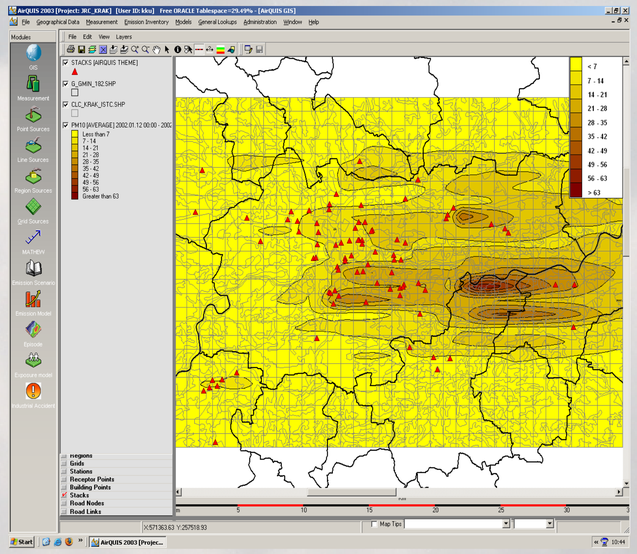

Figure 5: Concentration of PM_{10} for Krakow area (heating season) - results of dyspersion modeling

AirQUIS Installations and applications

- Data acquisition and measurement module
- Air Quality assessment
- Air Quality management
- Industrial accidents
- Forecasting/now-casting
- Scientific research (e.g. EU)

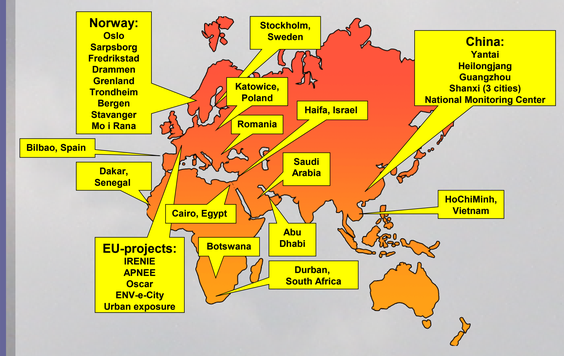

Figure 6: AirQUIS Installations [www.nilu.no]

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