7.07 AIR QUALITY ASSESSMENT FOR EUROPE: FROM LOCAL TO CONTINENTAL SCALE – AIR4EU

Peter Builtjes
TNO Environment, Energy and Process Innovation, Apeldoorn, the Netherlands

INTRODUCTION

Air quality-AQ-assessment according to the EU-Directives, but also in the broader scope of the CAFE-program, and with respect to Environmental Impact Assessment studies is a key topic for international, national, regional and (large) city authorities. There is a clear need for integrated AQ-assessment, based on both monitoring and modelling.
There are a wide variety of assessment methods to provide reliable and accurate AQ data, but the methods depend on the spatial and temporal scales, and are often not or only partially compatible. Monitoring and modelling methods are generally used separately and consequently yield results that are not mutually consistent. So, there is a clear demand for scientific sound and practical recommendations on how to integrate measuring and modelling techniques into internally consistent, comprehensive and cost-effective methods. So, key research items are methods to combine in an objective way observations and modelling results by data-assimilation methods of different complexity.

To analyse the different current AQ-methods, and to try to improve the current situation, the 6e FP-project AIR4EU has been established, and started in January 2004

The aim of AIR4EU is to provide recommendations on integrated AQ assessment for different temporal and spatial scales: ranging from hourly to annual and from 'hotspot'/street to continental scale. This will directly benefit EU stakeholders including policy makers and city, national and regional users. Research objectives in AIR4EU are directed to review the benefits and drawbacks of existing modelling and monitoring methods for different spatial and temporal scales. Criteria for the review are parameters such as accuracy, costs, input requirements and spatial representativeness of the data. These parameters are evaluated against the requirements for different policy purposes. This will result in recommended methods for AQ assessment with the emphasis on a combined use of monitoring and modelling. AIR4EU will also prepare AQ maps at different scales in Europe based upon available data sets (monitoring, meteorology and emissions) and the recommended methods.

GENERAL STRUCTURE OF AIR4EU

This three-years project brings together 6 research partners - 2 institutes and 4 universities (TNO, NILU, and the Universities of Thessaloniki, Stuttgart, Hertfordshire and Aveiro) - and 8 user partners representing 7 different cities (Paris, Rome, London, Prague, Athens, Rotterdam, Oslo). This structure indicates the important role the cities play in this project. The cities should clearly present their experience with AQ-assessment, and the difficulties they anticipate in determining the current air quality situation in their cities, including the determination of the contribution by different emission sources. One of the key aspects will be the Action Plan that cities in case of exceedances have to formulate. The cities will in fact be behind the wheel in AIR4EU, or are at least back-seat drivers.

BASIC ELEMENTS OF AIR4EU

The following overall aims of the project AIR4EU have been defined:

1) To formulate a guidance document on best practices for the combined use of monitoring methods and models to assess AQ in Europe from hotspot/street level to continental level for various users on local, regional, national and European level and for various purposes.

2) To prepare maps of air quality in Europe based on the available European wide data sets and best techniques of assessment.

AIR4Eu will present AQ maps covering the European scale, including examples of the hotspots, street, urban, agglomeration and regional level for PM10, PM2.5, NO_2, O_3, CO, SO_2, Pb and benzene. These maps will illustrate the application of the recommendations on best practices, which have been validated in a number of case studies.

In order to achieve these overall aims, a set of tasks will be carried out.

I. To set the policy framework for AIR4EU and identify the user needs in relation to air quality assessment methods,

This will be performed by studying and evaluating the available information about the policy purposes. Starting point is the current AQ framework and methods and current experiences of the users.

II. To review and examine the benefits and drawbacks, including the variability and uncertainty of a range of monitoring and modelling air quality assessment methods relevant to local/hotspot, urban/agglomeration and regional/EU spatial scales and at various temporal scales.

III. To review and assess the procedures for quantifying the main natural and anthropogenic sources and emissions and to estimate the quality of such data relevant to local/hotspot, urban/agglomeration and regional/EU spatial scale air quality assessment.

Task II and III will be done by studying and evaluating current methods to assess AQ methods at hotspot/street level scale, urban/agglomeration scale and regional/European scale by monitoring and modelling. The detailed analysis will result in first recommendations for conducting AQ assessments.

In order to create and maintain the coherence between the different spatial scales, local, urban, regional, the following cross-cutting issues have been defined and will be carried out:

a. *Emission and data needs on all spatial scales*
The aim is to provide a comprehensive methodology to generate emission inventories by developing spatial integration methods and to determine good practice/guidelines for emissions and scenarios including QA/QC.

b. *Determination of uncertainties of models and monitoring*
The aim is to provide uncertainty estimates by applying data quality indicators and data quality objectives.

c. *Determination of representativeness of model outputs and monitoring data*
The aim is to provide a better concept of representativeness and integration of modelling and monitoring data and a statistical framework for generalisation.

d. *Scale interactions*
The aim is to provide a review of the current modelling methods used to describe the interaction between the different spatial scales and to improve these methods.

e. *Data assimilation*
The aim is to identify data assimilation methods adequate to combine model results and observations.

IV. To synthesize and harmonise the benefits and drawbacks of AQ assessment methods and their variabilities and uncertainties, as well as procedures for quantification of natural and anthropogenic emissions.
To prepare draft recommendations on best techniques for assessment of air quality relevant to local/hotspot, urban/agglomeration and regional/EU spatial scales and at various temporal scales.

The aim is to test the recommendations made in case studies covering all seven cities

V. To prepare, implement and evaluate case studies in the seven application cities according to the protocols and reflect the appropriateness of the draft recommendations.
To formulate final recommendations on best techniques for assessment of air quality, relevant to local/hotspot, urban/agglomeration and regional/EU spatial scales and at various temporal scales.
To develop a GIS-based mapping framework, visualized through a web portal, intended as an operative system for air quality mapping and data retrieval and accessible to policy makers, experts and the public.
To prepare air quality maps relating to various spatial and temporal scales, based on available Europe-wide data sets, results from the cities' case studies and other available data.

The aim is to perform case studies for each participating city/area, using the protocols based on the harmonized first recommendations, and to create a mapping framework.

VI. To widely disseminate and exploit the projects interim and final results to wider public target groups including policy makers, member states, authorities, practitioners and other relevant national and international stakeholders.
To make stakeholders conscious of the current challenges faced in relation to AQ management at the final conference.

The objective is to disseminate relevant information on a continuous basis to stakeholders and the general public by an internet site, newsletters and open workshops.

SOME FIRST, PRELIMINARY RESULTS

A first analysis of the AQ-assessment practices and problems in the cities reveals the following aspects:

- First of all, the cities prefer a review of their current AQ assessment instead of being confronted with new methods.
- Most cities indicate that traffic is their main AQ problem.
- Most cities indicate exceedances of the annual average limit value for NO_2, not of the high peak values, as well as exceedances of the number of days that the 24-hours limit value of PM10 is exceeded, whereas there are no exceedances of the annual average limit value.
- Most cities have a major problem in defining the regional scale background values.
- Most cities struggle with the 'ethical' problem to reduce the locale exceedances by spreading the problem, and thus increasing the concentrations over larger areas.
- Most cities indicate that their scope is rather small, due to spatial planning and the lay-out of cities. Choices in town planning made years ago determine the problem to a large extent.
- Some cities express their concern that different models will give different answers and that there will be no clear guidance in choosing the right model, or choosing the model that gives the most reliable answer. Here, ensemble modelling might be considered.
- Some cities express their concern with regard to the impact of complex orography and complex meteorological conditions on their air quality situations and the problems to model them adequately.
- Most cities have the same, common problems. However, some cities encounter their own specific problems such as 'studded' tyres in Oslo, resulting in elevated PM10 levels, and twin-engined mopeds in Rome and Athens, resulting in high benzene levels.

OUTLOOK.

Work is in progress to review the methods currently in use for AQ-assessment on local, urban and regional scale. Also, the requirements and needs by the cities are becoming clearer, which will focus the direction of the research.

The largest scientific challenge in the project is to combine observations and model results in a practical way. Most modern data-assimilation techniques as 4D-Var and Kalman Filtering are very computer demanding. Simpler methods as Optimal Interpolation might be more in balance with the user demands.

Ensemble modelling instead of trying to find the "best model" has clear advantages and will also lead to insight in the uncertainty of the model results.

REFERENCES:

AIR4EU webpage will be operational by June 2004.

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