

Panel Discussion on the Uncertainty Analysis of Modelling Studies

Initiated by EEA/ETC-AQ on the Occasion of the
EUROTRAC-2 Symposium, Garmisch, 30 March 2000.

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After welcoming the participants (attendance list appended), Dr. Moussiopoulos outlined the reasons for performing uncertainty analyses of modelling studies. He addressed both model quality assurance and the need to evaluate model input data emphasising the associated scientific aspects as well as the obvious policy relevance. Subsequently, he addressed the individual aspects of model QA and input data QA in the light of the new developments that became apparent in the Symposium (see attachment).

The need for a better co-ordination of activities related to the uncertainty analysis of modelling studies was noted in a number of earlier meetings (6th Model Harmonisation Conference, Rouen, 12 October 1999; SATURN workshop, Ispra, 23 November 1999; EAG meeting, Munich, 25 January 2000). The outcome of all previous discussions was that intense scientific work is needed to achieve a noticeable progress with regard to both model QA and input data QA. All associated research could be accommodated in the EUROTRAC-2 subprojects SATURN, GLOREAM and GENEMIS, whereas starting with 2001 EEA's European Topic Centre on the Atmospheric Environment could play a substantial supporting role, among other:

- In offering guidance on how model performance may be evaluated.
- In providing transparent information on the achievable accuracy for a variety of individual modelling studies and
- In organising all necessary information exchange ranging from model validation datasets to recommendations where required input data and information on their uncertainty range may be found.

In agreement with the above ideas, the discussion in Garmisch led to the conclusion that a joint activity of the EUROTRAC-2 subprojects SATURN, GLOREAM and GENEMIS should be launched for investigating to what extent state-of-the-art air pollution models may be used to analyse the attainment of legislated air quality guidelines (e.g. those prescribed by the EU Air Quality Directives).

In particular, the exceedance of the NO₂ and O₃ limit values in the year 1997 will be analysed for several European cities¹ using a variety of air pollution models, even those resolving street canyon geometries. Wherever feasible, the uncertainty range of the "target" model output due to input data uncertainties will also be calculated in the course of a sensitivity analysis and compared to both the limit value itself and the uncertainty of the observations usually analysed to assess urban air quality. In this context, the important issue of the representativeness of air quality observations was addressed.

¹ In the discussion it was agreed that good candidate cities would be these considered in the Auto Oil Programme, as for instance Athens, Cologne, Milan and Madrid.

In a first preparatory activity models developed and/or used in SATURN and GLOREAM will be invited to participate at this activity. Each modeller will be asked to specify in detail his (her) “target” model output or, in other words, how the legislative requirements will be addressed. The modellers’ specifications will constitute a technical report, which will be discussed with end users.

This preparatory activity would be linked to a related action agreed on 28 March 2000 at the SATURN-INT meeting. This action, to be carried out by Dr. San Jose, had been defined primarily from the end user’s view: The first step was to investigate the new EU Air Quality directives and derive in detailed operational terms the model output needed to fulfil the legal assessment requirements. Especially the resolution and statistics in time and space needed were expected to pose practical problems. In the second step the participants would analyse the potential of their models to deliver this output and calculate the parameters from earlier studies carried out in their “own” cities.

Figure 1 illustrates the SATURN-INT approach. The dashed arrows illustrate how this approach starts by analysing the needs of the end user and work backwards to derive requirements to the model. This approach is complementary to the approach that starts by analysing the model uncertainty and works subsequently towards the end use. It was proposed to include and integrate the SATURN-INT action in the above-described SATURN/GLOREAM/GENEMIS preparatory activity.

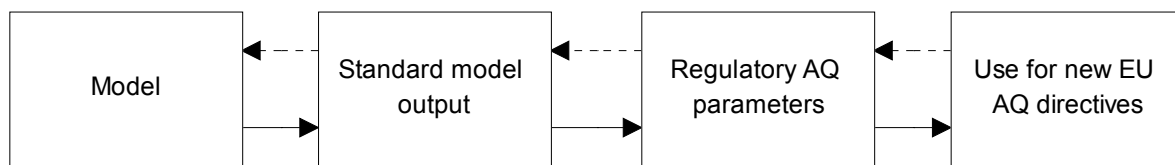


Figure 1 Science-orientated approach (left to right): start by model and input data QA, followed by adaptation to end use. User-orientated approach (right to left): start by defining quality of model output from end-use.

Given the characteristics of most legislated limit values, normally models will have to be applied over a whole year. As an exception, in case of comprehensive models which can hardly be applied for such a long time period the situation in August 1997 will be analysed.

The overall technical framework for the above activity will be formulated by Drs Sahn, Memmesheimer and NN to represent SATURN, GLOREAM and GENEMIS, respectively. Above all, the model input requirements will be reviewed, input data uncertainties will be agreed upon and the procedure to be followed for the sensitivity analysis will be specified. In addition Drs Schlünzen and Memmesheimer will finalise their model inventories to reveal in a consistent manner the characteristics and capabilities of models developed and used in SATURN and GLOREAM.

One of the central discussion points was how to seek funding for the activity envisaged. Given that each modeller is anyhow concerned with (at least) one specific city, it was realised that as long as the work refers to that city no additional funding is urgently needed. As, however, the intention is to apply several models to each city, the attempt has to be made to ensure financial support for the groups involved. Among other, it was suggested to propose a Concerted Action on this matter (Dr. Schaller agreed to undertake first steps in this direction), but also the possibility of a “LIFE” project was mentioned (Dr.v.d.Hout was asked to investigate this option).

As an additional scenario the possible collaboration with city authorities was considered. For exploring the prospects of such a collaboration, it was suggested to plan a joint meeting of modelling group representatives and key persons in charge of urban air quality management. Other possibilities would be to involve in the discussions representatives of regional governments or even National Focal Points, e.g. in the frame of the forthcoming EIONET workshop organised by the Topic Centre on Air Quality (Prague, 18/19 September 2000).

Action summary:

- | | |
|--------------------------|---|
| Q2/00 | - Report specifying how the legislation requirements will be addressed by individual models |
| | - Formulation of technical framework for overall activity |
| | - Model inventory finalization |
| | - Exploitation of funding possibilities |
| Q3/00 | - First model application for “own” city |
| | - Contacts to city authorities and other end users |
| Q4/00 & Q1/01 | - Bulk of model applications |
| Q2/01 | - Reporting |

Model uncertainty analysis

1. Model QA - mainly validation (using field and lab. data):

a) Type of models

- Obstacle resolving local scale models, wind/dispersion.
- Urban scale Eulerian grid models, wind/dispersion inert.
- Regional scale Eulerian grid models, wind/dispersion react.

b) Evaluation protocol - SATURN.

c) Joint cases

- Hanover data, Helsinki data....
- Lisbon case, Graz case, ESCOMPTE/URBCAP
- August 1997

d). Statistics

- * Observed data QA: Check adequacy of measuring method and representatives.

2. Input data QA

a). Issue (target parameter)

Any emphasis to requirements of FWD.

b). Input data needs.

c). Inaccuracy ranges of input data.

d). Sensitivity analysis

Exercise (2) may be performed independently of (1) to reveal:

- whether the modelling study may lead to the desired "target" output.
- quality objectives for model input data.

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