

WG4 Development of evaluation tools and methodologies

Despite the wide application of mesoscale meteorological models for air pollution transport and dispersion, no procedures or protocols have been established at the European level that assure minimum requirements for the use or performance of mesoscale meteorological models (MetMs). Scientific principles that assure model consistency and robustness do exist, but are not organised or adopted globally according to a well-defined protocol. Currently, model testing is mainly performed on the basis of few analytical solutions for simple ideal cases and by application of the model to different real case studies. The latter rely on the use of local (in space and time) measurements for both case configuration and model verification. Often this reduces the simulation to a “trial and error” process aiming at reproducing, at best, the observations available without considering the representativeness and error included in the latter, nor the global consistency of model results. There is the need, therefore, for protocols that encompass various aspects of model testing with increasing complexity and that could ensure model robustness and applicability of the mesoscale meteorological model to air pollution transport and dispersion studies. An initiative of this nature would be very relevant and beneficial for model development, amelioration and verification. Such an evaluation guideline for mesoscale meteorological models is currently developed by the German Engineering Association VDI on the basis of a validation procedure proposed by Schlünzen (1997). Other initiatives of this kind include the activities of SATURN (urban air pollution subproject of EUREKA/EUROTRAC2) which focused more on local and urban scales (Borrego et al 2003). The outcome could be much more significant if the model evaluation protocols would be harmonized on a European level.

The overall aim of WG4 is the development of tools and methodologies that can be applied to validate and evaluate mesoscale meteorological models for pollution transport and dispersion applications. Different methods shall be developed for single case studies in a forecast type of model application as well as for calculating statistical quantities (e.g. exceeding threshold values as defined in EU Air Quality directives and the daughter directives).

To achieve this aim, the following activities are planned within WG4:

- a) Worldwide collection and review of existing methodologies and tools for mesoscale meteorological model validation with emphasis on concepts that are based on fundamental physics principles rather than on single case application.
- b) Extending the previous database on mesoscale meteorological models information on validation procedures. This can be based on the information available from EUROTRAC2-SATURN (http://www.mi.uni-hamburg.de/technische_meteorologie/Meso/saturn/overview.html).
- c) Identification of the advantages and limits of the different evaluation methodologies and tools.
- d) Critical review of available, well documented, three-dimensional data sets of known quality for model validation on the regional scale. This includes air pollution episode datasets as resulting from or used in earlier projects (e.g. FUMAPEX, COST715, CITY-DELTA, TFS).
- e) Selection of case studies from the available data sets that can be used for evaluation on the regional scale.
- f) Characterisation of the impact of model errors (including initial and boundary value uncertainties) on meteorological data relevant for concentration calculations.
- g) Derivation of validation procedures for mesoscale meteorological models for pollution transport and development of protocols for model quality assurance based on scientific and fundamental principles.

The evaluation of models is necessary but not sufficient to ensure reliable model results. Mesoscale models are too complex to be applied without deep knowledge of and experience in

such applications. There is currently no consensus on the extent or the depth of training that would be required for a nonexpert to competently use mesoscale models. This Action will provide guidance on both aspects as well as recommend procedures for non-experts to evaluate the reliability of model results used e.g. in environmental impact assessment studies.

The following further activities, therefore, are planned to achieve this objective:

- h) Collection and review of existing methods and tools for mesoscale meteorological model user training.
- i) Development of a catalogue of necessary model user skills.
- j) Development of a conceptual framework for user training.
- k) Development of guidance for model result evaluation that considers both model evaluation and user training.

For the documentation of the tools/methodologies as well as of the data sets, the evaluation protocols and the guidance will be available on the Action website. Additional publications will be in COST reports, conference and peer reviewed publications.

Inputs to the Activity:

Partners will provide the data and information on models, datasets and evaluation methods for model evaluation. In addition, software usable for user training or model evaluation will be an important input.

Deliverables:

Key deliverables of WG4 will be:

- 1) Overview on tools and methods for model evaluation, datasets for model evaluation (metadata) and tools and methods for user training.
- 2) Recommendation for mesoscale model evaluation guidelines for model developers.
- 3) Documented framework for user training.
- 4) Guidance for model result evaluation aimed at end users and non-experts.