



**Economic and Social  
Council**

Distr.  
GENERAL

ECE/EB.AIR/GE.1/2007/3  
20 June 2007

Original: ENGLISH

---

**ECONOMIC COMMISSION FOR EUROPE**

**EXECUTIVE BODY FOR THE CONVENTION ON LONG-RANGE  
TRANSBOUNDARY AIR POLLUTION**

Steering Body to the Cooperative Programme for Monitoring and Evaluation  
of the Long-range Transmission of Air Pollutants in Europe (EMEP)

Thirty-first session  
Geneva, 3–5 September 2007  
Items 4 (e) of the provisional agenda

**MEASUREMENTS AND MODELLING**

Progress report by the Co-Chair of  
the Task Force on Measurements and Modelling in collaboration with the secretariat

**INTRODUCTION**

1. This report presents the results of the eighth meeting of the Task Force on Measurements and Modelling, held in Dessau, Germany, from 25 to 27 April 2007. The Task Force discussed, in particular, the implementation of the EMEP Monitoring Strategy and Measurement Programme 2004–2009, EMEP intensive field campaigns, fine-scale and national activities using Eulerian grid models, the EMEP Particulate Matter (PM) Assessment Report and the future coordination of global model development between the Meteorological Synthesizing Centre-East (MSC-E) and Meteorological Synthesizing Centre-West (MSC-W). Minutes and presentations are available at: [www.nilu.no/projects/ccc/tfmm/index.html](http://www.nilu.no/projects/ccc/tfmm/index.html).

2. Experts from the following Parties to the Convention participated in the meeting: Austria, Belgium, Bulgaria, Canada, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, the European Community, Finland, France, Germany, Ireland, Italy, Latvia, the Netherlands, Norway, Portugal, the Slovak Republic, Spain, Sweden, Switzerland and the United Kingdom of Great Britain and Northern Ireland. Representatives from the Chemical Coordinating Centre (CCC), MSC-E, MSC-W and the European Commission's Joint Research Centre, as well as a member of the secretariat, also attended.

3. Mr. R. Derwent (United Kingdom) chaired the meeting. The meeting was hosted by the German Federal Environment Agency.

## **I. IMPLEMENTATION OF THE MONITORING STRATEGY**

4. Ms. Wenche Aas (CCC) reported on the status of the EMEP Monitoring Strategy. She stressed that most Parties intended to comply with the monitoring requirements, but that there were some challenges to implement the strategy by 2009. Sites with a complete Level 1 measurement programme were still relatively few. Attention was drawn to the need for more sites measuring base cations in air and low-cost denuder measurements. The spatial distribution was not totally satisfactory, but there were some positive tendencies in that new sites had been established in the Eastern Europe, Caucasus and Central Asia (EECCA) region. For Levels 2 and 3 there was a good link between EMEP and various research projects, especially on PM. It was, however, a challenge to get more sites measuring nitrogen gas/particle distribution, persistent organic pollutants (POPs), volatile organic compounds (VOC) and heavy metals. It was expected that European Union (EU) legislation on air quality would help to get more of the latter measurements.

5. The Task Force expressed its gratitude to the Parties to the Convention for their strong efforts towards the implementation of the 2004–2009 EMEP Monitoring Strategy. It was noted that these activities had led to a significant improvement in the coverage of some measurements. The additional data was already being used to improve the understanding of many processes involved in the modelling activities undertaken at MSC-E and MSC-W. The Parties asked for more information on how the information from Level 3 activities were going to be integrated into the EMEP Monitoring Strategy and how arrangements for quality assurance/quality control were going to be handled for these activities.

6. The Task Force proposed holding a workshop on the synthesis of the new monitoring data with the modelling activities at the EMEP centres to mark the completion of the 2004–2009 phase of the EMEP Monitoring Strategy.

7. The Task Force recognized that the present EMEP Monitoring Strategy had been developed for the period 2004– 2009. Bearing in mind the time taken to prepare a possible revision of the Monitoring Strategy, the Task Force recommended that a review of the current strategy be prepared in 2008. In parallel, considerations should start soon on the format of a revised strategy and the policy issues that would constrain it. The Task Force proposed that this activity form an element of its 2008 workplan, and that this issue be discussed at the EMEP Steering Body session in September 2007.

## **II. INTENSIVE FIELD MEASUREMENT CAMPAIGNS**

8. Mr Karl-Espen Yttri (CCC) gave an overview of the EMEP intensive measurement campaigns held during June 2006 and January 2007. He informed the Task Force which countries were willing to participate in the EMEP intensive measurement periods, by which type of measurements, and what was the current status of reporting of these data. Finally, he urged those Parties who had not yet submitted data to do so no later than June 2007. He also challenged the audience to share experiences from the intensive campaigns and to choose topics for future intensive campaigns.

9. The Task Force expressed its appreciation of the work done by CCC in organizing the EMEP intensive campaigns during the summer of 2006 and 2007 and to the many research institutes that had participated in them. It stressed the importance of their results to the Centres and to the Parties for improving modelling tools. The Task Force encouraged participants to write up their results expeditiously. It also proposed holding a workshop to discuss the final results, to prepare a synthesis of them, and to present them to MSC-W and the national modelling teams so that they could be used to improve the modelling tools in use across Europe.

10. Two additional intensive campaigns were proposed. The first would focus on hourly observations and be held during late winter and early spring 2009. The second would be held during late summer and early autumn 2009. The emphasis of these two additional intensive campaigns would be much the same as the 2006/2007 campaigns. The aim would be to improve mass closure, particularly in southern Europe, by tackling mineral dust. Increased focus would be given to denuder measurements of nitric acid, ammonia, SO<sub>2</sub> and NO<sub>2</sub>, and to elemental carbon/organic carbon (EC/OC) measurements by reference techniques. Attention would be given to the measurement of vertical gradients by lidars, balloons, towers and aircraft. More hourly measurements would be made using instruments.

### **III. FINE-SCALE DEPOSITION MODELLING**

11. The Task Force noted the progress in applying the Unified EMEP model at the fine scale in the United Kingdom and Croatia and how it could be made to work with different meteorological models as drivers. It noted that the EMEP Unified model at 5 km x 5km had successfully captured the orographic enhancement of wet deposition over the United Kingdom. This suggested that the calculation of wet deposition used in the EMEP Unified model improved with increased horizontal resolution. It was agreed to present the progress to the EMEP Steering Body at its session in September 2007.

### **IV. NATIONAL ACTIVITIES USING EULERIAN GRID MODELS**

12. The Task Force took note of national modelling activities using Eulerian grid models, and in particular the Canadian air quality model AURAMS, and the application of the CMAQ modelling system to acidification, ground level ozone formation and heavy metals in Europe.

13. The Task Force agreed that the national experiences with large Eulerian grid modelling systems needed to be synthesized and used to support the modelling activities of the EMEP centres. The Task Force needed to consider at its future sessions how best to audit and benchmark model results and how best to use the CMAQ model to test and investigate different process parameterizations to speed up model improvement in Europe in the future.

### **V. PARTICULATE MATTER ASSESSMENT REPORT**

14. The Task Force noted the workshop on the preparation of the PM Assessment Report held in Paris at the end of November 2006. The workshop had reviewed the national PM assessments that comprise the Part B of the Assessment Report and had initiated the drafting of the Europe-wide Part A.

15. The Task Force reviewed the draft Part A and Part B, giving detailed consideration to the summary and conclusions of the report. The conclusions of the Assessment Report are presented in the following paragraphs.

16. The EMEP PM Assessment Report addresses the adequacy and completeness of the underpinning science upon which models currently used for policy development have been built. An important issue has been to strike a balance between the need to resolve a number of key scientific uncertainties and the desire to make progress with integrated assessment modelling. It has been recognized that striking this balance is important for policymaking within the Working Group on Strategies and Review.

17. The purpose of the report is to inform the policy process about the state of current understanding on PM issues and the level of confidence in PM models.
18. The PM models currently used in policy development underestimate total PM<sub>10</sub> and PM<sub>2.5</sub>, and none currently achieve mass closure. The main reason for this is that some PM components are not included in models and others are treated in simplified ways. There are large uncertainties in the emissions inventories of the primary PM components, especially with respect to the coarse PM fraction, and of some PM precursors. Confidence in the PM models ultimately rests on the comparison of model predictions with observations. Currently, there are too few observations for satisfactory model verification.
19. There is a high degree of confidence that SO<sub>2</sub> sources can be linked to the observed levels of particulate sulphate. Over the years, most of the important uncertainties in SO<sub>2</sub> emission inventories have been tackled and a few outstanding problems remain, such as coal burning and ship emissions. Observations of particulate sulphate have the necessary reliability and spatial coverage for model verification purposes. Long-running time series are available to check model calculated trends with observed trends over the last two decades.
20. There is a reasonable level of confidence that NO<sub>x</sub> sources can be linked to the observed levels of particulate nitrate. Too few measurements for particulate nitrate have been made using techniques that are artefact-free and some of the outstanding problems with evaporation of the ammonium nitrate still have not been solved. Intensive field campaigns have been organized using continuous instruments to overcome these shortcomings. There are uncertainties associated with ammonia emissions that, when taken together with the non-linearities in the formation of ammonium nitrate, limit our confidence in particulate nitrate modelling and its response to ammonia and NO<sub>x</sub> emission reductions.
21. Uncertainties in European models for particulate sulphate are currently judged to be of the order of  $\pm 15 - 20\%$ , on an annual average basis. The corresponding uncertainties in model particulate nitrate are somewhat larger at about  $\pm 40\%$ . Measurement uncertainties in particulate sulphate and nitrate are comparable to those in models. This situation is considered acceptable for the policy purpose of assessing the outcome of different control measures for SO<sub>2</sub> and NO<sub>x</sub> on the regional component of particulate sulphate and nitrate.
22. Uncertainties in model results for EC/OC PM are large. Many of our current difficulties with EC/OC particulates stem from difficulties with their measurement methods, the lack of a reference method and the lack of consistency between the existing European measurements. The split between elemental and organic carbon depends on the method and is influenced by charring, leading to elemental carbon measurements that may differ by up to a factor of two

when comparing the two most commonly used protocols. Measurements are therefore considered to have limited reliability.

23. Many of the remaining difficulties with elemental carbon and organic PM stem from problems with emission inventories. Emission inventories for primary PM components are of relatively recent development. Reliability, size and spatial resolution, coverage of the different source categories, and PM species coverage still remain crucial issues for PM emission inventories. Emission inventories for elemental carbon need substantial improvement in terms of accuracy and coverage of source categories, particularly those of road traffic, wood combustion and residential heating. Improvements are required in spatial resolution at the European scale and in the representation of diurnal, weekly and seasonal emission profiles.

24. Without these improvements in the emission inventories for primary carbonaceous PM, confidence is limited in the regional scale distributions of primary carbonaceous PM calculated with the current PM models used in policy development.

25. The review of the Unified EMEP model noted that confidence in the understanding of the mechanism of the formation of secondary organic aerosol was so low that it had not been included in the EMEP model, leading to underestimates for PM<sub>10</sub> and PM<sub>2.5</sub>. There are major problems with emission inventories and with the representation of the main atmospheric processes that control the distribution of particulate organic matter across Europe. Uncertainties in measurement data, as well as their general paucity, preclude any quantification of model uncertainty for these PM components. As a consequence, it is not possible to link VOC emissions and their control to secondary organic PM in the PM models currently used for policy development.

26. There are major difficulties in the representation of mineral dust in PM models, which stem from a range of causes mainly due to the lack of knowledge on their emissions and of the soil databases with which to characterize them.

27. Uncertainties in current model predictions for natural PM components, such as mineral dust, sea salt and biogenic primary organic matter, are large and difficult to assess.

28. On this basis, we have a high level of confidence that the PM models currently used for policy development can address the regional scale impacts of SO<sub>2</sub> emission reductions on PM mass concentrations, for the purposes of integrated assessment modelling. There are uncertainties with ammonia emissions that, when taken together with the non-linear chemical production pathways to form ammonium nitrate, limit our confidence in the representation of ammonia and NO<sub>x</sub> emission reductions on PM mass. Because of outstanding problems with the

emission inventories for EC/OC PM, there is little confidence that the PM models currently used for policy development are ready to describe accurately the urban and traffic increments in PM<sub>2.5</sub> that are required for integrated assessment modelling and for policy assessments of urban health effects. Current PM models used in policy development might thus be adequate for the assessment of the relative magnitudes of emission reductions of some PM components and their precursors on PM mass concentrations, but not necessarily for their quantitative assessment against target and limit values for PM.

29. There is currently a significant level of effort being undertaken by the Parties to the Convention and by the EMEP centres that is focused on improving PM emission inventories, improving PM observations, carrying out targeted field campaigns, and enhancing PM models. These activities should be encouraged within the EMEP framework and will, over time, bring increased confidence to our understanding of PM and its representation in PM models.

30. The Task Force agreed to submit the completed report to the EMEP Steering Body at its session in September 2007 and to provide the Executive Summary to the Chairman of the Working Group on Strategies and Review in advance of its next meeting.

## **VI. FURTHER WORK**

31. The Task Force requested that the following activities be reflected in the 2008 workplan of the EMEP Steering Body:

- (a) Preparing a synthesis developing the outcome of the EMEP Monitoring Strategy 2004–2009 and planning its adoption in the Unified EMEP model;
- (b) Initiating discussions of a follow-up to the EMEP 2004–2009 Monitoring Strategy;
- (c) Preparing a synthesis of the data from the EMEP intensive campaigns and assessing its role in improving the confidence in the Unified EMEP model;
- (d) Preparing a synthesis of national observations and modelling of urban PM increments and ozone decrements.

32. The Task Force agreed to hold its ninth meeting in spring 2008 and proposed the following items for its agenda:

- (a) Observations and modelling of urban PM increments;
- (b) Discussions of a further EMEP monitoring strategy;
- (c) The proposed integrated nitrogen initiative.

33. It further agreed to hold:

- (a) A workshop to integrate the EMEP Monitoring Strategy outcomes with the national PM assessments, and to provide a synthesis to drive EMEP model development;
- (b) A joint workshop with the Task Force on Emission Inventories and Projections;
- (c) A joint workshop with the Task Force on Integrated Assessment Modelling to prepare a synthesis of national observations and modelling of urban PM increments and ozone decrements.

----