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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-third session
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Item 6(a) of the provisional agenda

PROGRESS IN ACTIVITIES IN 2009 AND FUTURE WORK

MEASUREMENTS AND MODELLING (ACIDIFICATION, EUROPHICATION AND PHOTO-OXIDANTS, HEAVY METALS, PARTICULATE MATTER AND PERSISTENT ORGANIC POLLUTANTS)

Report by the Co-Chairs of the Task Force on Measurements and Modelling

I. INTRODUCTION

1. This report presents the results of the tenth meeting of the Task Force on Measurements and Modelling, held from 15 to 17 June 2009 in Paris in accordance with item 2.2 of the workplan approved by the Executive Body at its twenty-sixth session (ECE/EB.AIR/96/Add.2). It describes progress in the field campaigns of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) and plans for the effective implementation of the revised EMEP monitoring strategy, as well as presents future priorities in modelling.

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2. A scientific joint workshop of the Task Force on Measurement and Modelling and the Task Force on Hemispheric Transport of Air Pollution on links between regional and global scale air quality models as well as between air quality and climate change was held back-to-back to this meeting (17–19 June 2009). Conclusions from the workshop are presented in the annex to the report of the Task Force on Hemispheric Transport of Air Pollution (ECE/EB.AIR/GE.1/2009/11). The presentations made during the meeting and the reports presented can be accessed online at: http://www.nilu.no/projects/ccc/tfmm/.

A. Attendance

3. Sixty-five experts from the following Parties to the Convention attended the meeting of the Task Force: Austria, Belarus, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Italy, Netherlands, Norway, Portugal, Russian Federation, Slovak Republic, Spain, Sweden, Switzerland, United Kingdom of Great Britain and Northern Ireland, and United States of America. In addition, experts from India and Thailand took part. Also present were representatives from the Chemical Coordinating Centre (CCC), Meteorological Synthesizing Centre-East (MSC-E), Meteorological Synthesizing Centre-West (MSC-W), the Centre for Integrated Assessment Modelling (CIAM), the European Environment Agency (EEA), the European Commission's Joint Research Centre (DG-JRC), the World Meteorological Organization (WMO) and CONCAWE (oil companies' European Association for Environment, Health and Safety in refining and distribution). A representative of the secretariat also attended.

B. Organization of work

4. Ms. L. Jalkanen (WMO) and Ms. L. Rouïl (France) co-chaired the meeting, which was hosted by the French National Institute for Environmental Technology and Hazards (INERIS) with the assistance of the French Agency of Environment and Energy Management (ADEME).

5. A representative of the secretariat presented the conclusions of the EMEP Steering Body from its thirty-third session, in 2008, highlighting items of relevance to and those requiring action by the Task Force.

II. FIELD MEASUREMENT CAMPAIGNS

A. National experiences

6. A representative of CCC summarized the experiences gained from the EMEP intensive field measurement campaigns carried out in 2008 and 2009, stressing the significant progress achieved since the last field experiments of 2007 and 2008, in particular regarding the availability of guidelines, the use of reference methods, the establishment of harmonized formats and the management of data ownership and intellectual property right issues. She also acknowledged that the measurement campaigns had been positive in producing a unique data set for EMEP. First results related to elemental carbon (EC)/organic carbon (OC), and wood combustion tracers were presented as well as ongoing work on chemical analysis. She further stressed that the data were available for use and publishing, and encouraged the members of the Task Force to issue publications.

7. A number of Task Force members presented national measurement experiences and the results from the EMEP intensive field campaigns they had contributed to. These included:

(a) Preliminary outcomes of the French measurements of aerosol composition and physico-chemical characteristics performed at two supersites (Puy-de-Dôme and Peyrusse-Vieille) during the 2008–2009 EMEP field campaigns;

(b) An evaluation carried out in Switzerland of the DELTA mini-denuders recommended under the EMEP monitoring strategy for ammonia/ammonium (NH_3/NH_4) and nitric acid/nitrate (HNO_3/NO_3) measurements at level 1 stations. The Swiss experience had demonstrated the advantages of separating the mini-denuder systems into two independent ones. The Task Force was also reported on the modifications with which the mini-denuder systems would provide reliable results;

(c) German particulate matter 10 (PM_{10}), $PM_{2.5}$ and particulate compound long-time observations carried out at the Melpitz site. Their analysis, including weekly and seasonal temporal variability over seasons and weeks, had highlighted the significant contribution of long range transport depending on air mass origin;

(d) Time series of PM composition at the Italian Montelibretti measurement station during the EMEP intensive campaigns and their chemical analysis which had allowed to identify the origin of PM compounds, according to the season and the site location;

(e) Outcomes of the Finnish fine particles chemistry studies with the Aerosol Mass Spectrometer (AMS) performed in two sites in the Helsinki area and under various meteorological conditions. AMS performances had been compared with those of other instruments. Helsinki was considered ideal for studying sources owing to the much lower background pollution than in Central Europe, which allowed each day to be distinguished. The

Task Force considered the formation of secondary aerosols in wintertime, with the lack of photochemistry, and raised a hypothetical question of whether there could be quick particle conversion from diesel exhaust;

(f) Measurements made at the Swedish Raö station during the EMEP field campaigns, which had focused on nitrogen compounds.

B. Conclusions by the Task Force

8. The Task Force took note of the information provided. It acknowledged the important amount of work carried out by the national experts as well as the efficient coordination of this work by CCC during the EMEP field campaigns. It welcomed the good cooperation with the research community during the campaigns, in particular with the European Union (EU) European Supersites for Atmospheric Aerosol Research (EUSAAR) project and European Integrated Project on Aerosol Cloud Climate Air Quality Interactions (EUCAARI).

9. The Task Force highlighted the importance of establishing a publication plan/strategy to ensure the promotion and dissemination of the results obtained from the field campaigns. Some experts pointed out that the 2006–2007 field campaign data had still not been properly published. Ms. Rouïl informed the meeting that the journal *Atmospheric Chemistry and Physics* was currently preparing a special issue on the EMEP campaigns, which provided an opportunity for publishing data. The Task Force members were encouraged to submit papers for this special issue before the end of 2009. More detailed information would be made available on the Task Force's website.

10. The Task Force stressed the need for making available the results from the new field campaign (2008–2009) as soon as possible to allow experts to proceed with their analyses at the national level. CCC encouraged the measurement teams to submit the data in autumn 2009, in order to be able to make (some of) these data available after quality checking before the end of 2009.

III. ISSUES RELATED TO THE REVISED MONITORING STRATEGY

A. The revised monitoring strategy and its future implementation

11. A representative of CCC presented the final (fifth) draft of the revised EMEP monitoring strategy and measurement programme for the period 2010–2019, prepared by CCC in consultation with the Bureau of the EMEP Steering Body on the basis of the feedback provided during and after the Steering Body's thirty-second session, for approval by the Steering Body at

its thirty-third session in 2009. CCC had sent the document to Task Force members for comment in early spring 2009 and had amended it in accordance with the feedback received. The Task Force had been informed about the updated parts of the strategy in comparison with the previous strategy (2004–2009).

12. The Task Force members presented their views, expectations and concerns regarding the future implementation of the revised monitoring strategy. They agreed on the main contents of the revised strategy, but considered its implementation challenging and costly.

13. The questions posed during the meeting included the following:

(a) The criteria for complying with the required site density for level 1 and level 2 should be more detailed. Notably, these criteria should take into account the topography and the local meteorological conditions;

(b) According to the revised strategy, in certain cases when significant efforts were required for implementing level 2 parameters or for improving spatial resolution of the network, the mandatory level 1 requirements could be relaxed on a provisional basis. The Task Force members wished to receive further clarification about these situations;

(c) Concerns were expressed about measuring some of the new level 2 parameters that used to be level 3 under the former monitoring strategy. The cost of measuring the parameters was a determinant factor for the successful implementation of the monitoring strategies at the national level;

(d) Some experts highlighted that some of the new level 2 parameters (e.g. greenhouse gases) were already measured under other international processes such as the WMO Global Atmospheric Watch network (GAW), and that overlaps with this work should be avoided for reasons of cost-efficiency and to limit reporting efforts;

(e) The Task Force agreed on the need for further guidance, implementation priorities and assistance for implementing the new strategy.

14. The Task Force noted the following information and clarifications provided by CCC and the Co-Chairs:

(a) CCC could be consulted on any point in text of the strategy to be clarified whenever necessary, e.g. regarding the criteria for site density or the flexibility in implementing

the strategy;

(b) The level 2 parameters were not all mandatory for a given site. Level 2 sites were "topic-oriented", and each country could select the topics according to their national monitoring priorities and in connection with their national research programmes;

(c) Cooperation with international networks and research programmes would be enhanced in order to benefit from the high-level observations they provide to promote the achievement of the objectives of strategy without duplication of effort. To facilitate the cooperation and coordination efforts, EMEP could agree on a common framework for data reporting;

(d) The Task Force on Measurement and Modelling and CCC would assist the countries in the implementation of the EMEP monitoring strategy, e.g. by means of a workshop dedicated for this purpose.

(e) It was important to update the EMEP manual with the new parameters as soon as possible.

B. Potential areas of collaboration

15. An expert from the Czech Research Center for Environmental Chemistry and Ecotoxicology (RECETOX) presented long-term trends of persistent organic pollutants (POPs) concentrations in ambient air using passive samplers, in needles, mosses, soil and sediments measured at the Kosetice station, as well as results from the Czech field campaigns to assess the spatial and temporal representativeness of the Kosetice station. The Task Force was also informed about European and international POPs monitoring activities, in particular in the context of the Stockholm Convention on POPs, and the campaign by RECETOX for monitoring of persistent organic pollutants (POPs) in ambient air in Europe using the passive air sampling technique (MONET-Europe). The Task Force recommended enhancing cooperation with these initiatives, which provide a supplementary technical framework for POPs monitoring.

16. A representative of DG-JRC reported on progress for defining reference methods for measuring particulate OC and EC and on the activities of the European Committee for Standardization (CEN) to this end. The EUSAAR2 method, implemented in the EMEP field campaigns and recommended by the monitoring strategy, was one of the candidates for being the reference method. The Task Force members were invited to support the EUSAAR2 method through their representatives in the CEN group, as well as through attending CEN meetings.

17. A representative of EEA reported on EEA activities in the field of air pollution, and on present and possible further cooperation between EEA and EMEP. These included partnerships and joint work on relevant EEA studies, e.g. on the "State and trends in Europe's Environment". EEA and its European Information Observation Network (EIONET) were about to implement near-real time (NRT) observation data reporting for ozone, PM and nitrogen oxides (NO_2). CCC and EEA had agreed to conduct jointly a feasibility study with a view to identifying and recommending a strategy for handling NRT air quality data in line with the future needs and taking account of the respective capacities and strategies of EMEP and EEA, including the EEA Shared Environmental Information Systems principles. Further cooperation should also be developed in the context of the establishment of the future GMES (Global Monitoring for Environment and Security) Atmospheric services.

C. Future field campaigns in line with the monitoring strategy

18. In the session devoted to the identification of the needs and priorities for future field campaigns, presentations by representatives of the EMEP centres (MSC-W, MSC-E and CCC) helped the Task Force to understand the major gaps to be filled for improving the modelling practices (e.g. model evaluation) as well as the current technical and cost limitations.

19. In addition, the Task Force was informed by an expert from the Centre of Ecology and Hydrology of Edinburgh about the new perspectives (in terms of PM composition data and mass size distribution) made possible by the new AMS technology that had been implemented in around 10 sites during the EMEP field campaigns.

20. The following considerations for the future design of the EMEP field campaigns emerged from the presentations and the ensuing discussions:

(a) "Intensive Observation Periods" are important both for science and capacity building in the EMEP framework;

(b) Given the currently lack of data on dry deposition fluxes, vertical profiles of pollutant concentrations, volatile organic compound (VOCs) concentrations (summer situation) are needed for improving models dedicated to acidification, eutrophication, ozone and PM concentration simulations. More data on PM chemical speciation and gas-particle partitioning is expected to become available from the 2008/2009 EMEP intensive measurement campaigns;

(c) Activities involving passive sampler fields campaigns for characterizing POPs concentrations and heavy metals measurements (with high temporal resolution), including effect data, should be prioritized and carried out in cooperation with the Working Group on Effects and

with national reference research centres (e.g. RECETOX in the Czech Republic). Moreover, data on POPs and heavy metals in soils, seas, fresh water and vegetation are necessary to improve model parameterizations of processes in the environmental compartments;

(d) Cooperation with current and future EU projects is needed to retain the momentum (especially on flux, VOCs and POPs);

(e) Evaluation of the data from the previous intensive periods is a prerequisite for the launching of the new field campaigns. Launching new intensive measurement periods was not considered feasible before 2011;

(f) The next field campaigns should be in preparation now, in terms of the choice of priorities, publication and promotion plans as well as liaising with national expert teams and research laboratories.

IV. BETTER UNDERSTANDING OF AIR POLLUTION SOURCES

21. The Task Force considered information on the outcomes of national modelling studies for quantifying air pollution sources, as follows:

(a) An expert from the Swiss Paul Scherrer Institute presented a new approach for $PM_{2.5}$ source apportionment based on a non traditional mixing of methods: use of 14C measurements, and Positive Matrix Factorization (PMF) for organic and elemental PM species measured with AMS and rotating drum impactors respectively. The analysis carried out in this study allowed for sources attribution of organic and elemental compounds found in PM. It also demonstrated that wood combustion organic aerosol can be surprisingly high (due to oxidization processes). Secondary fraction in organic aerosol can be high, but it is still difficult to discriminate between various sources;

(b) An expert from Spain provided a review of source apportionment modelling studies performed in Spain, involving various approaches using a large panel of tracers and physico-chemical parameters. Some groups of tracers had been found throughout Europe as a result of oil combustion or tires/brake emissions. This work also highlighted the current lack of knowledge with respect to the origin of secondary compounds;

(c) A representative of MSC-E presented an application of the monitoring-modelling approach to characterize the pollution levels and an attempt to link discrepancies between modeled and measured values with the uncertainties of heavy metal emission data by means of back trajectories. It was shown that measurements with high temporal resolution were

particularly helpful for this task. The necessity to prepare more contemporary emission expert estimates for modelling purposes was stressed.

22. The Task Force welcomed these outcomes, which demonstrated the usefulness of source-apportionment and source-receptor modelling studies as well as the interest of developing field campaigns strategies for obtaining appropriate data for better quantification of emission and process parameterizations.

23. The Task Force discussed the benefits of considering emission, measurement and modelling data together for developing a comprehensive analysis of the emission sources as well as of the physico-chemical processes (e.g. secondary chemistry, deposition). It concluded that field campaigns, new instruments (e.g. AMS) and new data (e.g. on carbon-14) could be helpful in developing of the comprehensive analysis. The Task Force acknowledged, however, that more information was still needed on emission profiles (especially for PM), the time and meteorological dependence of emissions, and new parameters (PM number concentration). Some of these data gaps could be addressed by the Task Force on Emission Inventories and Projections and by the EMEP Centre on Emission Inventories and Projections.

24. As a first step in the integrated analysis process, the Task Force welcomed and supported the proposal of MSC-E to organize a case study to investigate heavy metal pollution levels in a given country. Two of the main aims of the study would be to understand the reasons of the discrepancies between the modelled and measured values and to analyse the quality of the emission data. The case study would be a joint evaluation involving national experts as well as the modelling, emissions and monitoring communities.

V. FUTURE MODELLING PRIORITIES

25. As a basis of its conclusions on the future modelling priorities, the Task Force considered the following information presented at the meeting:

26. Representatives of MSC-W presented its latest modelling results for acidification and eutrophication compounds, as well as for PM. A stepwise approach for improving both meteorology and emission resolutions was presented, involving evaluation of results against the EMEP measurements. A stepwise improvement of the results on primary compounds concentrations had been observed with improved meteorology. This trend had been less clear for secondary compounds and wet deposition. Most of the improvement seemed to have been reached with a 25 km resolution and only with smaller improvements with resolution ranging from 25 km to 10 km. However, these results should be evaluated against a denser network, including also sub-urban sites in the evaluation (e.g. against the EEA air quality database,

AIRBASE). Temporal resolution of the modelling results had not improved in average, probably because of the lack of improvement in temporal correlation of precipitation. For source-receptor matrices, the effect of improved emission and meteorology resolution was low, although redistribution of emissions did matter a bit more.

27. In addition, a representative of the MSC-W informed the Task Force about the effect of improved model resolution on PM simulation results. The effects were rather small, especially on the bias, and independent on the PM compounds considered. Spatial correlation was generally improved with the resolution, but this change was more significant with resolution increasing from 50 km to 25 km than from 25km to 10km. However, some peaks in time series were better captured by the highest resolution model. This work should be followed up with an extensive set of monitoring stations, including AIRBASE.

28. An expert from Germany presented a hybrid stochastic-deterministic model for simulation of air pollutant concentrations near urban roads, which combined the use of regional chemical transport model with the urban and roadside increment calculations based on emission, and city-characteristic data. This method improved the PM10 results and should be considered as a complementary approach to the City-Delta[1] concept.

29. A representative of DG -JRC presented the European Commission's Eurodelta regional air quality policy model intercomparison study and described some recent results where source-receptor relationships were developed on a sectoral basis. Eurodelta showed that sectoral source receptor relationships could be very different to those currently used in the integrated assessment modelling under the Convention (based on national total emissions and including all sectors). The Eurodelta project had achieved a number of policy relevant results, and follow-up activities could be foreseen with respect to integrated modelling assessment needs.

30. The following other air quality modelling initiatives which could be relevant for the Task Force's future work were referred to :

(a) The EEA Forum for Air Pollution Modelling (FAIRMODE) (http://fairmode.ew.eea.europa.eu), which aims to build a network of modellers in Europe with a

[1] A European modelling exercise for an intercomparison of long-term model responses to urban-scale emission-reduction scenarios.

view to establishing common and agreed rules on model evaluation (from regional to street scale) for models likely to be used for regulatory reporting;

(b) The European Consortium for Modelling of Air Pollution and Climate Strategies (EC4MACS) (http://www.ec4macs.eu/home/index.html), a project funded by the European Commission (by LIFE, the EU financial instrument for the environment). EC4MACS develops methodologies and databases that are likely to be implemented in integrated assessment modelling for assessing various environmental policies. A new subproject had recently been introduced for updating and improving the former City-Delta approach, hence providing for a better assessment of urban air pollution patterns.

(c) The EU Air Quality Model Evaluation International Initiative (AQMEII) (http://aqmeii.jrc.ec.europa.eu), which aims to promote research on regional air quality model evaluation across the European and North American atmospheric modelling communities through the exchange of information on practices, the realization of inter-community activities and the identification of research priorities, keeping in focus policy needs.

31. In discussing the priorities for future modelling activities that the Task Force should carry out or support, the Task Force agreed that its members – and in particular the national and EMEP modelling teams – should be aware of and if possible contribute to the above-mentioned initiatives, as well as to other European and international modelling initiatives that are policy-relevant and fall within the Task Force's field of interest.

32. Moreover, considering the wealth of observation data accumulated through the EMEP monitoring activities (via observation sites, intensive observation periods and cooperation with research networks), the Task Force noted that there was a potential for starting a new modelling activity in the framework of the Task Force. This activity should be designed to support the work under the Convention (according to the integrated assessment modelling needs) and to further evaluate/improve the EMEP models. The Task Force agreed that the "Eurodelta concept", which had proved to be well-suited for both model development and assessment, would be appropriate for demonstrating the robustness of policy applications of models. The Task Force concluded that Eurodelta follow-up activities should be reported to the Task Force and that its objectives and methodologies should be discussed at the next Task Force workshop.

33. As proposed by the FAIRMODE community, the Task Force agreed to organize its next workshop in fall 2009, back-to-back to the next FAIRMODE annual meeting.

VI. FUTURE WORK

34. Following discussion on the activities to be reflected in the 2010 workplan of the EMEP Steering Body, the Task Force agreed to propose the following work items for the next year:

(a) Build up the appropriate framework and support for the implementation of the updated EMEP monitoring strategy. This involves the following actions:

(i) Including the issue as a topic for a workshop in 2010 (clarification of some points, assistance and exchange of experiences (CCC/Task Force on Measurements and Modelling);

(ii) Enhancing the dialogue with the satellite and remote-sensing community, including through setting up a joint working group that included Task Force members and experts from this community;

(b) Contribute to the analysis and promotion of the EMEP field measurement campaigns and their results in collaboration with CCC;

(c) Identify gaps and topics that should be covered by the future EMEP field campaigns, and establish a strategy towards this end;

(d) Design one or two key studies that would bring together the know-how for policy support from the emission, measurement and modelling communities for submission to the EMEP Steering Body at its thirty-fourth session (2010);

(e) Conceive a “Eurodelta follow-up” modelling exercise that fits the integrated measurement modelling needs and takes account of the lessons learned from the previous model intercomparison projects and for new available observation data;

(f) Contribute to ongoing European Union modelling initiatives (e.g. EC4MACS, FAIRMODE and AQMEII);

(g) Organize a workshop in autumn 2010, preliminarily planned to be held jointly with the Task Force on Emission Inventories and Projections and the Task Force on Integrated Assessment Modelling, focusing on emission, measurement and modelling interaction in view of

integrated assessment modelling;

(h) Hold its eleventh meeting in spring 2010 (date and venue to be specified), and report on its outcomes to the EMEP Steering Body at its thirty-fourth session in 2010.
