United Nations ECE/EB.AIR/GE.1/2011/3

Economic and Social Council

Distr.: General
24 June 2011

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-fifth session
Geneva, 5–7 September 2011
Item 6 (a) of the provisional agenda
Progress in activities in 2011 and future work: measurements and modelling (acidification, eutrophication, photo-oxidants, heavy metals, particulate matter and persistent organic pollutants)

Measurements and Modelling*

I. Introduction

1. The present report presents the results of the twelfth meeting of the Task Force on Measurements and Modelling, held on 11 to 13 May 2011 in Dubendorf, Switzerland, in accordance with item 2.2 of the workplan approved by the Executive Body at its twenty-seventh session (ECE/EB.AIR/106/Add.2). It describes progress in the heavy metals pilot study and in the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) field campaigns' analysis and feedback related to the effective implementation of the revised EMEP monitoring strategy, as well as ongoing work on modelling aspects.

2. Sixty experts from the following Parties to the Convention attended the meeting of the Task Force: Austria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, Malta, the Netherlands, Norway, Portugal, the Russian Federation, the Slovak Republic, Spain, Sweden, Switzerland, and the United Kingdom of Great Britain and Northern Ireland. Also present were representatives from the Chemical Coordinating Centre (CCC), the Meteorological Synthesizing Centre-East (MSC-E), the Meteorological Synthesizing Centre-West (MSC-W), the International Institute for Applied Systems Analysis (IIASA), the European Environment Agency (EEA), the European Commission's Joint Research Centre (DG-JCR), the World Meteorological Organization

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(WMO) and CONCAWE (the oil companies' European association for environment, health and safety in refining and distribution).

3. Ms. L. Rouïl (France) and Ms O. Tarasova (World Meteorological Organisation) chaired the meeting, which was hosted by the Swiss Federal Office for the Environment and the Swiss Federal Laboratories for Material Science and Technology (EMPA).

4. Mr. R. Ballaman, Chairman of Working Group on Strategies and Review (WGSR) gave an overview of the work under progress related to the revisions of the Heavy Metals Protocol, the Gothenburg Protocol, and of the implication of the report of the ad hoc Expert Group on Black Carbon (BC). He provided some recommendations to the Task Force for developing further work well-suited to support these initiatives, e.g. compounds to be measured, monitored, modelled and reported through the EMEP strategy.

5. Ms. Sonja Vidic, Chair of the EMEP programme, presented the Long-term strategy (LTS) for the Convention on Long-range Transboundary Air Pollution and action plan for its implementation. The LTS should impact the Task Force activities: focus on pollutants within the Gothenburg Protocol, outreach activities, especially with countries in Eastern Europe, the Caucasus and Central Asia and South-east Europe integration of climate change in air pollution modelling approach and integration of short lived climate forcers (SLCFs) in the instruments of the Convention, collaboration with the Working Group on Effects.

6. Finally, as an introduction, Ms. Rouïl gave a short presentation with an outline of the workplan agreed for 2011 and currently in progress within the Convention with regard to the ongoing revision of its protocols.

II. Heavy metals issues the EMEP test case study

7. A representative of MSC-East presented the rationale and the progress of the heavy metal test case studies launched in 2010 for an in-depth investigation of the inconsistencies between heavy metal emissions, measurement and modelling in several European countries. At present, six countries (Croatia, the Czech Republic, Italy, the Netherlands, Slovakia and Spain) expressed their interest in participating in the project, and presented current on-going work with various progress levels. Recommendations for further improvement of air quality assessment (emission data, model parameterization, quality and representativeness of monitoring data, etc.) were expected as the main results of those test case studies.

8. He reminded that, as agreed by the Task Force, the project had been organized in several work packages: collection of data (emissions, observations, etc.); preparation of input geophysical and meteorological data for modelling; atmospheric modelling; analysis; and interpretation. MSC-East and country involvement could differ according to the availability of data (inputs for modelling and observations), modelling results from potential national projects (with various spatial resolution for instance), national skills and resources. The project should be achieved by the beginning of 2012 with the publication of assessment reports and recommendations.

9. First results highlight an issue with wind re-suspension which is an important contributor to heavy metals levels assessed in evaluations with high uncertainties, and needs more detailed investigation. Moreover, models still substantially underestimate wet deposition of heavy metals).

10. The six countries involved in the project presented their experience and their first feedback related to the project. Few insights had been raised as followed:

(a) The Czech representative mentioned that the country developed its modelling capacity with the support of MSC-East. Policy support for elaborating control strategies had been enhanced thank to the test case project;

(b) The representative from Croatia raised the issue of resuspension processes of heavy metals stored in soils. This point will be furthermore investigated in modelling studies with the link with climate change likely to increased the effect of this process;

(c) The representative of the Netherlands showed high resolution emission inventory data used for modelling, analysis of the monitoring network structure, and critical loads application;

(d) The representative from Italy presented comparison of national model results for heavy metals and persistent organic pollutants with the numerical evaluations provided by MSC-East. Large differences seemed to be due to ship emissions accounting;

(e) The representative from Spain, a new Party in the test case study, described the 37 Spanish monitoring sites with various typologies. Speciation studies to assess the contribution of the various industrial sectors and traffic exist had been discussed as well.

11. The representative of the Portugal presented the work on modelling of gaseous mercury emissions from natural sources in Portugal. Mercury release from vegetation occurs via mercury uptake from soil solution to the transpiration stream.

12. The Task Force acknowledged the progress of the work provided by MSC-East and the volunteer countries in the test case studies. In particular, the Task Force highlighted its interest in the initiative and its relevance for improving emission inventory data, model parameterizations and optimizing the monitoring network. An intensive discussion took place on the possibility of the inverse modelling application for better quantification of heavy metals emissions. Forward modelling with improved emission resolution definitely improved the agreement between observations and simulation. The key issue remains with resuspension. It is unclear to what extent inverse modelling based on a limited observational based can contribute to resuspension and direct emission estimates (both are competing processes). Better observational database and a-priori information should still be collected for a better understanding of driving processes (resuspension, wet deposition...).

13. It was recommended to continue and extend this practice (not limit it only to **heavy metals)**.

Case studies were acknowledged to be very relevant due to number of reasons:

(a) Parties of Convention were very deeply involved in this work;

(b) Results of the study could be used for PM analysis at the national level;

(c) Better resolution of model outcome could help countries to take more localized measures on emission regulations;

(d) Different countries got various national focus (impact of meteorology, geophysical conditions like soils or land use etc), hence sensitivity of the EMEP models against the parameters of national interest could be assessed via case study;

(e) Better collaboration was developed within countries as the participants of case study had to “dig for” information in the country.

14. The Task Force noted that MSC-East would present the progress and first results of the pilot studies at the thirty-fifth session of the EMEP Steering Body, in September 2011.

III. Issues related to the implementation of the revised EMEP monitoring strategy

15. As an introduction, a representative of CCC gave a presentation on the status of its activities with the implementation of the EMEP monitoring strategy. EMEP stations of level 1 are in a quite good shape. There are still some challenges: how to deal with additional driving sources linked to the implementation of the EU CAFÉ directive (PM speciation)? How to more involve countries in Eastern Europe, the Caucasus and Central Asia in EMEP network, through bilateral agreement? It was highlighted that the geographical coverage improved with inclusion of the four stations in Moldova, Armenia, Georgia and Kazakhstan.

16. However pressing challenges in implementation of the new monitoring strategy at level 1 stations with respect to data completeness (respective to time and parameters), QA/QC, data reporting, funding were mentioned. As a general tendency, because of funding issues the frequency of observations (e.g. precipitation chemistry) is reduced and long-term stability of the observations falls very often under question.

17. Level 2 sites are focused on aerosol characteristics, volatile organic compounds (VOCs), elemental carbon/organic carbon (EC/OC) and persistent organic pollutants (BaP and PCB) and are largely supported by research infrastructure projects e.g. EUSAAR (aerosols), ICOS (CO2), NitroEurope (Nitrogen Compounds), GMOS (Hg), INGOS (non CO2 greenhouse gases), ACTRIS (aerosols, NOx, VOCs). EMEP level 3: includes EMEP intensive periods of observation in connection with research projects like EUCAARI. The main challenges hold with data reporting of new parameters, quality assurance and quality control (QA/QC) for compounds reported by the EU (e.g. in comparison with EC/OC speciation in EMEP), involvement of the parties that are not partners of EU projects, data sharing and data ownership when working with research laboratories; standardization of measurement processes (e.g. EC/OC EUSAAR2 protocol adopted or ACTRIS/WMO for photo-oxidants).

18. A representative of the DG-ENV Joint Research Center provided an update about the progress in the OC/EC measurements within EMEP. The EUSAAR project allowed the definition of a standardized artifact free procedure to measure EC/OC in Europe (www.eusaar.net for further detail). The derived Standard Operated Procedure (SOP) for sampling and thermo-optical analysis of atmospheric particulate organic and elemental carbon had been submitted to CCC for approval for EMEP monitoring network.

19. A representative of Germany presented the progress with an implementation of the MARGA (Online Monitor for AeRosols and GAses in ambient air) instrument at Melpitz site in Germany. Instruments allows for a wide spectrum of measurements (in gas and aerosol phase). An intensive comparison of the instrument with the standard methods was performed.

20. Several countries (the Netherlands, Denmark, Czech Republic and Malta) presented their current work within the implementation of the EMEP monitoring strategy.

21. The discussion about the implementation and the improvement of the EMEP monitoring strategy allowed consensus of the participants to set a number of recommendations related to the EMEP monitoring strategy:

(a) Extension and consolidation of the level 1 network;

(b) Compliance with the Air quality directive requirements for resources optimization;

(c) Securing resources to ensure long term datasets promoted by the Convention strategy for trend analyses that are likely to be destroyed with changes in the country monitoring strategy (for developing collocating observations for instance);

(d) More generally, sspecial attention was given to decisions related to changes in the monitoring network that can lead to breakdowns in time series, e.g. grouping instruments to get collocated observations or a larger set of parameters;

(e) Close cooperation with research network should be maintained to improve networks and database for environmental assessment.

A. Simultaneous implementation of the EMEP strategy and the Air Quality Directive monitoring requirements

22. Considering challenging issues for a large part of the Parties to conciliate both frameworks requirements, a dedicated session had been organised on this question.

23. As an introduction, a representative of the DG-ENV Joint Research Center presented its activities to establish air quality directive requirements and on which topics the JRC's European Reference Laboratory for Air Pollution is involved in. Setting-up of the AQUILA network (Air Quality Reference Laboratories) was presented as well.

24. A Swiss representative introduced the AirMonTech project. This project is a Coordination and Support Action (for period 12/2010 – 05/2013) with the aim of reviewing the state-of the-art for urban air pollution monitoring and assesses opportunities and limitations of recent and new generations of in-situ technologies.

25. Discussion developed on shared concerns related the potential difficulties with simultaneous implementation of EU Directive and EMEP Monitoring strategy because of different and unharmonized requirements. EU Directive recommends a number of measurement methods which are automatic but not precise enough for monitoring transboundary fluxes at rural regions as recommended by EMEP. Some parameters recommended for measurements by EU Directive and EMEP strategy (e.g. PM) are different while complementarity should be searched out (for instance for the implementation of rural background supersites). Simultaneous implementation of different requirements puts a risk of funding cuts for regional EMEP stations.

26. Therefore, it is essential to demonstrate which of EMEP observations can contribute to the required measurements under Directive. CCC will take the lead for writing a paper explaining how the EMEP monitoring strategy if well developed, could contribute to the development of the Air Quality Directive monitoring strategy and the assessment of what has been achieved with the previous mandate of the Directive.

27. The following decision had been taken: the CCC prepares a condensed booklet with the summary of parameters measured in EMEP, their environmental relevance and synergy/applicability to address the EU Air Quality Directive. It must be prepared in consultation with countries to reflect possible national issues. By 1st of August 2011, CCC will circulate the draft to the countries. Final draft is planned to be presented at the EMEP Steering Body session in September 2011.

28. CCC was requested to participate as far as possible in the discussions that hold at the European Commission level within the future revision process of the Air Quality Directive to ensure further harmonization of measured parameters and measurement techniques between EMEP Monitoring strategy and the EU Directive monitoring requirements.

B. Climate forcers, ozone, PM and precursors monitoring in EMEP

29. The CCC reminded how monitoring of climate forcers is addressed in the EMEP monitoring strategy. A number of parameters are currently considered according to the EMEP monitoring strategy that sets out "*information needs associated with the coupling between atmospheric composition and deposition rates with climate variability/change*". Recommendations to EMEP for climate forcers monitoring were focussed on communication for explaining the relevance of the EMEP network, training and capacity building, better and more comprehensive observation database (call for available data, also historic), involvement of greenhouse gas experts in EMEP monitoring/assessments.

30. Special care was given to black carbon (BC) issue which impacts both climate change and air quality. All BC measurements must contain detailed information on how they are obtained. This is a real issue in the cases when comparison of observations with model simulations should be performed. Scientific Advisory Group for Aerosols in the Global Atmospheric Watch should prepare a special document of proper use of "black carbon" term within research community.

31. The French coordinator of the EUSAAR project presented recommendations for the monitoring of short-lived species in Europe based on the results from EUSAAR and its follow-up named ACTRIS. ACTRIS should contribute to EMEP strategy through the implementation of level 3 (and 2) sites. There is a real challenge with extensive NOy and VOC monitoring species but also with 3-D monitoring (ACTRIS includes the ERALINET LIDAR network as well), PM speciation (tracer approach) and elemental carbon/black carbon issues.

32. Swiss experts from EMPA presented some results related to VOCs, NOy and NO2 measurements obtained with various approaches and illustrated the need for close cooperation between research networks and projects which evaluate the methods and the EMEP program which "probates" some of them for regulatory use.

33. Finally, the WMO representative reported on the outcome of the second workshop on troposphere ozone trends (Toulouse 2011) which set a number of recommendations for ozone monitoring data process, especially to study concentration patterns variability.

C. EMEP intensive field campaigns

34. The CCC presented the current status of the collected data from the last EMEP field campaigns, with a focus on the latest one. The two intensive measurement periods, one in 2008 (17 September–15 October), and one in 2009 (25 February–26 March), aimed at studying aerosol characteristics (gas/particles conversion, size distribution, carbonaceous aerosol). In total, 18 sites had participated in the field campaigns with a remarkable geographical coverage, and 9 of them had carbonaceous aerosol source apportionment in their programme (filter or 14C analysis). There were several issues connected with isotopic measurements which delayed the final results. At four of the Northern European sites chemical composition of the carbonaceous aerosols had been performed. Data reporting is about to be achieved, and released to the Parties through the EBAS website (http://ebas.nilu.no/).

35. To improve visibility of EMEP intensive periods results, which are quite successful and give good example of efficient cooperation with the research community, the respective list of publications based on the campaign collected data should be made available on the CCC website.

36. An expert from the Paul Scherrer Institute (PSI) from Zurich showed how data measured by the AMS could be used for identifying organic aerosol from local and transboundary sources and quantifying their contribution to aerosol mass concentration,

thanks to source apportionment (Positive Matrix Factors (PMF)) techniques. Moreover, a comparison had been performed between AMS and Aerosol Chemical Speciation Monitor (ACSM so-called "mini-AMS"), on-line instruments with a 15 minute resolution. Ten to twelve instruments were employed during different periods. Spatial coverage was not uniform and Eastern Europe and Mediterranean region were not correctly documented but the results were very promising for the next steps.

37. The Finish representative presented the results of the implementation of the Aerodyne Aerosol Chemical Speciation Monitor (ACSM) instrument in Helsinki. Its advantages were commercial availability, robustness, and easier operations in comparison with research AMS. On the other hand, this "easy to use" is associated with a number of disadvantages, like missing size separation and low resolution (mass units). However, as highlighted from the EMEP Intensive Observation period experiment, the results are very promising.

38. Discussion about the priorities for the next EMEP field campaigns followed and some priorities and a preliminary "wish list" had been discussed and agreed:

(a) Main focus still to be on PM compounds and source characterization with tested and validated procedures thanks to the experience gained during the previous Intensive Observation Periods;

(b) "Real" summer and winter periods to be targeted, eventually according to the field campaigns already planned within research projects (ACTRIS). Summer 2012 (16-Jul to 24-Aug 2012 with the London Olympic campaign ongoing) and winter 2013 (7-Jan to 15-Feb 2013 for the ACTRIS field campaign);

(c) New geographical distribution of measurement sites with urban/rural paired measurements where possible and a better coverage of the Eastern and Mediterranean Europe;

(d) Opportunity for use and evaluation of new and easily accessible instrumentation like ACMS and Multi-wavelength aethalometer;

(e) More information on gas phase precursors is expected (NH_3, HNO_3, HCl, SO_2, NO_x, VOC_s). This is necessary to better understand potential discrepancies between model and measurements;

(f) Access to vertical profiles of pollutant concentrations should be of great interest for the modellers;

(g) Close cooperation with the modelling community should be enhanced during both the preparation and the implementation phases.

39. It was agreed that a paper is needed to specify the framework and the priorities of the future Intensive Observation Periods with formulated objectives, collaboration with research projects, involvement of national experts etc. Organizers of the future Intensive Observation Periods (CCC and other involved) were requested to prepare such a paper.

IV. Modelling issues

A. Grid transformation of EMEP model

40. A representative of MSC-West presented a position of both EMEP Centres on this issue. Several characteristics of the EMEP modelling framework had been addressed: projection (e.g. polar stereographic, latitude-longitude), resolution (e.g. '50km x 50km',

0.2º x 0.2º), domain. Current models use a polar stereographic projection with a resolution of 50 x 50 km.

41. Pros and cons of such changes were discussed. Positive points relate to better consistency with the grid adopted by the Chemistry-Transport Model's meteorological driver and the gridded emission inventories. The new grid would correspond to what is more commonly used throughout the scientific community for an easier exchange of data. Amongst the "cons", strongly varying grid size and inevitable inclusion of countries outside EMEP within the model domain were identified.

42. The final conclusion was an agreement for the implementation of a better resolution in the EMEP modeling systems for all runs and to switch to a latitude-longitude projection with corresponding update of the current domain.

B. Status of the EMEP modelling system and national contributions

43. Representatives of MSC-West presented their latest modelling results, especially those related to PM concentrations' prediction. They presented a comparison of EMEP model runs with AMS measurements from 2008-09 intensive periods. The comparison was based on hourly simulations which allow for addressing meteorological processes (dispersion, chemistry, dry deposition) and diurnal cycle of emissions. Model's behaviour varies according to the considered compounds, the location and the period.

44. The status of development of a secondary organic aerosol (SOA) module based on a volatility basis set concept in the EMEP model and its preliminary evaluation had been commented. Encouraging results had been shown. MSC-West also reported on the progress with inorganic PM modelling. The main aspect of the presentation was on the role of change in meteorological driver of the model (HIRLAM model data are now used instead of PARLAM data). It caused more turbulent mixing (faster aloft transport), bias in wind velocity and precipitation anomalies responsible for significant changes in dry and wet deposition. The Task Force stressed the high sensitivity of the modelling results to the meteorological driver and recommended further investigation to assess its impact for policy purposes. The need for the definition of appropriate metrics for model evaluation was highlighted as well.

45. A general and recurrent comment was the recommendation to MSC-West to work furthermore on the improvement of the boundary layer processes parameterization, the chemical scheme, and high resolution meteorology. Improvement of the EMEP model resolution should not be the only one updating priority.

46. Four presentations from national representatives allowed the Task Force to consider the modelling activities developed by Parties:

(a) A representative of Switzerland presented the online-coupled chemistry-climate model COSMO-ART and comparison of simulations with EMEP data collected during different intensive measurement periods as well as with the data submitted to Airbase;

(b) A representative of the Netherlands presented the latest developments in the LOTOS-EUROS modeling system with respect to the mass balance of ammonia (effects of including bi-directional surface-atmosphere exchange);

(c) A representative of the United Kingdom reported results on the impact of the chemical mechanisms used in the Chemical Transport Model for policy issues. Six mechanisms had been tested giving significantly different responses to 30% reductions in VOC and NO_x emissions;

(d) A representative of France presented the results from the European Consortium for Modelling of Air Pollution and Climate Strategies (EC4MACS) project on regional air quality model results at the city scale. EC4MACS' "urban modeling"» component is the follow-up of the CityDelta project aiming at better accounting for the urban dimension in the regional integrated assessment modeling.

47. Two presentations were given concerning national activities related to European scale modeling that are likely to feed the EMEP modeling developments:

(a) A representative of Spain presented observed PM1, PM2.5 and PM10 speciation, BC and N data available in Spain for model validation. 38 stations are available although they were operated during different periods;

(b) A representative from the Netherlands presented a new high resolution European emission inventory for 1999 funded by the CONCAWE in support of the EURODELTA 3 initiative.

48. Information about the status of the EURODELTA3 initiative was given by the Task Force chair. The project aimed at establishing an intercomparison model framework for a new assessment of the current European modeling systems including the EMEP model. Comparison against observation data from the Intensive Observation Periods together with a retrospective analysis to assess the capacity of the Chemical Transport Models to reproduce impacts of past changes in emissions should be established as well. Unfortunately, the project has not started so far, because of a temporary lack of availability of the Task Force chair who could coordinate the project. However, it should start in summer 2011, and several modeling teams attending the Task Force meeting confirmed their willingness to participate. A note setting a new framework for the project will be circulated in July 2011.

V. Future work

49. Following discussion on the activities to be reflected in the 2012 workplan of the EMEP Steering Body, the Task Force agreed to propose the following work items for the remaining part of 2011 and for 2012:

(a) Build up the appropriate framework and support for the implementation of the updated EMEP monitoring strategy, by undertaking the following actions:

(i) Considering possible synergies with the monitoring requirements of the EU Air Quality Directive; (CCC/Task Force/Parties);

(ii) Developing cooperation with the atmospheric composition research community and the existing operational monitoring networks, especially for short lived climate forcers monitoring (e.g. Global Atmospheric Watch).

(b) Contribute to the development and the implementation of the workplan for the next EMEP field campaigns scheduled for summer and winter periods in 2012 and 2013, respectively. Present this workplan to the EMEP Steering Body at its thirty-fifth session in 2011; (CCC/Task Force);

(c) Provide guidance and assistance for the implementation of the six case studies on heavy metal pollution assessment (in the Czech Republic, Croatia, the Netherlands, Spain, Italy, Slovakia), which aims at bringing together the know-how for policy support from emission, measurement and modelling communities; assess and analyse the results and overall success of the exercise. Report on the interim results of this test case study to the EMEP Steering Body at its thirty-fifth session in 2011 (MSC-E/Task Force);

(d) Organize and coordinate the EURODELTA3 follow-up modelling exercise focusing on the evaluation of the ability of models (especially the EMEP model) to simulate fine resolution atmospheric processes, with the emphasis on the development of common model intercomparison protocols, model-to-observation performance indicators and criteria needed for to evaluation of the state of the art of the EMEP model, as well as its ability to reproduce past trends in air pollutant concentrations (Task Force/parties/MSC-W);

(e) Organize and coordinate the preparation of a report on LRTAP achievements within the last 10 years, based on monitoring observation data, modeling results and national expertise. As a first step, a questionnaire to assess the results of the Gothenburg Protocol implementation will be circulated to countries (Task Force/Parties/MSC-W/MSC-E/CCC);

(f) Improve cooperation with the Working Group on Effect through exchange of results and data dedicated to transboundary air pollution impact assessment. Common work should be organised for the edition of the 10 years assessment report (Task Force);

(g) Report on progress at the thirty-sixth session of the EMEP Steering Body; (Task Force/MSC-W/CCC/Parties);

(h) Contribute as far as possible to the ongoing European Union modelling initiatives (e.g., the European Consortium for Modelling of Air Pollution and Climate Strategies (EC4MACS), the EEA Forum for Air Pollution Modelling (FAIRMODE) and the Air Quality Model Evaluation International Initiative (AQMEII));

(i) Consider options and opportunities for enhancing the visibility and promotion of the work of the Task Force e.g., by means of newsletters or conferences); (Task Force, Parties, Centres);

(j) Hold its thirteenth meeting in April 2012 in Malta, and report on its outcomes to the EMEP Steering Body at its thirty-sixth session in 2012.