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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

Working Group on Effects

First joint session*
Geneva, 14–18 September 2015
Item 15 of the provisional agenda
Progress in activities in 2015 and further development of effects-oriented activities

Modelling and mapping**

Report by the Coordination Centre for Effects and the Task Force on Modelling and Mapping

Summary

The present report is being submitted for consideration by the first joint session of the Steering Body to the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe and the Working Group on Effects in accordance with the request of the Executive Body for the Convention on Long-range Transboundary Air Pollution in the 2014–2015 workplan for the implementation of the Convention (ECE/EB.AIR/122/Add.2, items 1.1.1, 1.1.10 and 1.2.1) and the Long-term Strategy for the Convention (ECE/EB.AIR/106/Add.1, decision 2010/18, annex).

* The Executive Body to the Convention agreed that, as of 2015, the Working Group on Effects and the Steering Body to the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe should meet jointly, to achieve enhanced integration and cooperation between the Convention's two scientific subsidiary bodies (ECE/EB.AIR/122, para. 47 (b)).

** The present document is being issued without formal editing.

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The present report includes a review of the workplan and a summary of the discussion and conclusions reached at the back-to-back meeting of the thirty-first Task Force of the International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends and the twenty-fifth workshop of the Coordination Centre for Effects (Zagreb, 20–23 April 2015). The meetings focused on progress achieved in modelling and mapping, inter alia, regarding methods and objectives for assessing air pollution effects on plant species diversity. The meetings included a training session addressing modelling methods and input requirements for use by Parties under the Convention to enable the continuation of contributions to European databases on critical loads and air pollution effects, for incorporation in integrated assessment modelling.

Contents

I. Introduction

1. France is the lead country of the Task Force of the International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends (ICP Modelling and Mapping).[1] The Netherlands is the lead country of the programme centre of ICP Modelling and Mapping, the Coordination Centre for Effects (CCE).[2] The Task Force is hosted by the French National Competence Centre for Industrial Safety and Environmental Protection (INERIS).[3] The CCE is hosted at the Dutch National Institute for Public Health and the Environment (RIVM).[4] Representatives of more than 30 Parties to the Convention on Long-range Transboundary Air Pollution participate in the activities of ICP Modelling and Mapping. National Focal Centres (NFCs) of ICP Modelling and Mapping contribute to methods and data to help compile and maintain the CCE European database of critical loads for acidification and eutrophication. NFCs also research novel thresholds for impacts on plant species diversity. ICP Modelling and Mapping results are also used in the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) Task Force on integrated assessment modelling (TFIAM) in collaboration with the Meteorological Synthesizing Centre-West (MSC-W), the Meteorological Synthesizing Centre-East (MSC-E) and the Centre for Integrated Assessment Modelling (CIAM). ICP Modelling and Mapping collaborates with all the International Cooperative Programmes (ICPs) under the Convention and the Joint Task Force on the Health Aspects of Air Pollution.[5]

II. Progress in the modelling and mapping activities

2. The thirty-first meeting of the ICP Modelling and Mapping Task Force and the twenty-fifth CCE workshop were hosted by the Meteorological and Hydrological Service of Croatia and held back to back in Croatia (Zagreb, 20–23 April 2015).[6]

3. Fifty-two delegates from the following 19 countries participated in the meeting: Austria, Belgium, Canada, China, Croatia, Czech Republic, Denmark, France, Germany, Italy, Norway, Netherlands, Poland, Russian Federation, Slovakia, Spain, Sweden, Switzerland and the United Kingdom of Great Britain and Northern Ireland. Representatives of the ICP on Effects of Air Pollution on Natural Vegetation and Crops (ICP Vegetation), the ICP on Assessment and Monitoring of the Effects of Air Pollution on Rivers and Lakes (ICP Waters), the ICP on Integrated Monitoring of Air Pollution Effects on Ecosystems (ICP Integrated Monitoring), the Joint Expert Group (JEG) on Dynamic Modelling and CCE were represented. A contribution by the United States of America via internet was planned, but could not be given due to technical difficulties. In 2015, lack of funding from the lead countries and from workplan-related funds prevented a number of

[1] See www.icpmapping.org.
[2] See www.wge-cce.org.
[3] See www.ineris.fr
[4] See www.rivm.nl
[5] The Task Force is a joint body of the World Health Organization (WHO)/European Centre for Environment and Health (ECEH) and the Executive Body for the Convention.
[6] Le Gall et al. (2015) Draft minutes of the 25th CCE Workshop and the 31st meeting of the Programme Task Force of the ICP Modelling and Mapping in Zagreb, Croatia, 20–23 April 2015 available at http://icpmapping.org/.

representatives of countries in Eastern Europe, the Caucasus and Central Asia from attending the meeting and the workshop.

4. Decisions by the ICP Modelling and Mapping Task Force were reviewed by the participants during the meeting. Presentations and posters were made available on the ICP Modelling and Mapping website. Ms Solveg Kovac from the Croatian Ministry of Environment and Nature Protection welcomed the participants to the meeting.

5. This meeting included a common session between ICP Vegetation and ICP Modelling and Mapping on the combined effects of ozone and nitrogen on vegetation, which is also an important deliverable in the project "Effects of Climate Change on Air Pollution and Response Strategies for European Ecosystems" (ECLAIRE) under the European Union's Seventh Framework Programme for Research and Technological Development.[7]

6. The objectives of the meetings included:

(a) To review the response to the call for data on indicators, issued in 2014 by CCE with a deadline in March 2015, following a request of the Working Group on Effects at its thirty-third session (17–19 September 2014);

(b) To hold a training session addressing (NFC-) specific issues on dynamic soil-vegetation modelling related to the requirements of the call for data;

(c) To share national results related to field measurements, tools and modelling developed in order to assess the impacts of air pollution on ecosystems and their biodiversity;

(d) To consider the ICP Modelling and Mapping workplan and other Task Forceissues under the 2012–2013 workplan for the implementation of the Convention(ECE/EB.AIR.109/Add.2), the 2014–2015 workplan, the Long-term Strategy for theConvention and the the Action Plan for the Implementation of the Long-term Strategy forthe Convention (ECE/EB.AIR.109/Add.1, decision 2011/14, annex).

III. Workplan items relevant to the International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends

A. Setting priorities for monitoring and collection of other data in view of policy needs and financial constraints (workplan item 1.1.1)

7. Following a request from the thirty-third session of the Working Group on Effects, CCE issued a call for data to all Parties to the Convention in the autumn 2014 with a deadline in March 2015. This call for data aimed at:

(a) Adapting the European critical loads database to the 0.50° x 0.25° and 0.1° x 0.1° longitude-latitude grids, used by EMEP, to ensure compatibility of database with these new EMEP grid resolutions and, at the same time, offering the possibility to NFCs to update their national critical load data on acidity and eutrophication;

[7] Grant agreement no. 282910. See www.eclaire-fp7.eu.

(b) Offering the opportunity to NFCs to apply novel approaches to calculate nitrogen and sulphur critical loads;

(c) Applying critical load functions taking into account their impact on biodiversity. NFCs were encouraged to use the Habitat Suitability Index agreed at the 2014 ICP Modelling and Mapping Task Force meeting in Rome.

B. Further implementation of the Guidelines for Reporting on the Monitoring and Modelling of Air Pollution Effects (workplan item 1.1.10 (a))

8. With regard to the development of envisaged reporting guidelines, following a possible adoption by the European Union of a New Clean Air Policy Package, CCE, in collaboration with ICP Vegetation, ICP Waters, ICP on Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests) and ICP Integrated Monitoring, continued to provide advice as appropriate to a draft text in the process, led by the European Union, of reviewing and revising the National Emission Ceilings Directive.[8] The input specifically relates to a draft of its Annex V on monitoring requirements.

C. Enhanced involvement of countries in Eastern Europe, the Caucasus and Central Asia (workplan item 1.1.10 (b))

9. Representatives of several countries of Eastern Europe, the Caucasus and Central Asia have been invited to meetings of the Task Force on Modelling and Mapping back to back with CCE workshops and training sessions of information, and have participated in the past.

10. In 2014 and 2015, a lack of funding prevented a number of country representatives from Eastern Europe, the Caucasus and Central Asia from travelling to and participating in the CCE workshops and Task Force meetings.

D. Cooperation with programmes and activities outside the region (workplan item 1.1.10 (c))

11. In terms of cooperation with programmes outside the region, CCE collaborates with Chinese counterparts in the framework of EMEP Task Force on Hemispheric Transport of Air Pollution on the development of methods and data to enhance critical load computations and exceedances.[9]

[8] See Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants.

[9] Posch M, Duan L, Reinds GJ, Zhao Y, 2015. Critical loads of nitrogen and sulphur to avert acidification and eutrophication in Europe and China, Landscape Ecology 30:487–499; DOI 10.1007/s10980-014-0123-y.

E. Analysis and compilation of the responses by National Focal Centres to the 2014 call for data (workplan item 1.2.1)

12. Thirteen NFCs of the following Parties submitted critical load data for inclusion in the European critical loads database, 2015 version, held at CCE: Austria, Belgium (Wallonia Region), Czech Republic, Finland, France, Germany, Italy, Netherlands, Norway, Poland, Sweden, Switzerland and the United Kingdom.

13. This 2015 updated European critical loads database will be reviewed at the thirty-fourth session of the Working Group on Effects for approval for use by Convention subsidiary bodies and for European policy support.

14. Three Parties provided tentative results for critical loads on biodiversity. Biodiversity critical loads submitted in 2015, based on the Habitat Suitability Index, may be used for testing and research purposes (e.g., scenario analysis in the ECLAIRE project), but will not be used for policy support at the Convention level.

15. No data were received from NFCs of Parties in Eastern Europe, the Caucasus and Central Asia.

IV. Expected outcomes and deliverables over the next period and in the longer term (workplan item 1.2.1)

16. Outcomes and deliverables of the ICP Modelling and Mapping and CCE can only be compiled, for use in support of European air pollution abatement policies and work under the Convention, provided that sufficient funding is confirmed at the thirty-fourth session of the Working Group on Effects.

17. The ICP Modelling and Mapping and CCE aim at developing and maintaining up-to-date databases required for the calculation of critical loads for acidification, eutrophication and heavy metals. This is an essential step to assess air pollution impacts on ecosystems, in particular in integrated assessment modelling.

18. Several Parties indicated that biodiversity critical loads could be completed, provided that a call for data would be decided in the autumn of 2015, with a deadline in 2017, and interim results be presented in 2016.

19. For this, a call for data could be proposed for adoption at the thirty-fourth session of the Working Group on Effects over the period 2015–2017. The aim of the call for data would be to enable NFCs to continue their development of biodiversity-based critical loads.

20. The update of the Mapping Manual is an ongoing process involving many experts under the Convention and NFCs (workplan item 1.1.10). The current version of the Mapping Manual[10] will be submitted to the Working Group on Effects for review at its thirty-fourth session. Its translation into Russian could be considered, provided that funding is available.

[10] Manual on Methodologies and Criteria for Modelling and Mapping Critical Loads and Levels and Air Pollution Effects, Risks and Trends; see Task Force on Modelling and Mapping (Berlin: Federal Environmental Agency (Umweltbundesamt), 2004). Available from www.icpmapping.org/Mapping_Manual.

V. Policy-relevant issues, findings and recommendations

21. Calculations by CCE for the European Environmental Agency,[11] for the 2016 Assessment Report and the trends report of the Working Group on Effects[12], show that the risk of high nitrogen deposition to vegetation remains in Western, Central and South-Eastern Europe.

22. Effects-based integrated assessment of air pollution abatement policies, and related economic assessments, could benefit from knowledge on targeting deposition levels that meet requirements for "no net loss of biodiversity and ecosystem services" in air, waters, soils and vegetation as an explicit endpoint.

23. It is noted that the effects-based integrated assessment of protection, on local, regional or continental scales, of public health and the environment through the reduction of ambient concentrations and depositions of nitrogen compounds can benefit from understanding a variety of trade-offs, such as between (in-)direct effects of:

(a) Reduced and oxidized nitrogen emissions;

(b) Urban and regional emission reductions;

(c) National and international emission reductions.

24. The modelling work of ICP Modelling and Mapping relies on other ICPs for results of field, laboratory and exposure experiments as well as long-term (more than 3 years) monitoring. Those activities provide essential information for establishing dose-response relationships used in models as well as for calibrating and validating them. Such activities are missing in some parts of the region of the United Nations Economic Commission for Europe, increasing the uncertainties in the modelling approach.

25. The progress made in research, including within the ECLAIRE project, has highlighted evidence of separate effects of ozone and nitrogen on many ecosystem processes. These combined effects are species-specific and vary with levels of ozone and nitrogen deposition. At high concentrations, ozone mitigates the effects of nitrogen (in particular growth enhancing and nitrogen resorption from leaves before senescence). In arid conditions, ozone tolerant and nitrophilous species are expected to become dominant in Mediterranean meadows. Ongoing research suggests that combined high-level depositions of ozone and nitrogen affect species composition above and below ground, altering the competition relationships among species and potentially affecting the structure and biodiversity of the community.

26. A call for biodiversity critical loads (see section IV) and "Habitat Suitability Indices" could lead to results to provide further knowledge on the risk of nitrogen deposition to biodiversity and ecosystem services.

[11] EEA, 2014. Effects of Air Pollution on European Ecosystems: Past and future exposure of European freshwater and terrestrial habitats to acidifying and eutrophying air pollutants. European Environment Agency, Technical Report 11/2014 prepared by the CCE with contributions from the ETC-ACM and the EEA, http://www.eea.europa.eu/publications/effects-of-air-pollution-on.

[12] De Wit *et al.*, 2015. Trends in ecosystem and health responses to long-range transported atmospheric pollutants. Report produced for the Working Group on Effects and as input to the Convention's 2016 Assessment Report (*in press).*

27. Countries in Eastern and South-Eastern Europe, the Caucasus and Central Asia are strongly encouraged to assist the participation of their national experts in ICP Modelling and Mapping activities, especially in the calculation and mapping of critical loads.

VI. Issues for the attention and advice of other groups, task forces or subsidiary bodies, notably with regard to synergies and possible joint approaches or activities

28. In relation to integrated assessment modelling, it was underlined that policy measures that protect human health (generally focussing on urban areas) do not necessarily lead to sufficient protection to ecosystems. However, it was shown that additional low-cost measures were available that may lead to substantial protection of rural areas. The nature and the effects of such measures should be further investigated and considered in a relevant policy arena.

VII. Scientific and technical cooperation activities with relevant international bodies

29. Experts all over the world collaborated to provide a unique overview of research methods assessing critical loads and temporal effects of the deposition of air pollutants in a book entitled "Critical loads and dynamic risk assessments: nitrogen, acidity and metals in terrestrial and aquatic ecosystems".[13]

30. Applications address examples for each air pollution threat on local and regional scales in Europe, Asia, Canada and the United States of America.

31. The importance of this book for work under the Convention was reviewed in a seminar on Critical Loads and Dynamic Risk Assessments and the future of effect-oriented policy support (Wageningen, The Netherlands, 27 May 2015). The seminar included a forum discussion among the following: Ms. Anna Engleryd (the Chair of the Executive Body; Mr. Peringe Grennfelt (the Chair of the Working Group on Effects); Mr. Rob Maas (the Chair of the Task Force on Integrated Assessment Modelling); Ms. Anne Christine Le Gall (the Chair of the Task Force on Modelling and Mapping); Mr Christer Ågren of *Acid News* journal (a leading non-governmental organization on air pollution issues); Mr. Markus Amann, Head of CIAM at the International Institute for Applied Systems Analysis; and Mr Andre van der Zande, Director General of the National Institute for Public Health and the Environment of the Netherlands.

32. The seminar benefited from the participation of about 50 experts. Conclusions included the observation that the book by De Vries, Hettelingh and Posch was an important reference on critical loads and their applications.

33. Results of the ECLAIRE project have been presented and discussed at the CCE workshop (see above), in order to resolve issues related to the analysis of combined effects of ozone and nitrogen in integrated assessment modelling.

[13] De Vries W, Hettelingh J-P, Posch M (eds), 2015. Critical Loads and Dynamic Risk Assessments: Nitrogen, Acidity and Metals in Terrestrial and Aquatic Ecosystems. Environmental Pollution Series Vol. 25, Springer Science+Business Media, Dordrecht, xxviii+662 pp.; ISBN 978-94-017-9507-4; DOI: 10.1007/978-94-017-9508-1 (www.springer.com/gp/book/9789401795074).

34. For the development, under the Convention, of methods and data for the modelling and mapping of critical loads for biodiversity, the collaboration between CCE, NFCs and habitat experts is of significant importance. Therefore, the European Topic Centre on Biological Diversity of the European Environment Agency is acknowledged for sharing knowledge on habitat-specific species from the BioScore project.[14]

VIII. Relevant scientific findings: highlights

35. Long-term effects of atmospheric pollution on aquatic and terrestrial ecosystems have been modelled by CCE for use in the trends report of the Working Group on Effects and the 2016 Assessment Report, using the European critical loads database of 2011. Using deposition fields for 2010 from MSC-W shows that the area at risk of acidification covers about 5 per cent of all ecosystems and about 10 per cent of catchments for which critical loads for surface waters are available. While exceedances have markedly decreased since 1980, it may still take decades for recovery from acidification of aquatic and terrestrial ecosystems to be established.[15]

36. Eutrophication is computed to put about 60 per cent of the European ecosystem area at risk (see footnote 13) when 2010 deposition fields are used from MSC-W. The use of the updated critical loads database (see paras. 12 and 13) would lead to a computed area at risk of 58 per cent using recent 2010 emission data from MSC-W.

37. When emission data for 2010 from CIAM are used to compute depositions that are compared to the updated 2015 critical loads database, then the total ecosystem areas at risk of acidification and eutrophication are computed to be about 7 per cent and 58 per cent, respectively.

38. In 2020, the area in 2010 at risk of atmospheric deposition of lead and mercury in particular, is computed to be about 20 per cent and 56 per cent, respectively (see footnote 13) when using the latest (2005) critical loads database of heavy metals held at CCE.

IX. Publications

39. For a full list of ICP Modelling and Mapping and CCE publications and references for the present report, please visit the ICP Modelling and Mapping website.[16]

[14] See www.bioscore.eu.

[15] Hettelingh J-P, Posch M, Slootweg J, Reinds GJ, De Vries W, Le Gall A-C, Maas R, 2015. Effects-based integrated assessment modelling for the support of European air pollution abatement policies. Chapter 25 in: De Vries et al. (eds), op.cit., pp. 613-635; DOI: 10.1007/978-94-017-9508-1_25.

[16] See www.icpmapping.org.