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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

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Item 10 (b) of the provisional agenda
Progress in activities in 2021 and further development of effects-oriented activities: critical loads and other issues related to modelling and mapping

Modelling and mapping

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

Summary

The present report is being submitted for consideration by 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 at their seventh joint session, in accordance with both the 2020–2021 workplan for the implementation of the Convention (ECE/EB.AIR/144/Add.2) and the revised mandate for the International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trend (Executive Body decision 2019/20).[a]

The present report includes a review of the implementation of the workplan activities undertaken by the International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends (ICP Modelling and Mapping) and a summary of the discussion and conclusions reached at the thirty-seventh meeting of the ICP Modelling and Mapping Task Force and centres (online, 20–22 April 2021). The meeting was organized by Ms. Alice James Casas (France) – Chair of ICP Modelling and Mapping – in close collaboration with the Coordination Centre for Effects and the Centre for Dynamic Modelling.

[a] Available at www.unece.org/env/lrtap/executivebody/eb_decision.html.

I. Introduction

1. The International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends (ICP Modelling and Mapping) is a scientific programme of the Working Group on Effects under the United Nations Economic Commission for Europe (ECE) Convention on Long-range Transboundary Air Pollution. France is the lead country of the ICP Modelling and Mapping Task Force. Germany and Sweden are the lead countries of, respectively, the Coordination Centre for Effects[1] and the Centre for Dynamic Modelling[2] – the two ICP Modelling and Mapping programme centres. The Task Force, the Coordination Centre for Effects and the Centre for Dynamic Modelling are hosted by, respectively, the French National Institute for Industrial Environment and Risks, the German Environment Agency and the Swedish Environmental Institute.

2. Representatives of almost 30 Parties to the Convention participate in the activities of ICP Modelling and Mapping. ICP Modelling and Mapping national focal centres help to compile and maintain the database of critical loads for acidification and eutrophication and carry out research regarding novel thresholds for impacts on plant species diversity. ICP Modelling and Mapping results are also used by the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) Task Force on Integrated Assessment Modelling, in collaboration with the Meteorological Synthesizing Centre-West, the Meteorological Synthesizing Centre-East and the Centre for Integrated Assessment Modelling. ICP Modelling and Mapping collaborates with all the international cooperative programmes (ICPs) under the Convention and with the Joint Task Force on the Health Aspects of Air Pollution.[3]

II. Progress in modelling and mapping activities

3. The thirty-seventh meeting of the ICP Modelling and Mapping Task Force and centres was organized as a web conference following the introduction of travel restrictions due to the coronavirus disease (COVID-19) pandemic (online, 20–22 April 2020).

4. Seventy-five delegates from the following 22 Parties participated in the meeting: Austria, Belgium, Bulgaria, Canada, Czechia, Denmark, Finland, France, Germany, Hungary, Italy, Malta, Netherlands, Norway, Poland, Portugal, Russian Federation, Spain, Sweden, Switzerland, United Kingdom of Great Britain and Northern Ireland and United States of America. Representatives of China, Mexico and Tajikistan also participated. Representatives of the following Convention intergovernmental bodies, expert groups and scientific centres were present: the Bureau of the Working Group on Effects and of the Working Group on Strategies and Review; the Coordination Centre for Effects; the Centre for Dynamic Modelling; the International Cooperative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests); the International Cooperative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems (ICP Integrated Monitoring); the International Cooperative Programme on Effects of Air Pollution on Natural Vegetation and Crops (ICP Vegetation); the International Cooperative Programme on Assessment and Monitoring of the Effects of Air Pollution on Rivers and Lakes (ICP Waters); the Centre for Integrated Assessment Modelling; and the Task Force on Reactive Nitrogen.

5. ICP Modelling and Mapping Task Force decisions were reviewed by the participants during the meeting. Presentations are available at the Coordination Centre for Effects website.[4]

[1] See www.umweltbundesamt.de/en/cce.
[2] See www.ivl.se/projektwebbar/centre-for-dynamic-modelling.html.
[3] The Joint Task Force on the Health Aspects of Air Pollution is a joint body of the World Health Organization European Centre for Environment and Health and the Executive Body for the Convention on Long-range Transboundary Air Pollution.
[4] See www.umweltbundesamt.de/en/meetings-workshops-0?parent=69334.

6. The objectives of the meeting included:

(a) Presentation of the current status of work of the Coordination Centre for Effects on updating and revising the European background database for critical loads;

(b) Presentation of the current status of work of the Coordination Centre for Effects in collaboration with the Task Force on the revision of the databases of steady-state critical loads further to the responses of national focal centres to the call for data 2019–2021 communicated in November 2019;

(c) Presentation of the current status of work of the Coordination Centre for Effects in collaboration with other bodies on the review and revision of the empirical critical loads process launched in 2019;

(d) Presentation of the current status of work of the Centre for Dynamic Modelling;

(e) Sharing new knowledge on critical loads established through (field) experiments and modelling by the national focal centres and other expert groups;

(f) Discussion on issues relating to ICP Modelling and Mapping tasks within the current review of the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol) (ECE/EB.AIR/WG.5/2021/4);

(g) Discussion on an update of the revised long-term strategy of the effects-oriented activities.[5]

III. Relevant items of the 2020–2021 workplan

A. Development of existing information technology infrastructure and software to guarantee an operational Coordination Centre for Effects, and revision of the existing European background database

7. In order to rebuild, update and document the European background database on critical loads,[6] the Coordination Centre for Effects contracted Wageningen Environmental Research and former members of the Coordination Centre for Effects. The main objectives of the project were to: (a) construct a database and software in R to compute critical loads for eutrophication (by nitrogen) and acidification (by nitrogen and sulfur) for terrestrial ecosystems in Europe; (b) precisely and extensively report the background data used (maps, tables), the computational rules implemented to derive some of the data (for example, transfer functions between soil type and soil characteristics) and of the procedures which compute the critical loads; and (c) validate this database and its results. The Coordination Centre for Effects will publish the final report in 2021. The results of this work were presented during the thirty-seventh meeting of the ICP Modelling and Mapping Task Force and centres.

B. Update of critical loads databases according to new knowledge

8. Critical loads and the calculation of their exceedances are dedicated instruments for assessing possible impacts of air pollution on ecosystems. In order to target an assessment that is as scientifically sound as possible, steady-state and empirical critical loads need to be updated regularly. The call for data is an important instrument in attaining this goal and is achieved by continued collaboration between the Coordination Centre for Effects and national focal centres. At the time the thirty-seventh meeting of the ICP Modelling and Mapping Task Force and centres was held, the call for data 2019–2021 had allowed for the

[5] Available at www.unece.org/fileadmin/DAM/env/documents/2012/EB/Informal_document_no_18_Revised_Long-term_Strategy_of_the_effects-oriented_activities_clean_text.pdf.

[6] The European background database on critical loads has been used in the past for countries not having submitted national critical loads data to the Coordination Centre for Effects.

provision of update reports (phase one - 2019–2020) and of an update of data (phase two - 2020–2021). Six countries (Austria, Belgium (Flanders Region), Canada, Norway, Switzerland and the United Kingdom of Great Britain and Northern Ireland (Northern Ireland reported separately)) responded to the first phase and three countries updated their national critical loads data (Belgium (Flanders Region), Czechia and Netherlands). In addition, seven countries (Austria, Germany, Finland, Norway, Sweden, Switzerland and Belgium (Walloon Region)) confirmed the critical loads data of the previous call and four countries (Canada, Hungary, Poland and the United Kingdom of Great Britain and Northern Ireland (Northern Ireland reported separately)) announced a delayed data delivery. The critical loads for acidification and eutrophication will be updated accordingly in the European critical loads database by the Coordination Centre for Effects.

9. The review and revision of the empirical critical loads for nitrogen was included in the 2020–2021 workplan (ECE/EB.AIR/144/Add.2, item 1.1.1.14) after it was considered that a substantial amount of new data and scientific papers had become available since the publication of the most recent update.[7] A preliminary literature review had been completed by the Thünen Institute (Germany) for the Coordination Centre for Effects in 2019 and 2020 as the first step in that process during the thirty-sixth meeting of the ICP Modelling and Mapping Task Force and centres (online, 21–23 April 2020). In June 2020, a virtual kick-off meeting for the review was attended by 58 participants and, since then, 45 authors have been working on updating the different chapters of the previous report on empirical critical loads for nitrogen. Further to the collation and assessment of new data, the dedicated chapters of the *Manual on methodologies and criteria for Modelling and Mapping Critical Loads and Levels and Air Pollution Effects, Risks and Trends*[8] will be updated. The schedule announced aims at completing the first internal revision in June 2021 and a second review by external experts will end by September 2021. The Coordination Centre for Effects Expert Workshop on Empirical Critical Loads for Nitrogen is currently planned for 26–28 October 2021 in Bern. Following the Expert Workshop, the background document will be finalized in 2022 after addition and incorporation of the comments of the workshop participants. In addition, a draft executive summary will be produced for formal use in ECE by April 2022.

C. Development of effects-oriented scientific work with a focus on dynamic modelling

10. The new Centre for Dynamic Modelling is mandated to develop methods focusing on dynamic modelling and developing suitable indicators of biodiversity using dynamic modelling. As a complement to steady-state models (such as are commonly used for calculating critical loads) the dynamic models add the dimension of time to the calculations, i.e. they provide not only the end-point of calculation of an ecosystem at steady state but also the trajectory of how this end-point will be reached. Dynamic models can calculate and visualize possible future development under different scenarios, as well as historical development that resulted in the current observed situation. Working with these models allows for the integration, interpretation and packaging of theoretical knowledge with results from experiments and monitoring and, in that way, benefits from the work of several ICPs and of EMEP. One outstanding goal for the modelling community is the development of indicators and methods to set critical loads for nitrogen as a nutrient based on biodiversity. One of the key activities of the Centre for Dynamic Modelling is to promote and lead this work and progress in this regard was presented by several Parties at the thirty-seventh meeting of the ICP Modelling and Mapping Task Force and centres.

[7] Roland Bobbink and Jean-Paul Hettelingh, eds., *Review and Revision of Empirical Critical Loads and Dose-response Relationships, Proceedings of an Expert Workshop, Noordwijkerhout, 23–25 June 2010* (Bilthoven, the Netherlands, National Institute for Public Health and the Environment of the Netherlands, 2011).

[8] Till Spranger, Ullrich Lorenz and Heinz-Detlef Gregor, eds. (Berlin, German Federal Environmental Agency, 2004).

D. Collaboration between ICP Modelling and Mapping and other bodies of the Convention

11. The thirty-seventh meeting of the ICP Modelling and Mapping Task Force and centres was organized and held in close collaboration with the Coordination Centre for Effects and the Centre for Dynamic Modelling. To build up a cooperation network within the Convention, the Coordination Centre for Effects held bilateral meetings with the Meteorological Synthesizing Centre-West and with the Centre on Emission Inventories and Projections (online, 23 March 2021). The Chair of ICP Modelling and Mapping and representatives of both the Coordination Centre for Effects and the Centre for Dynamic Modelling attended remotely the EMEP Steering Body and Working Group on Effects Extended Bureaux Meeting (online, 1–4 March 2021) and the thirty-fourth meeting of the ICP Vegetation Task Force (online, 22–24 February 2021), the twenty-ninth meeting of the ICP Integrated Monitoring Task Force (online, 13 and 14 April 2021), the fiftieth meeting of the Task Force on Integrated Assessment Modelling (online, 21–23 April 2021), the thirty-seventh meeting of the ICP Waters Task Force (online, 28 and 29 April 2021), and the thirty-seventh meeting of the ICP Forests Task Force (online, 10 and 11 June 2021).

E. Development and maintenance of the common Working Group on Effects website

12. The purpose of the common Working Group on Effects website[9] is to provide a common entry point to which all the parts of the Working Group on Effects are linked. It does not replace or duplicate the individual ICPs' websites but provides meta information on their existence and indicates what kind of data and results are to be found where. The common entry point has primarily been developed for users outside the Convention to facilitate an easy overview of the conceptual framework and of the Working Group on Effects work as a whole. The website has been created over the past two years by a small group consisting of representatives of ICP Forests, the Bureau of the Working Group on Effects and the former Joint Expert Group on Dynamic Modelling. The further development of the common website is currently managed by the Centre for Dynamic Modelling. During 2021, work commenced on restructuring the common website around three key activities undertaken by the Working Group on Effects: monitoring, modelling and mapping (as opposed to the current structure, which is centred around the ICPs' structure). This work will be discussed with all the ICPs during the second half of the current year.

IV. Recommendations and other outcomes of the thirty-seventh meeting of the Task Force

13. The update of the steady-state critical loads according to reports submitted by national focal centres should be continued and communicated in the next Coordination Centre for Effects status report.

14. The review and revision of empirical critical loads for nitrogen should be continued with the Expert Workshop on Empirical Critical Loads for Nitrogen (Bern, 26–28 October 2021).

15. The Coordination Centre for Effects will inform the national focal centres of substantial updates of the items mentioned in paragraphs 13 and 14 above.

16. The ICP Modelling and Mapping Task Force and centres will contribute actively to the current review of the Gothenburg Protocol by:

(a) Calculating critical loads exceedance for European countries, which will be based on the data submitted by the national focal centres within the recent or the previous

[9] See www.unece-wge.org/.

call for data (2019–2021/2015–2017), as well as on the updated background database for countries that have not provided new critical loads data since 2017;

(b) Contributing to evaluation of impacts of new scientific findings on environmental and health effects assessments, for example, impact of critical loads, dynamic modelling of ecosystem recovery, interactions between air pollution, climate change, nitrogen fluxes and other stress factors for biodiversity.

17. The revision of the current long-term strategy of the effects-oriented activities should consider the need to:

(a) Improve assessment of ammonia effects via both the implementation of critical levels of ammonia and the better linking of air quality and biodiversity monitoring;

(b) Give non-forest ecosystems – as a habitat for a large number of sensitive plant species – a more prominent role in future monitoring and modelling activities;

(c) Continue progress on considering critical loads for heavy metals;

(d) Link biogeochemical change to species changes, recalled as being an important issue to progress on, possibly with tools such as target loads;

(e) Include all habitat types for biodiversity, with improved harmonization between countries or/and on the European scale;

(f) Enhance communication building on ICP Modelling and Mapping expert capacity, via training sessions, but also leaning towards policy (within the Convention framework, but also exchanging with the European Union on the National Emission Ceilings Directive,[10] the Habitats Directive[11] and the European Environment Agency), communicating for example, on the cost of inaction.

18. The further development and consolidation of acidification and eutrophication critical loads should be continued, as should the development of critical loads using dynamic modelling concepts.

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[10] Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC, *Official Journal of the European Union*, L 344 (2016), pp. 1–31

[11] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, *Official Journal of the European Communities*, L 206 (1992), pp. 7–50.