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Working Group on Effects

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Item 4 of the provisional agenda
Recent results and updating of scientific and technical knowledge

Modelling and mapping

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

Summary

The present report contains a summary of the discussion and conclusions reached at the back-to-back meetings of the Task Force on Modelling and Mapping under the International Cooperative Programme on Modelling and Mapping of Critical Loads and Levels and Air Pollution Effects, Risks and Trends and the workshop of the Coordination Centre for Effects (Copenhagen, 8–11 April 2013). Those meetings focused on progress achieved in modelling and mapping, inter alia, regarding methods and objectives for valuing air pollution effects, and included a training addressing software and input requirements of dynamic models for nitrogen impacts on vegetation.

The report is submitted for the consideration of 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 2012–2013 workplan for the implementation of the Convention (ECE/EB.AIR/109/Add.2, items 3.1 (c) and 3.7).

I. Modelling and mapping progress

1. The twenty-ninth meeting of the Task Force on Modelling and Mapping under the International Cooperative Programme on Modelling and Mapping of Critical Loads and Levels and Air Pollution Effects, Risks and Trends (ICP Modelling and Mapping) and the twenty-third Coordination Centre for Effects (CCE) workshop were hosted by the Department of Bioscience of the Aarhus University and held back to back in Denmark (Copenhagen, 8–11 April 2013).

2. Sixty-five delegates from the following 23 countries attended the meeting: Austria, Canada, China, Czech Republic, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Norway, Poland, Republic of Moldova, Russian Federation, Slovakia, Spain, Sweden, Switzerland, Ukraine, United Kingdom of Great Britain and Northern Ireland and United States of America. The Bureau of the Working Group on Effects, 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 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 Materials, including Historic and Cultural Monuments (ICP Materials), the Joint Expert Group on Dynamic Modelling, CCE, the United Nations Economic Commission for Europe secretariat and the European Environment Agency were also represented. In addition, the Task Force welcomed the members of the ICP review group set up by the Bureau of the Executive Body for the Convention on Long-range Transboundary Air Pollution (CLRTAP).[1] The United States representatives followed the meeting via video conferencing.

3. The objectives of the meetings included:

(a) To consider and discuss the status of the scientific support for the revision of the Protocol to Abate, Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol)[2] and the European Commission thematic strategy on air pollution, on the basis of the Task force on Integrated Assessment Modelling and Working Group on Effects (impact) assessment reports;

(b) To assess the response to the 2011–2012 call for National Focal Centre (NFC) contributions regarding the use of models to assess (site-specific) dynamics of soil chemistry and plant species diversity and to share up-to-date results, methodologies and progress between NFCs;

(c) To hold a training session addressing (NFC-) specific issues on dynamic soil-vegetation modelling and their application for the 2012–2014 call for data (deadline 2014);

(d) To share national results related to field measurements and model assessments addressing plant species diversity;

(e) To consider the ICP Modelling and Mapping workplan and other Task Force issues.

[1] ECE/EB.AIR/113, para. 31.

[2] Available from http://www.unece.org/env/lrtap/multi_h1.html.

II. Task Force decisions for review at the thirty-second session of the Working Group on Effects

4. The Task Force concluded that gradient-based relationships between nitrogen deposition and species richness of acid grasslands could be used on a regional scale for European Nature Information System (EUNIS) classes[3] E1, E2 and E3, subject to specific constraints regarding acidity (pH), altitude and precipitation. The suitability of that approach for other EUNIS classes needed to be further explored. NFCs that had relevant relationships to that work, were encouraged to provide them to CCE.

5. NFCs were encouraged to contribute to the vegetation tables in order to extend the information to EUNIS classes other than forests.

6. The Task Force agreed that ICP Forests would provide their critical load and background data to the ICP Modelling and Mapping NFCs for assessment and potential inclusion in the European critical load database.

7. It was agreed that the European background database would be used by CCE for effects-based assessments, after CCE had checked with NFCs that no national data were available, unless countries requested CCE not to carry out calculations for a given parameter on their national territory.

8. The Task Force recommended that new knowledge be taken into account during the implementation of CLRTAP protocols or European Union directives, and that ongoing knowledge improvements be made available to policymakers.

9. The Task Force decided that the *Manual on Methodologies and Criteria for Modelling and Mapping Critical Loads and Levels and Air Pollution Effects, Risks and Trends*[4] (Mapping Manual) should be updated to reflect recent scientific advances, i.e.:

(a) The inclusion of empirical critical loads in the main chapters;

(b) A description of the advances in biodiversity modelling;

(c) To update the introduction.

It would also be the opportunity to improve the layout of some chapters and, at the end of the process, to produce an improved up-to-date version of the Mapping Manual in the Russian language.

10. The Task Force decided that the updated version of the Mapping Manual would remain available as a downloadable file in PDF format on the ICP Modelling and Mapping website, and on the Convention website, as appropriate.

11. The Task Force recommended that the Mapping Manual be cited as: "CLRTAP, [year of publication]. Manual on methodologies and criteria for modelling and mapping critical loads and levels and air pollution effects, risks and trends, ECE Convention on Long-range Transboundary Air Pollution; accessed on [date of consultation] at www.icpmapping.org" (this reference format will be indicated on the website).

12. The Task Force agreed that the next CCE status report would be published in 2014 following the results of the call for data. In 2013, there would be several ICP Modelling and Mapping and CCE contributions to reports as an outcome of the collaboration between the

[3] See http://eunis.eea.europa.eu/habitats-code.jsp.

[4] 2004. Available from http://www.icpmapping.org.

Working Group on Effects and the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP).

13. NFCs and their collaborative institutions were requested to check whether their names and addresses were fully and correctly listed on the updated ICP Modelling and Mapping website (http://icpmapping.org/NFCs) and the new CCE website (http://wge-cce.org/). Comments on both the websites were encouraged.

III. Analysing exceedances using the latest EMEP model and critical load database on the new EMEP grid

14. The EMEP model was recently revised to cover a 0.50º × 0.25º (about 28 kilometres (km) × 28 km) longitude-latitude grid (EMEP28) (Simpson et al., 2012).

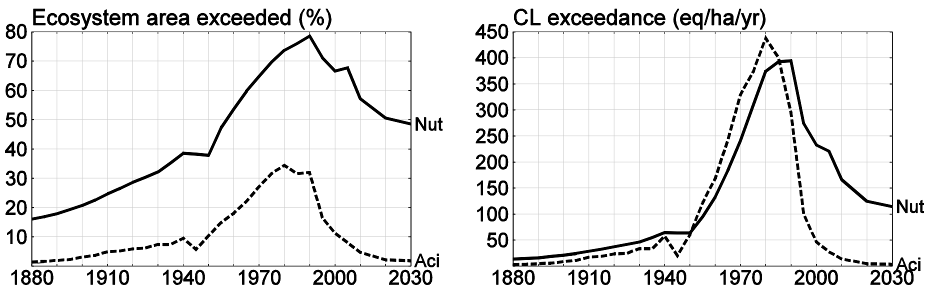
15. In anticipation of the increased resolution of the EMEP model, NFCs under ICP Modelling and Mapping responded to a CCE call for data in 2010 to update the scale (and protection requirements, as appropriate) of their contribution to the European critical load database[5] (Critical Load (CL)28) (see Posch, Slootweg and Hettelingh, 2011).

16. These new methods and data have enabled the revision of calculated exceedances and areas at risk caused by deposition patterns (MSC-W, 2013) due to a combination of the revised Gothenburg Protocol and Current Legislation scenario (GP-CLE) provided by the International Institute for Applied Systems Analysis.

17. Figure 1 illustrates the result based on emission trends since 1880 (Schöpp et al., 2003), deposition patterns following different versions of the EMEP model (e.g., Hettelingh et al., 2013) and the most recent critical load database (Posch, Slootweg and Hettelingh, 2012).

Figure 1

Temporal development since 1880 of the area at risk (in per cent, left) and magnitude (in equivalents per hectare per year (eq/ha/yr), right) of average accumulated exceedance (AAE)[6] of acidification (dotted) and eutrophication (solid) using the GP-CLE scenario depositions as of 2010



18. Assuming the GP-CLE scenario to be implemented as of 2010, figure 1 shows that both the percentage of the area exceeded, i.e., at risk of acidification (figure 1, left), as well as its average accumulated exceedance (AAE) magnitude (figure 1, right) in 2030, are

[5] See http://wge-cce.org/Methods_Data/Critical_load_exceedance_and_gap_closure_concepts.

[6] The AAE is the area weighted exceedance (of acidity or nutrient nitrogen) of depositions over critical loads.

similar to 1880, i.e., about 2 per cent and 5 eq/ha/yr, respectively. The peaks of the acidified area and exceedance magnitude occur in 1980.

19. Eutrophication continues to remain a serious issue under GP-CLE emissions in 2020, affecting about 50 per cent (54 per cent in the 28 member States of the European Union (EU28)) of the European ecosystem area in 2020, with an AAE of about 125 eq/ha/yr (159 eq/ha/yr in the EU28).

20. The European area at risk has increased in comparison to computations made with methods and data available for the support of the negotiations, i.e., 42 per cent with an AAE of 109 eq/ha/yr on the EMEP resolution of 50 km x 50 km (Reis et al., 2012).

21. It can be noted that the old computations for the EU27[7] turned out to yield a larger area at risk than with EMEP28 and CL28, i.e. about 62 per cent (Hettelingh et al., 2012, p. 14) instead of the 54 per cent now.

22. The geographical patterns of the areas at risk of both acidification and eutrophication under the revised Gothenburg Protocol in 2020, as computed with CL28 and EMEP28, reveal a similar geographical pattern as with the old computations (Hettelingh et al., 2012).

23. Areas with relatively high exceedances continue to be found in the bordering area of the Netherlands and Germany (acidification) and in Northern Italy and western France (eutrophication).

24. However, in comparing the results of new with old methods, in particular with respect to the risk of eutrophication, lower exceedances are found in, e.g., France, Poland and the United Kingdom, and higher ones in Romania, the Russian Federation and Spain. The changes are due to updated critical loads sent by NFCs and an update of the background database (Reinds et al., 2008) to obtain the required higher resolution critical load maps of Europe. The background data set is used by CCE for countries that do not submit complete data (see above).

25. Finally, it can be noted from figure 1 that it appears that eutrophication already existed in 1880. The area at risk more than a century ago is computed to have already been exceeding about 20 per cent. This was likely caused by emissions of reduced nitrogen.

26. The peaks of eutrophication come a decade later than acidification, due to the fact that policies to curb nitrogen emissions seemed less urgent (emission abatement policies focused on sulphur dioxide reduction) and started later.

[7] The 27 member States of the European Union before the accession of Croatia in 2013.

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