



Convention on Long-range Transboundary Air Pollution

Working Group on Effects

2023

Annual report of the

International Cooperative Programme

on Modelling & Mapping of

critical levels and loads

and air pollution effects, risks and trends

(ICP M&M)

Chair of the Programme Task Force: Alice James (INERIS, France)

Coordination Centre for Effects (CCE)

hosted by the German Environment Agency (UBA, Dessau, Germany)

headed by a team consisting of:

Markus Geupel, Thomas Scheuschner and Christin Loran

Centre for Dynamic Modelling (CDM)

hosted by the IVL Swedish Environmental Research Institute

(IVL, Göteborg, Sweden)

headed by a team consisting of:

Filip Moldan and Sara Jutterström

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1. Glossary

BAFU	Federal Office for the Environment
CBD	Convention on Biodiversity
CCE	Coordination Centre for Effects
CDM	Centre for Dynamic Modelling
CIAM	Centre for Integrated Assessment Modelling
CIEMAT	Centre for Energy, Environmental and Technological Research
CL(s)	Critical Load(s)
CLempN	Empirical Critical Loads
CLRTAP	Convention on Long-range Transboundary Air Pollution
EEA	European Environment Agency
EECCA	Eastern Europe Caucasus and Central Asia
eLTER	European Long Term Ecological Research
EMEP	European Monitoring and Evaluation Programme
EUNIS	European Nature Information System
EVA	European vegetation Archive
FAB	First-order Acidity Balance
FAO	Food and Agriculture Organization of the United Nations
GPNV	Global Potential Natural Vegetation
HWSD	Harmonized World Soil Database
ICP	International Cooperative Programme
IVL	Swedish Environmental Research Institute
M&M	Modelling and Mapping
MSC	Meteorological Synthesizing Center
Ineris	French National Institute for Industrial Environment and Risks
NFC	National Focal Center
RIVM	Dutch National Institute for Public Health
SEI	Stockholm Environment Institute
SLU	Swedish University of Agricultural Sciences
SMB	Simple Mass Balance
SSWC	Steady-State Water Chemistry
TDN	Total Dissolved Nitrogen
TF	Task Force
TFIAM	Task Force on Integrated Assessment Modelling
TNO	Netherlands Organization for Applied Scientific Research
UBA	German Environment Agency
WGE	Working Group on Effect

2. The ICP M&M

The International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends (ICP Modelling & Mapping, ICP M&M) is a programme under the Convention on Long-range Transboundary Air Pollution (CLRTAP).

Interest in the critical loads (CL) and levels approach for pollution control has gathered momentum over the past decades. To provide strategies for emission reductions as inputs to the negotiations of protocols to the Convention, the ICP M&M was established in 1988.

The programme is planned and coordinated by a Task Force (TF) under the leadership of France, located at the French National Institute for Industrial Environment and Risks (Institut National de l'Environnement Industriel et des Risques, Ineris), in collaboration with the Coordination Centre for Effects (CCE) hosted at the German Environment Agency (UBA, Germany) and with the Centre for Dynamic Modelling (CDM) hosted at the Swedish Environmental Research Institute (Institut für Vegetationskunde und Landschaftsökologie, IVL, Göteborg).

The mandate of the ICP M&M is to provide the Working Group on Effects (WGE) and the Executive Body and other subsidiary bodies with comprehensive information on (i) critical levels and loads and their exceedances for selected pollutants, (ii) the development and application of other methods for effects-based approaches, and (iii) modelling and mapping of the present status and trends in impacts of air pollution. To this aim, the CCE together with the Programme TF determine receptor-specific CL for (indirect) effects of the (long-term) deposition of various air pollutants and critical levels for direct effects of gaseous air pollutants; map pollutant depositions and concentrations which exceed critical thresholds and establish appropriate methods as a basis for assessing potential damage, e.g. *via* dynamic modelling. Moreover, various European databases on soil, land, climatic and other variables are used to calculate CL for those countries that do not provide national data. The maps are used for integrated assessment modelling by the Task Force on Integrated Assessment Modelling (TFIAM). Since its creation in January 2020 the CDM is the second designated centre to the ICP M&M, hosted by IVL Swedish Environmental Research Institute. Its main tasks mandated by the Executive Body are the development and promotion of methods for dynamic modelling (including consideration of effects on biodiversity, interactions with climate change and land use, to complement CLs with additional measures of the effects such as, e.g., target loads) and the development and maintenance of the common Working Group on Effects (WGE) website (<https://www.unece-wge.org/>).

3. The ICP M&M 2022-2023 workplan

In line with the priorities set out in the long-term strategy for the Convention for 2020–2030 and beyond, the Executive Body of the CLRTAP has adopted in December 2021 the biennial workplan 2022-2023 for the Convention Workplan items where ICP M&M together with its designated centres constitute the main lead bodies are summarised in Table 1. An advanced version of the full workplan is available at the following address:

https://unece.org/sites/default/files/2022-06/%28Advance%29_ECE_EB.AIR_148_Add.1.pdf

Table 1: Biennial ICP M&M workplan for 2022-2023.

Workplan item	Activity description/objective	Expected outcome/deliverable	Lead body(ies)	Resource requirements and/or funding source
1.1.1.19	Steady-state Critical Loads: (a) Update of National Critical Loads by National Focal Centres; (b) Establishment of European Background Database by CCE	Database (2020/2021) for Critical Loads for acidification and eutrophication; Report (2022)	ICP Modelling and Mapping /CCE	National Focal Centres and recommended contributions
1.1.1.20	Empirical Critical Loads: Review and revision of the CLemp N published in 2011	Report on empirical Critical Loads in Europe (2022)	ICP Modelling and Mapping /CCE	CCE, National Focal Centres and recommended contributions
1.1.1.21	Update of the harmonized Convention receptor map	Harmonized receptor map for Europe (2023)	ICP Modelling and Mapping /CCE	CCE and Germany
1.1.1.22	Critical Levels for ammonia: literature review and empirical data provision supporting a workshop	Organization of an international workshop (2022) and workshop report (2023)	ICP Modelling and Mapping /CCE	CCE and Germany
1.1.1.23	Modelling interaction between air pollution and climate change: N and C	Expert workshop (2022)	ICP Modelling and Mapping /CDM	CDM and National Focal Centres experts
1.1.1.24	Modelling biodiversity change to set critical loads for N	Report on methodology development and proposal for call for data (2023)	ICP Modelling and Mapping /CDM/CCE	CDM, CCE and National Focal Centres experts

4. News from 2022 and objectives of 2023 annual meeting

The work achieved by CCE and CDM and the national contributions to ongoing activities held since the last annual TF meeting (May 2022) were presented during the 2023 Annual Meeting of the ICP M&M, in Prague (Czech Republic) from Tuesday 28 to Thursday 30 March 2023. This was the 39th TF, 30th CCE meeting, and 4th CDM meeting. The presentations and discussions were mainly related to the previously defined main scientific challenges, grouped under the following items:

- Empirical Critical Loads,
- Steady state modelling, critical limits for simple mass balance models, critical levels for ammonia,
- Update of the harmonized Convention receptor map,
- Dynamic modelling.

Chapter 3 of this report summarises the main tasks achieved by CCE before 2022 which are reported in its “CCE Status report 2022”. Chapter 4 states on the publication of the report on review and revision of empirical CL as a main piece of work achieved end 2022. Chapter 5 reports the state of play of the current work handled by the CCE on the update of the European receptor map, while Chapter 6 and 7 inform on the current status of the work on steady-state CL for eutrophication and acidification and the review of critical levels for ammonia, respectively. Chapter 8 reports the current status of the work on development of dynamic modelling carried out by CDM. Then, the “Mapping Manual” updates subsequent to these works are reported in Chapter 9. Finally, a special focus is made in Chapter 10 on possible outreach activities ahead of ICP M&M further to the discussion on this topic during the 2023 Annual Meeting of the ICP M&M.

The agenda and list of participants of the 2023 Annual Meeting of the ICP M&M are available as annexes, together with its proceedings (summaries of the presentations).

5. Publication of CCE Status report 2022

The mandate of the CCE is to develop and update methodologies for assessing CL, to compile data on CL and to generate maps of CL and their exceedances. Following these goals, the CCE publishes reports describing main CCE activities. The CCE published on 2022 its first status report since it was transferred to the German Environment Agency (UBA) from the Dutch National Institute for Public Health (RIVM) in 2018. It reports on CCE activities including the following major projects:

- i) Coordination of a revision process of empirical CL for nitrogen (CLempN) in Europe resulting in scientifically adjusted CLempN ranges based on the last CLempN update in 2011;
- ii) Call for national data on CL which yielded updated national CL maps representing a respective spatial coverage of 40% for eutrophication and 45% for acidification of the model domain;
- iii) Updating the European background database for CL calculation, which was necessary in order to ensure a frictionless transfer of data and knowledge from RIVM to UBA. A comparison of CL data between old and new database revealed only minor quantitative differences related to changes in input parameters to the simple mass balance (SMB) model for calculating CL;
- iv) Assessing CL exceedances, which were calculated from CL values of national data, the updated European CL background database and modelled historic and projected deposition values provided by the European Monitoring and Evaluation Programme (EMEP) Meteorological Synthesizing Center (MSC) West depending on past emissions and emission scenarios for 2030 – 2050 respectively. Calculated exceedances of CL in the investigated years 2000 - 2020 occurred in a relatively large area of around 74% - 61% of the model domain for eutrophication and a smaller area of 14% - 4% for acidification (both decreasing trends from 2000 - 2020). Projections of CL exceedances for the years 2030 to 2050 as a function of multiple emission scenarios highlighted ecosystem risks for eutrophication even under low emission scenarios;
- v) Estimation of exceedance of critical atmospheric nitrogen inputs to the Baltic Sea as a first attempt to evaluate the risk of open sea eutrophication.

This report is available at the following link:

<https://www.umweltbundesamt.de/en/publikationen/cce-status-report-2022>

6. Publication of the report on review and revision of empirical CL

In the year 2022 the Coordination Center for Effects (CCE) published the report on the Review and revision of empirical Critical Loads of nitrogen for Europe. With this report Empirical Critical Loads (CLEmpN) have been updated for the 4th time since 1992. The report reflects the results of an international cooperative process, coordinated by CCE between 2020 and 2022, to which a total of 43 authors, representing ICP Forests, ICP Integrated Monitoring, ICP Modelling & Mapping, ICP Waters and ICP Vegetation, contributed with their scientific expertise. The review was finalised with an UNECE CCE expert workshop in Berne in October 2021, hosted by the Swiss Federal Office for the Environment (BAFU). The updated list of CLEmpN contains CL values for 51 different European ecosystems. There was enough evidence to take up 9 new ecosystems in the list of sensitive receptors and adapt the values for 36 receptors. Most of the revised values have been lowered considering latest scientific findings.

This report is available at the following link:

<https://www.umweltbundesamt.de/en/publikationen/review-revision-of-empirical-critical-loads-of>

7. Update of the European receptor map

For the calculation of the CL for terrestrial ecosystems throughout Europe, but also for the modelling of the air quality, an up-to-date harmonized land cover map is necessary. The map currently used within the framework of the Convention was nearly 15 years old and based on even older underlying datasets such as Corine Land Cover 2000, Stockholm Environment Institute (SEI) Land European Cover Map (2002 Revision), Food and Agriculture Organization of the United Nations (FAO) Soil Map of the World, European Environment Agency (EEA) European Biogeographical regions (2005). Therefore, revision was urgently needed. This update was coordinated by the CCE in the framework of a project financed by the German Environment Agency. Within the project the updating was combined with a spatial extension to Eastern Europe, Caucasus, and Central Asia (EECCA). The updated harmonized European Land Cover Map complies with the Level 3 classes of the European Nature Information System (EUNIS) Habitat Classification Scheme as much as possible. Based on an evaluation of the availability and suitability of different spatial data it was decided to 1) use CORINE Land Cover 2018 and Ecosystem Type Map v3.1 and apply transition rules towards EUNIS Level 1 and Level 2 for European countries covered by CORINE Land Cover Maps, 2) use Copernicus Global Land Cover Map and apply transition rules towards EUNIS Level 1 and Level 2 for European countries not-covered by CORINE Land Cover Maps, 3) use Global Potential Natural Vegetation (GPNV) maps and the Harmonized World Soil Database (HWSD) to further disaggregate Level 2 classes towards Level 3. More than 700,000 points from the European Vegetation Archive (EVA) classified at EUNIS Level 3 were provided by Expert system for automatic classification of European vegetation plots to EUNIS habitats. Details are to be described in a project-report (not yet available, upcoming in 2023). Preliminary maps at a national level or for the complete domain can be made available upon request to the CCE. Further implementation of soil and forest growth data for the calculation of CL within the background database including EECCA region is part of the CCE workplan tasks 24/25. As a last step the latest knowledge will also be transferred to the Mapping Manual.

8. Current status of the work on steady-state CL for eutrophication and acidification

Current procedures of modelling CL for eutrophication and acidification are being reviewed by project activities coordinated through the CCE. Within a project on the review of critical limits for the SMB calculation of CL together with UBA Wien (Austria) a workshop was held in December 2022. The main goal of the project and the workshop is to review whether currently used critical limits for critical load calculations of acidification and eutrophication needs to be updated based on recent findings from scientific literature. Part of this project is to elaborate how alterations in critical limits would affect CL on a Pan-European scale. A report of those activities is going to be published in 2023. In another recent project coordinated by the ICP Modelling & Mapping German National Focal Center (NFC), the sensitivity of SMB-CL on German Level II Plots is assessed towards climate dependent parameters such as soil water leaching rate, temperature and weathering rate of base cations. A report is in preparation and is going to be published early 2024.

9. Review of critical levels for ammonia

More than ten years after the recommendation of the updated CLRTAP critical levels for ammonia (NH₃), new findings on the effects of ammonia on vegetation have been discussed in a workshop in Dessau in March 2022. Scientists dealing with research on effects of ammonia on vegetation and ecosystems and those involved in the monitoring of ammonia in the environment were asked to present their recent research. In total 19 presentations from presenters from nine countries were dealing with a current review, models and future trends of ammonia across Europe in the first session, different ammonia monitoring networks in the second session and with vegetation effects (recent research on different scales) in the third session. The proceedings document to the workshop contains a thematic literature review on adverse ammonia-effects in vegetation, which was presented as a background document to the workshop as well as summaries of the talks. The proceedings are published by the German Environment Agency (see link below).

The main results of the workshop were transferred also to a draft revised version of the respective chapter on NH₃ Critical Levels in the Mapping Manual. A group of interested participants to the workshop, and members of ICP Vegetation and ICP Modelling & Mapping discussed changes to the latest stage of chapter 3.2.3 Ammonia Critical levels of the Mapping Manual during an online meeting in January 2023. The elaborated proposal for a revision was presented to ICP Vegetation 2023 online meeting (13 February 2023) and the ICP Modelling & Mapping meeting in Prague (Czech Republic) on 30 March 2023, requesting the ICPs for approval. Based on valuable recommendations by the ICP Vegetation meeting in addition to the workshop conclusions, further content was updated. Both, ICP Vegetation and ICP Modelling & Mapping approved the revised text.

The draft revised chapter 3.2.3 will be presented to the 9th Joint EMEP/WGE meeting and the Parties will be asked to approve the suggested changes and the update of the Mapping Manual, respectively.

The report including proceedings of the workshop in Dessau in March 2022 addressing critical levels of ammonia is available at the following link:

<https://www.umweltbundesamt.de/publikationen/review-of-internationally-proposed-critical-levels>

10. Current status of the work on development of dynamic modelling

Ongoing dynamic modelling work within the Working Group on Effects has been mapped through a series of interviews between CDM and the individual ICPs. Interactions between air pollution and climate change has been identified as one of the most important areas which are policy relevant and could be addressed by dynamic models. In modelling the effects of air pollution on ecosystems, including modelling of nitrogen effects and modelling of impacts on biodiversity, the interactions between carbon and nitrogen represent a clear and important overlap where modellers could and should be providing an input to both policies. An expert workshop on carbon-nitrogen interactions has been organised back-to-back with the 2023 Annual Meeting of the ICP M&M in Prague (Czech Republic) in March 2023. Apart from further work on effects of nitrogen deposition on ecosystems and interaction of air pollution and climate change, modelling biodiversity change, and modelling of impacts on soils has been identified as the most important areas. The meeting also stressed the importance of observational data from monitoring and from ecosystem experiments for model applications and development. The modelling activities undertaken by the individual ICPs has been reflected in the new structure of the common WGE website, presented at the Joint Meeting of the Extended Bureaux of EMEP Steering Body and the Extended Bureaux of the WGE in April 2023 in Uppsala (Sweden).

11. Manual updates

The current version of the Mapping Manual was last updated in 2015 and the eight different chapters are presented as single, downloadable pdf-documents. Because of the shift of the CCE from the Netherlands to Germany in 2018 and the finalisation of the review and revision of the CLempN, the current CCE at the German Environment Agency launched a process to transfer the existing independent manual chapters into a new continuous document, which is in line with latest layout and accessibility standards of the German Environment Agency. Also, a copy-editing of the whole document was done, without changing technical content.

Then, important technical updates were included as:

- 1) ICP Material provided the latest version of chapter 4 “Mapping of Effects on Materials”,
- 2) the results of the review and revision of CLempN were taken up into section 5.2 on CLempN,
- 3) outdated information in the section on “further advice” in chapter 2 was deleted.

The Scientific Background Documents of ICP Vegetation were not included into the new layout because it was decided that they will be presented as technical annexes and independent documents.

Finally, the new format opens a larger degree of flexibility for the CCE to incorporate also future necessary technical updates into the Mapping Manual. Upcoming updates comprise the revision of the section on Critical Levels for ammonia (see Chapter 7 of this report) and the revision of the information on the Harmonised Receptor Map (see Chapter 5 of this report).

The current version of the Mapping Manual is available at the following link :

<https://www.umweltbundesamt.de/en/cce-manual>

12. Outreach activities

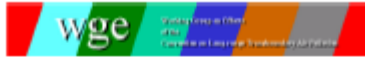
At the ICP Modelling & Meeting 2023, held in Prague (Czech Republic), representatives of the UN Convention on Biodiversity (CBD) were successfully invited through the Secretariat to present and report on the Kunming-Montreal Global Biodiversity Framework. The representatives reported on the developments under the CBD since the COP14 in 2018 and the results of COP15 in 2022. The concluded target 7 is closely related to activities of the CLRTAP as it targets the reduction of pollution as a threat for biodiversity and the halving of nutrients by 2030. Although related headline indicators for target 7 concluded by COP15¹ are not set up specifically to record terrestrial eutrophication but focuses on marine eutrophication as a complementary indicator the trend in nitrogen deposition is listed. The participants expressed great interest in the approaches presented in the exchange and confirmed their desire to continue this exchange.

More broadly, it was discussed how ICP Modelling & Mapping could contribute to any outreach activities and communicate outside of the CLRTAP community on their work achieved in the context of the CLRTAP. Some e-learning courses on e.g. CL was envisaged and it was announced that such activities would be further discussed also with the effects-oriented activities community of the CLRTAP. The topic would be brought up as a discussion item to the next Joint Session of the EMEP SB/WGE meeting in Geneva in September 2023.

¹ <https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-05-en.pdf>

13. Annexes

Annex I – Agenda of the meeting



Convention on Long-Range Transboundary Air Pollution
Working Group on Effects

International Cooperative Programme on
Modelling and Mapping of Critical Levels & Loads
and Air Pollution Effects, Risks and Trends
(ICP M&M)

39th ICP M&M Task Force meeting, 30th CCE and 4th CDM workshops

Tuesday 28th, Wednesday 29th and Thursday 30th March 2023

Hosted in Prague (Czech Republic)

**FINAL AGENDA (March 2023)
All times CEST**

*Please note the meeting will be recorded for reporting purpose.
Should you have any objection regarding the recording of your contribution, please contact us.*

TUESDAY 28 MARCH (2 PM – 6 PM)

Keynote presentation (Kurt Dědič, Department of Air Protection director)

Opening session (2.15 PM – 3.45 PM)

– Chair: Alice James & Tomáš Chuman

“Chapeau” session including policy relevant questions and WGE framework/activities

- Recent development under the Convention (Anna Kaplina, UNECE Air Secretariat)
- Ongoing activities under Working Group on Effects (Isaura Rábago Juan-Aracil, WGE Chair)
- Feedback on Saltsjöbaden VII Workshop (Filip Moldan)
- The Kunming-Montreal Global Biodiversity Framework (Chantal Robichaud & Kieran Noonan)
- Overview on CCE ongoing and new activities (CCE)
- Overview on CDM ongoing and new activities (CDM)

Coffee Break (3.45 – 4.15 PM)

Contributions from other bodies of the Convention to effect-oriented activities (4.15 PM – 6 PM)

– Chair: Filip Moldan & Alice James

- Update on ICP Forests (Kai Schwärzel)
- Update on ICP Integrated Monitoring (James Kurén Weldon)
- Update on ICP Waters (Kari Austnes)
- Update on ICP Vegetation (Katrina Sharps)
- Update on CIAM (Maximilian Posch)

Closing of the meeting at 6 PM



WEDNESDAY 29 MARCH (9 AM – 4 PM)

NFCs' contributions to effect-oriented activities Tour de table (9 AM – 10.30 AM)

– Chair: Markus Geupel & Filip Moldan

- Update on Critical Loads Activities in Germany (Thomas Scheuschner)
- Update on Critical Loads Activities in the Czech Republic (Tomáš Chuman)
- Update of the Dutch Critical Loads following the update of the empirical critical loads (Wieger Wamelink)
- Using empirical Critical Loads for nitrogen in Spain: evaluation of agricultural management changes (Hector García-Gómez)
- Exceedance of critical loads of acidity in Norway (Cathrine Brecke Gundersen)

Coffee Break (10.30 AM – 11 AM)

NFCs' Tour de table (11 AM – 12 AM)

– Chair: Alice James, Markus Geupel & Filip Moldan

- NFCs "Tour de table"

Lunch Break (12 AM – 1 PM)

Call for Data 2023 and empirical Critical Loads for N (1 PM – 2 PM)

– Chair: Christin Loran

- Receptor map update (Steffen Gebhardt & CCE)
- Ongoing Call for Data (CCE)

Scientific developments regarding SMB Critical Loads (2 PM – 4 PM)

– Chair: Thomas Scheuschner & Tomáš Chuman

- Updating critical limits used in the simple mass balance model (SMB) for critical load calculations (Thomas Dirnböck & Karl Knaebel)
- Climate Sensitivity of German Level II Plot Critical Loads (SMB) (Jana Niebuhr)
- Considerations on the application of the European CL database, e.g. towards its use under the GP review process (CCE)

Closing of the meeting at 4 PM

The sightseeing tour – at 5.15 PM
Our host CGS kindly offers a Prague guided tour
It will end close to the place of the dinner at around 7 PM
The meeting point: Staroměstská Metro station

The dinner – from 7 PM
The dinner is organized at Restaurace U Labutí
The address: Hradčanské náměstí 11, Praha 1

All practical details for these side events are available in a separate document

Agenda_39th_ICP-MM

THURSDAY 30 MARCH (9 AM – 5 PM)

Dynamic Modelling activities (9 AM – 11 AM)

– Chair: Filip Moldan & Sara Jutterström

- Summary of CDM workshop on modelling interactions between air pollution and climate change (CDM)
- Estimation of soil denitrification in forests based on isotopic nitrogen balance (Filip Oulehle)
- Re-calibration of the MAGIC model with data from the Norwegian National Lake Survey in 2019 (Kari Austnes)
- Constructing historical deposition time series (Maximilian Posch)

Coffee Break (11 AM – 11.30 AM)

Scientific developments regarding Critical Loads & Critical Levels (11.30 AM – 1 PM)

– Chair: Markus Geupel & Thomas Scheuschner & Christin Loran

- Feedback from CCE workshop on Critical Levels for ammonia and update of the MM (CCE)
- Mapping exceedance data for ammonia in collaboration with NFCs (CCE)
- Recent development regarding Critical Limits for Heavy Metals (CCE)

Lunch Break (1 PM – 3 PM)

Summary and outlook session (3 PM – 5 PM)

– Chair: Alice James & Markus Geupel & Filip Moldan

- Wrap-up session, with inputs from NFCs and others
- Outreach activities of ICP M&M and centers
- Workplan 2024 – 2025

Closing of the meeting at 5 PM

Meeting documents available to all participants are to be downloaded from the CCE-cloud, here: <https://clous.uba.de/index.php/s/RXDoigqdHBMMe3G?path=%2F>

For further details on the meeting: Alice James – alice.james@ineris.fr
CCE – cce@uba.de
CDM – cdm@ivl.se

For further details on logistics: Tomáš Chuman – tomas.chuman@email.cz
Copy to Alice James – alice.james@ineris.fr

Agenda_39th_ICP-MM

Annex II – List of participants

Civility	Family name	First Name	NFC	CLRTAP Body	Participation type	Presentation title (or poster)
Mr	Aherne	Julian	Canada		Online	
Mrs	Augustin	Sabine			Online	
Mrs	Austnes	Kari	Norway	ICP W	In-person	1/ Status report from ICP Waters 2/ Re-calibration of the MAGIC model with data from the Norwegian National Lake Survey in 2019
Mr	Bleeker	Albert			In-person	
Mrs	Brecke Gundersen	Cathrine			In-person	Exceedance of critical loads of acidity in Norway
Mrs	Carrasco-Molina	Tania			In-person	Using empirical critical loads for nitrogen in Spain: a prospective study (poster)
Mr	Chuman	Tomáš	Czech Republic		In-person	Update on Critical Load Activities in the Czech Republic
Mrs	De la Maza Cruz	Elena			In-person	
Mr	Dirnböck	Thomas	Austria		In-person	Review of SMB Critical Limits
Mr	Duan	Lei			In-person	
Mrs	English	Yvonne			Online	
Mrs	Felker-Quinn	Emmi			Online	
Mrs	Fornasier	Maria Francesca	Italy		Online	
Mr	García-Gómez	Héctor			In-person	Using empirical critical loads for nitrogen in Spain: evaluation of agricultural management changes.
Mr	Gebhardt	Steffen			Online	Receptor Map update (with CCE)
Mr	Georgiev	Georgi	Bulgaria		Online	
Mr	Geupel	Markus		CCE	In-person	1/ Overview on CCE ongoing and new activities 2/ Feedback from CCE workshop on Critical Levels for ammonia and update of the MM
Mr	Gromov	Sergey	Russia		Online	
Mrs	Hayes	Felicity		ICP Veg	Online	Update on ICP Vegetation activities
Mr	Hruška	Jakub			In-person	

Civility	Family name	First Name	NFC	CLRTAP Body	Participation type	Presentation title (or poster)
Mrs	James	Alice		ICP M&M TF Chair	In-person	
Mrs	Jutterström	Sara		CDM	In-person	
Mrs	Kaplina	Anna		UNECE Sec.	Online	Recent development under the Convention LRTAP
Mr	Kelleghan	David	Ireland		In-person	
Mr	Knaebel	Karl			In-person	Presentation: Updating critical limits used in the simple mass balance model (SMB) for critical load calculations
Mr	Kram	Pavel			In-person	
Mrs	Kujundzic	Olivera			Online	
Mr	Kurén Weldon	James		ICP IM	Online	Update on ICP Integrated Monitoring activities
Mrs	Loran	Christin		CCE	In-person	1/ Recent development regarding Critical Limits for Heavy Metals 2/ Receptor Map update (with Steffen Gebhardt)
Mr	McDonnell	Todd			Online	
Mr	Meier	Reto	Switzerland		Online	
Mr	Moldan	Filip	Sweden	CDM	In-person	Summary of CDM workshop on modelling interactions between air pollution and climate change
Mrs	Niebuhr	Jana			In-person	Climate Sensitivity of German Level II Plot Critical Loads (SMB)
Mrs	O'Connor	Aisling			Online	
Mrs	Oliveira	Maria Alexandra	Portugal		Online	
Mr	Oulehle	Filip			In-person	Estimation of soil denitrification in forests based on isotopic nitrogen balance
Mr	Posch	Maximilian		CIAM	In-person	Update on CIAM activities
Mrs	Rábago	Isaura	Spain	WGE Chair	Online	Ongoing activities under Working Group on Effects
Mr	Reinds	Gert Jan			In-person	
Mrs	Robichaud	Chantal			Online	The Kunming-Montreal Global Biodiversity Framework
Mr	Rowe	Ed	United Kingdom		In-person	
Mrs	Sanz Noriega	Carolin		UNECE Sec.	Online	

Civility	Family name	First Name	NFC	CLRTAP Body	Participation type	Presentation title (or poster)
Mrs	Sawicka	Katarzyna (Kasia)	United Kingdom		In-person	
Mr	Scheuschner	Thomas	Germany	CCE	In-person	1/ Update on Critical Loads Activities in Germany 2/ Ongoing Call for Data 3/ Mapping exceedance data for ammonia in collaboration with NFCs 3/ Considerations on the application of the European CL database, e.g. towards its use under the GP review process
Mr	Schwärzel	Kai		ICP F	Online	Update on ICP Forests activities
Mrs	Sharps	Katrina		ICP Veg	Online	
Mr	van Hinsberg	Arjen	The Netherlands		In-person	
Mr	Wall	Brendan	Ireland		Online	
Mr	Wamelink	Wieger			In-person	Update of the Dutch critical loads following the update of the empirical critical loads
Mr	Zapletal	Miloš			In-person	
Mrs	Zhigacheva	Ekaterina			Online	

Annex III – Proceedings of the 39th ICP M&M Task Force meeting

The abstracts of the presentations made during the meeting outside of work properly achieved by CCE and CDM are available in the present document below.

The presentations themselves are available on the [CCE website](#), providing consent for such dissemination has been given to CCE by their authors:

Session on “Contributions from other bodies of the Convention to effect-oriented activities”

ICP Forests (Kai Schwärzel)

The Head of the Programme Coordination Centre of ICP Forests, Kai Schwärzel, presented the status and progress of the work of ICP Forests. ICP Forests studies forest conditions at two intensity levels. The Level I monitoring is based on about 5600 observation plots (as at 2021) on a systematic transnational grid of 16 x 16 km throughout Europe and beyond to gain insight into the geographic and temporal variations in forest condition. The Level II intensive monitoring comprises 561 plots (as at 2020) in selected forest ecosystems with the aim to clarify cause-effect relationships. Monitoring at the Level II comprises the following surveys: of meteorology, deposition, ambient air quality, crown condition, tree damage, tree growth, litterfall, tree nutrition (foliar), phenology, ground vegetation characterization, soil condition, soil solution chemistry. Results of the programme are presented annually in the Technical Report (TR, called Forest Condition in Europe). The 2022 assessment presents, among other things, atmospheric throughfall deposition in European forests in 2020, tree crown condition in 2021, and an overview about the history and progress of the ICP Forests ringtest programme and the Working Group QA/QC in Laboratories. In 2021, crown condition of 106 451 trees on 5 565 ICP Forests Level I plots was monitored. On third of the investigated plots showed moderate to severe defoliation. In contrast to deciduous trees, a slight increase in defoliation was observed in conifers compared to 2020. In 2020, deposition measurements (N_{inorg} , NO_3^- -N, NH_4^+ -N, SO_4^{2-} -S, Ca^{2+} , Mg^{2+}) were carried out on 277 ICP Forests Level II plots across Europe. During his presentation, Mr. Schwärzel presented the temporal development of total inorganic nitrogen for the period 2000 – 2020. Total inorganic nitrogen deposition has decreased over time, but is still high at some sites (e.g. in the Ore Mountains). Mr. Schwärzel reported that ICP Forests is currently preparing a publication in Springer's prime book series Ecological Studies. The book is to be published in 2025 on the 40th anniversary of ICP Forests. The aim of the book is to improve the ICP Forests data infrastructure and data quality, to bring together the different surveys and scientists involved, and to increase the visibility of ICP Forests, especially as an actor in the policy arena. Finally, Mr. Schwärzel gave an overview of upcoming events organized by the PCC.

ICP Integrated Monitoring (James Kurén Weldon)

James Kurén Weldon, Head of the Programme Center on Integrated Monitoring, presented an update on ICP IM activities with highlights on key activities such as the completion of the migration of the Programme Centre to Swedish University of Agricultural Sciences (Sveriges lantbruksuniversitet, SLU) and contribution from ICP IM to the review of Gothenburg Protocol. He also reported on the installation of new passive mercury samplers and an analysis of trends in heavy metal concentrations with an upcoming submission for publication. Mr Weldon indicated a project modelling biodiversity recovery from acidification was just beginning. In this regard, a pilot project would be running with small number of sites where ICP IM has good data and understanding, and with a dynamic geochemical model coupled to a statistical plant response model to investigate vegetation recovery after acidification. Investigations and development for further co-operation with European Long Term Ecological Research (eLTER), for which a memorandum of understanding was signed between WGE and eLTER, were also reported. Mr Weldon indicated that a workshop was planned for eLTER consortium meeting in Frankfurt to discuss further action (17-21 April). Further development of Extended IM was also communicated. Finally, Mr Weldon presented proposals for the next workplan to be discussed and finalised at the next ICP IM Task Force meeting which would be held with ICP Waters in Lunz (Austria 9-11 May).

ICP Waters (Kari Austnes)

The latest reports from ICP Waters are the annual reports on biological and chemical intercalibration, as well as Task Force proceedings. All reports and relevant papers are available at www.icp-waters.no. A new report on biological recovery will be available soon. It comprises a joint data analysis, as well as national contributions. The joint analysis shows a general improvement in water chemistry and an increase in species richness, indicating recovery. The latter is most pronounced in rivers and at sites that have crossed pH = 5.5 over the years. Analysis of functional diversity indicates ecosystem imbalance. This can affect the stability and sensitivity of the ecosystems. The 2023 thematic report is focused on trends in base cations at ICP Waters sites and potential implications for chemical recovery. The motivation is observations from the Norwegian 1000 lake survey, showing increasing Ca despite declining SO₄ concentrations in many regions. Other activities include update of the manual and a possible collaboration with ICP Forests on nitrogen trends. The 2023 Task Force meeting will be held in Lunz, Austria, 9-11 May.

ICP Vegetation (Katrina Sharps)

ICP Vegetation provided a summary of activities for 2022 and outlined the ongoing workplan for 2022-2023. As part of the Gothenburg Protocol review process, ICP Vegetation investigated if the proposed emissions reductions are sufficient to protect vegetation. Results showed estimates of the ozone impact on % yield for wheat and annual growth of living biomass for deciduous forest under 3 emissions scenarios. Losses due to ozone were seen to improve with time, however even under the most stringent scenario, large impacts are still predicted for 2050. Good progress has been made with the photosynthesis-based DO3SE model. The model is scaled from leaf scale to canopy scale so that the carbon assimilated *via* photosynthesis can be allocated to different crop components. An ozone damage module that includes the effect of ozone on both photosynthesis and canopy senescence allows an estimate of the ozone induced effect on canopy biomass and yield. The review of NO_x critical levels is underway and a second workshop will be scheduled for the coming months. Outreach work has included deployment of ozone diffusion tubes in South America, India and Africa, to help fill gaps in knowledge on ozone concentration data around the world. The moss survey for 2020-2022 is now complete, with >4000 samples collected across Europe. To ensure the continued participation of countries from Europe now and in the future, coordination of the European moss survey has been transferred back to the ICP Vegetation Coordination Centre in the UK. A new project trialling mosses as a biomonitor for microplastics (MADAME) has also begun, with >30 countries participating. Upcoming work for ICP Vegetation this year will include ozone flux-based risk assessment for vegetation with a focus on the contribution of methane as an ozone pre-cursor.

Center for Integrated Assessment and Modelling (Maximilian Posch)

M. Posch, representing the Centre for Integrated Assessment Modelling (CIAM), summarised the latest developments in the context of the Convention. This included CIAM's contribution to the review of the Gothenburg Protocol (finalised end 2022), some updates of the GAINS-Europe integrated assessment model (e.g., new SRMs from EMEP/MSC-W), and the development of future scenarios for the assessment with the Convention using the GAINS model (now covering all EECCA countries), as well as work supporting the 3rd EU Clean Air Outlook. In this context CL exceedance maps were presented, using the latest (2021) CLs provided by the CCE.

Session on “NFCs’ contributions to effects-oriented activities, Tour de table”

Update on Critical Loads Activities in Germany (Thomas Scheuschner)

The recent update of the empirical Critical Load has a direct impact on the guidelines for the licensing procedures for emitting installations and implies necessary updates. In addition, the guidelines containing a detailed description of habitat types (FFH/N2K) will be updated and published at the end of 2023 (by the Federal Agency for Nature Conservation) with lists of typical plant species for habitat types (link to CLempN and SMB CL). Specific process led by Landesanstalt für Umwelt Baden-Württemberg to enable consultants to identify CL more easily for N2K habitats.

CL exceedance calculated at the national level is used as an indicator for various national environmental strategies. Deposition (S+N) modeling with LOTOS-EUROS Netherlands Organization for Applied Scientific Research (Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, TNO) is based on national emission inventories. The consistency of time series and the generation of future scenarios are latently in the focus of the UBA research strategy. The current project ends this year, a follow-up project is planned.

The German NFC will validate the results of the current ongoing projects (Critical Limits, CL and Climate Change) and include possible results in the planned response to the current and future CfD.

Update of the Dutch Critical Loads following the update of the empirical critical loads (Wieger Wamelink)

The empirical critical ranges were updated in 2022. Therefore, there was the need to update the critical loads (CL) for the Netherlands as well. It was decided to follow the exact same procedure to update the CL as was followed for the update in 2012. This implies that the modelled CL by the model SMART was used for this update. The following rules were applied to estimate the new CL. The CL is the modelled CL if the modelled CL is within the range of the empirical critical range, the lower value of the range if the modelled CL is lower than the range and the upper value of the range if the modelled CL is higher than the range. If there is no modelled CL, then the average of the range is the CL and if there is no range but a modelled CL in which the experts had confidence, then the modelled CL is the CL. If there is no range and no modelled CL is available, then experts estimated a CL and if the experts did not know, then no CL is given, which means that it is assumed that the CL lies above 2400 mol/ha/yr or 34 kg/ha/yr. The new CL are on average lower than the ones estimated in 2012, 53 out of 98 got a lower CL.

Using empirical Critical Loads for nitrogen in Spain: evaluation of agricultural management changes (Hector García-Gómez)

The Centre for Energy, Environmental and Technological Research (Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas, CIEMAT) presented the oral communication *Using empirical Critical Loads for nitrogen in Spain: Evaluation of agricultural management changes*. Three examples of the use of the revised empirical critical loads (CL_{empN}) were shown. They were performed for the Central System range (in the framework of Biodiv-Support Project), throughout the Spanish territory (for Retos-Aire Project) and in the European territory SUDOE (for AgroGreen-SUDOE Project). Preliminary results of critical load exceedances (CL_{exc}) were shown in all cases, with special emphasis on the last of the three studies. CIEMAT's greatest concerns about the use of the new CL_{empN} were expressed: (a) the European receptor map (Ecosystem Types of Europe v3.1) does not concur for *Quercus ilex* woodlands with Spanish inventories, (b) the CL_{empN} for Mediterranean habitats still have low reliability in comparison to the rest of European ecosystems, and (c) the absence of CL_{empN} for certain Mediterranean habitats.

Moreover, CIEMAT exhibited a poster entitled *Using empirical critical loads in Spain: a prospective study*, presenting the methodology that will be followed to develop a consolidated receptor map for the Spanish territory to apply the CL_{empN}, as well as to calculate CL_{exc} in scenarios taking into account emission reductions and climate change.

Exceedance of critical loads of acidity in Norway (Cathrine Brecke Gundersen)

Critical loads and exceedances have been calculated for Norway using updated methodology and new deposition data covering the years 2017-2021. The methodology has been updated for acidification of surface water (Steady-State Water Chemistry (SSWC) and First-order Acidity Balance (FAB) models) and for eutrophication of vegetation and surface water (empirical critical loads) while no changes were made for acidification of forest soil (SMB model). Updates were also made to the method for estimating deposition (EMEP modelled + empirical adjustment). Overall, major updates covered new input data (water discharge, total organic carbon, and nitrate), differentiation of N-processing (N-immobilisation and denitrification) and updated empirical critical loads covering sub-categorisation of lakes. Effects from the methodological changes were i) lower critical loads, ii) reduced deposition (particularly N), and iii) increased geographical extent of exceedances (particularly for eutrophication).

Session on “Scientific developments regarding SMB Critical Loads”

Updating critical limits used in the simple mass balance model (SMB) for critical load calculations (Thomas Dirnböck & Karl Knaebel)

The presentation gave a brief overview of the latest updates concerning the project on critical limits for critical load calculations of acidification and eutrophication via the simple mass balance model (SMB). The main objective of this project is to evaluate whether critical limits currently used can possibly be updated based on recent findings from scientific literature. Furthermore, a survey was conducted on critical limits implemented by national focal centres. According to the literature investigated and analysed, updating critical limits for critical loads of acidification is not indicated. Solely, recent studies tend to use higher Bc:Al ratios such as 7 or 10 instead of 1, if applied as a constant. For critical limits of eutrophication, the main discussion points, also outlined during the expert workshop on critical limits hold in autumn 2022 in Vienna were presented and discussed among participants during the presentation. In keeping with that we also presented, how alterations in critical limits would affect overall critical loads via the critical load background database (version 2017). Furthermore, a mapping approach of critical N-leaching based on recent empirical critical loads and CN ratios was tested and presented.

Climate Sensitivity of German Level II Plot Critical Loads (SMB) (Jana Niebuhr)

Mrs. Jana Niebuhr gave a presentation about the actual status of a German NFC Project on SMB Critical Loads and climate change. Critical loads were calculated for German Level II plots following the German CL approach. Percolation rate, mean annual temperature and duration of vegetation period were used as climatic input parameters. Calculated CLs showed less conformity with empirical Critical Loads where percolation rates were extreme. Climate sensitivity calculations indicated a general strong influence of percolation rate on critical loads, influences of vegetation period and temperature were less. A general conclusion is that current CL approaches are limited in their ability to describe climate change effects.

Session on “Dynamic Modelling”

Summary of CDM workshop on modelling interactions between air pollution and climate change (CDM)

See content of the report in “Chapter 10 Current status of the work on development of dynamic modelling”

Estimation of soil denitrification in forests based on isotopic nitrogen balance (Filip Oulehle)

Mr. Filip Oulehle presented an analysis which provides insights into the mineralogical and stoichiometric controls on soil nitrogen (N) retention and loss fluxes in forest ecosystems, based on detailed N and $\delta^{15}\text{N}$ measurements across a dozen catchments in central Europe. The study finds that forest soils are important long-term N sinks, with the largest N store in the mineral soil being controlled by physicochemical properties, particularly aluminium- and iron-oxyhydroxides. The study also finds that catchment wetness is the strongest correlate among environmental variables influencing forest floor C:N:P stoichiometry, which in turn governs N losses. Dissolved N losses in runoff are tightly linked to forest floor nutrient stoichiometry, with observed increases in N leaching as forest floor C:N ratio decreases and N:P available ratio increases. The study also suggests that chronic N enrichment leads to progressive P limitation, which is consistent with forest growth responses and canopy chemistry observations. The total ecosystem ^{15}N enrichment increased with catchment wetness, pointing to the importance of gaseous losses. Combining measured stream Total Dissolved Nitrogen (TDN) fluxes with isotope-model derived denitrification estimates suggests a non-steady-state N ecosystem balance, with the sum of losses being less than N deposition inputs, yielding an N retention term by difference. These findings provide a globally consistent relationship between N gas and NO_3^- leaching losses, reflecting mechanistic drivers depending on nitrate surplus in ecosystems, enabling broader extrapolation to estimate N gas losses from forests worldwide.

Re-calibration of the MAGIC model with data from the Norwegian National Lake Survey in 2019 (Kari Austnes)

Re-calibration of MAGIC to the Norwegian 1000 lakes: NIVA has developed the MOBIUS modelling framework to develop or adapt relevant biogeochemical models/modules. This is freely available at <https://github.com/NIVANorge/Mobius> and has several useful features, including auto-calibration and statistical uncertainty analysis tools, as well as a use-friendly graphical interface. The MAGIC 8 model has been re-coded to Mobius, including several improvements. There are also new modules. The MAGIC model has been applied to the 1000 lakes dataset twice before, using data from 1995. The re-survey in 2019 as well as the new platform motivated a re-calibration. The new deposition estimates that were used gave higher deposition during the peak period. Calibrating to the 1995 data underestimated ANC in 2019 and vice versa. The 2019 calibration also needed higher Ca weathering rates. The observed increase in Ca concentration was not captured by the model. This exercise shows how crucial the deposition data are for the ability of MAGIC to simulate observed concentration changes. Attempts at 2-point calibrations were not completely successful. A follow-up project in 2023 will look more closely at this.