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Recent results and updating of scientific and technical knowledge

Modelling and Mapping

Report by the Coordination Centre for Effects of the International Cooperative Programme on Modelling and Mapping Critical Levels and Loads and Air Pollution Effects, Risks and Trends

I. Introduction

1. In 2010 the focus of the work of the Coordination Centre for Effects (CCE) of the International Cooperative Programme on Modelling and Mapping of Critical Loads and Levels and Air Pollution Effects, Risks and Trends (ICP Modelling and Mapping) was on the assessment of effects of the baseline scenario, the development of which is being coordinated by the Task Force on Integrated Assessment Modelling. The assessments were based on methods and indicators developed by CCE (www.rivm.nl/cce). Further work during 2010 is expected to result in revised empirical critical loads and new indicators to assess the change in plant species diversity by combining modelled soil chemical processes with the carbon and nitrogen (N) cycling with the extended very simple dynamic model (VSD+) and dynamic vegetation change models (e.g., the VEG model). The results are presented here in accordance with item 3.7 of the 2010 workplan for the implementation of the Convention on Long-range Transboundary Air Pollution (ECE/EB.AIR/99/Add.2), adopted by the Convention's Executive Body at its twenty-seventh session in December 2009.

II. Workplan items common to all programmes

A. Targets and ex post application

2. Target loads for recovery of acidification and eutrophication in 2030, 2050 and 2100 were estimated with the VSD model using a preliminary baseline emission scenario as of autumn 2009. Target loads for recovery from acidification were computed for the majority of ecosystems in northern, eastern and southern Europe. The results indicated that ecosystems in large parts of the United Kingdom of Great Britain and Northern Ireland and central Western Europe would not recover before 2100. The recovery of 95 per cent of the European ecosystems from eutrophication by 2030, 2050 or 2100 tentatively indicated a target load comparable to nitrogen depositions ranging from 400 to 1,000 eq ha^{-1} $year^{-1}$ in 2020. The deposition exceeding target loads in the European Union (EU) Natura 2000 areas in 2030 was limited for acidification but widespread for eutrophication.

B. Robustness

3. The robustness estimates for air pollution effects were based on the ensemble assessment of impacts (EAI) methodology of CCE, where different models and criteria are used to analyse the risk of nutrient N on natural systems in Europe. Results indicated that critical loads of nutrient nitrogen were virtually certain to be exceeded by the 2009 baseline scenario emissions in most natural areas in Europe. Recent analyses with updated emission data from the Centre for Integrated Assessment Modelling (CIAM) suggested similar results.

C. Links with biodiversity

4. CCE has tentatively applied dose-response relationships that were regionalized over European ecosystems according to the European Nature INformation System (EUNIS) classification. Preliminary calculations testing CCE methods of ex post assessments indicated that 2000 emissions had led to a significant (> 5 per cent) change in plant species diversity for 12 per cent of European nature (30 per cent in natural areas in the 27 EU Member States (EU27)). The results calculated with 2020 emissions suggested that significant changes in plant diversity would occur for 5 per cent of terrestrial ecosystems in Europe (12 per cent in EU27).

D. Trends in selected monitored/modelled parameters

5. The preliminary baseline emission scenario as of autumn 2009 was used to calculate trends in the average accumulated exceedance (AAE) of critical loads for acidification in the modelling domain of the Convention's Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP). The AAE was 53, 8 and 7 eq ha^{-1} $year^{-1}$ in 2000, 2020 and 2030, respectively. For eutrophication, the AAE was 184, 86 and 82 eq ha^{-1} $year^{-1}$ for the same years. For aquatic and terrestrial ecosystems trends in both AAE and area at risk (in km^2) were computed for different scenarios and spatial scales, including the EMEP modelling domain, cells of grids of various sizes, regional natural areas in selected regions and within countries.

III. Acidification

6. The computed area at risk of acidification in 2000 was 10 per cent in the EMEP modelling domain and 19 per cent in EU27, assuming emission data of CIAM as of March 2010. The computed area at risk in 2020 was 4 per cent in the EMEP domain and 7 per cent in EU27, assuming baseline emissions and depositions as of May 2010. The area diminished to 1 per cent in the EMEP domain and to 2 per cent in EU27, assuming tentative maximum technically feasible emission reductions.

IV. Nutrient nitrogen

7. The computed area at risk of eutrophication in 2000 was 52 per cent in the EMEP modelling domain and 74 per cent in EU27, assuming emission data of CIAM as of March 2010. The area at risk of eutrophication in 2020 was computed to be about 38 per cent in the EMEP domain and 61 per cent in EU27, assuming baseline emissions and depositions as of May 2010. The area diminished to 14 per cent in the EMEP domain and 24 per cent in EU27, assuming tentative maximum technically feasible emission reductions. An important part of European natural systems would then still be at risk of eutrophication.

V. Heavy metals

8. CCE has started to evaluate the risk caused by deposition of cadmium, lead and mercury on aquatic and terrestrial environments and human health, in collaboration with the Meteorological Synthesizing Centre-East (EMEP/MSC-E) and the Dutch TNO institute (www.tno.nl). The work will use critical loads for heavy metals and four emission scenarios, which are based on combinations from current legislation, implementation of the Convention's Protocol on Heavy Metals and its possible amendments. First results will be presented to the forty-seventh session of the Working Group on Strategies and Review in September 2010.

VI. Cross–cutting issues

9. ICP Modelling and Mapping has collaborated with other International Cooperative Programmes to support ex post assessments in general. That collaboration will also enable it to compile results from the ex post assessment for possible amendments to annex I of the Gothenburg Protocol, based on possibly amended emission ceilings in annex II.