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### Executive Body for the Convention on Long-range Transboundary Air Pollution

**Working Group on Effects**

**Thirtieth session**
Geneva, 27–29 September 2011
Item 4 of the provisional agenda
**Recent results and updating of scientific and technical knowledge**

# Dynamic Modelling

## Report by the Co-Chairs of the Joint Expert Group on Dynamic Modelling

1. This report comprises the results of recent work in dynamic modelling and summarises the discussion and outcomes of the tenth meeting of the Joint Expert Group on Dynamic Modelling held from 27 to 29 October 2010 in Sitges, Spain, presented here in accordance with item 3.9 of the 2011 workplan for the implementation of the Convention (ECE/EB.AIR/99/Add.2) adopted by the Executive Body at its twenty-eighth session in December 2010.

2. Twenty three experts from the following Parties to the Convention on Long-range Transboundary Air Pollution attended the meeting: Canada, the Czech Republic, Denmark, Finland, Germany, Ireland, the Netherlands, Norway, Spain, Sweden, Switzerland, the United Kingdom of Great Britain and Northern Ireland and the United States of America. The International Cooperative Programme (ICP) on Assessment and Monitoring of the Effects of Air Pollution on Rivers and Lakes (ICP Waters), ICP on Integrated Monitoring of Air Pollution Effects on Ecosystems (ICP IM), the Coordination Centre for Effects (CCE) and the Bureau of the Working Group on Effects were also represented.

3. The meeting was co-chaired by Mr. A. Jenkins (United Kingdom) and Mr. F. Moldan (Sweden). It was organized by the Centre for Ecology and Hydrology (United Kingdom) and by IVL Swedish Environmental Research Institute (Sweden).

## I. Aims and Organization

4. The aim of the Joint Expert Group meeting were to examine progress in dynamic modelling (DM) of acidification and nutrient nitrogen, including the interactions between

climate change and air pollution, biological response and terrestrial carbon sequestration. Specifically, and in accordance with the agreed Working Group on Effects workplan (document ECE/EB/AIR/99/Add.2) the objectives were to;

(i) Consider the outcome of the 2009/2010 call and proposed call for data 2010/2011

(ii) Assess progress in dynamic modelling

(iii) Assess progress in DM of climate change/air pollution interactions

(v) Consider progress in the workplan items common to all ICPs, the Task Force on Health and the Joint Expert Group on Dynamic Modelling, namely;

- Comparison of activities across continents and regions (North America, Western Europe, Eastern Europe, the Caucasus and Central Asia/South Eastern Europe)
- Ex post scenario assessment

# II. Conclusions and recommendations

## A. Calls for data 2009/10 and 2010/11

5. The call for data 2009/10 provided some VSD+ test runs, although rather few on national level, and these provided useful feedback which have led to improvements of the model as summarized in the CCE 2010 Status Report.

6. The Group support the 2010/11 call further requesting site-specific model runs involving both chemistry and biodiversity and urges all National Focal Centres and appropriate ICPs to undertake further dynamic modelling.

## B. Progress in model development

7. The Group emphasized that current model chains need to be further developed to incorporate the effect of changed biology as a feedback to soil- and water geochemistry. This is especially important when assessing the impact of climate change which will affect the soils both directly and indirectly through changes in the vegetation.

8. The Group applauded the work undertaken by the CCE to develop the European vegetation types response library for use in the VEG model and noted the further development of VSD+ including the new interactive version which makes use of long-term climate data.

9. The Group noted the considerable progress that is being made with several model chains including the VEG, BERN and PROPS models. The growing sophistication of models, both geochemical and biological, merits an examination of coupling models using novel statistical approaches as opposed to simple model chaining. A major disadvantage of model chaining is that not all useful information from the models gets to be used.

10. The Group was greatly encouraged by recent progress in restructuring N and C dynamics in the MAGIC model. The new model structure will facilitate evaluation of scenarios of combined climate change and air pollution.

11. The new version of MAGIC is being tested at sites with low to high N deposition and at manipulated sites. The Group welcomed the preliminary results of this evaluation and noted that the new structure of the model reproduces surface water chemistry observations over time, which were previously not reproduced satisfactorily.

12. The Group took note of developments with the INCA model. This has potential relevance to the work of the convention especially with respect to eutrophication, heavy metals and for the work of the TFRN. The model structure also allows assessment of the combined effect of climate change, air pollution and land use.

13. Abiotic ranges for habitat types are now available for pH and nitrogen and can be applied as a biological indicator linked to dynamic models.

14. There is an increasing amount of data from manipulation and experimental studies with which to test the vegetation models. An example is Gårdsjön in Sweden which has demonstrated that there are significant delays of the order of decades in the vegetation response to increased N deposition even at high nitrogen inputs.

15. The Group encourages ICPs to evaluate model predictions against appropriate data from long-term monitoring and manipulation experiments. A good example of such efforts is an initiative to re-visit the forecasts made by DM as part of the EU project RECOVER:2010.

16. All existing dynamic models and those under further development depend heavily on experiments and monitoring to provide data and observations for their parameterization, application and testing. Activities such as field experiments, chamber experiments, space–for-time substitutions and integrated monitoring of chemistry and biology must be continued as a priority to provide the necessary process understanding to further develop and test the models. This linkage of experiment, observation and modelling is essential for DM to be anchored in reality

## C. Climate change air pollution interaction

17. The Group agreed an urgent need for dynamic modellers within the Convention to engage with the earth system modelling community to address the issues of air pollution and climate change interaction. There is likely to be particular utility in linking biogeochemical models to earth system models such as JULES and LPJ GUESS. There may also be benefits in engaging with the mobile-DNDC approach.

18. The Group considered the necessary level of model complexity needed to examine the effects of multiple drivers and interactions, and to address questions specific to the Convention. There is a trade off in model complexity and applicability which requires consideration of what model complexity is appropriate to answer policy relevant questions posed by the Convention. Both approaches (detailed and generic) are useful and complementary rather than mutually exclusive.

## D. Common workplan items – Activities in North America

19. The Group welcomed the establishment of the US Focal Center Utility Study (FOCUS) under the NADP, and especially the DM aspects and anticipated future co-operation and their growing involvement in the work of the Working Group on Effects.

20. The Group noted the initial efforts to calibrate For-SAFE Veg to North American conditions and hoped to see the results brought into the Convention.

21. The Group noted the progress in DM in Canada including the exploration of databases for VSD+ application and encouraged participation in future Calls for data issued by CCE.

## E. Common workplan items – Ex post scenario analysis

22. The Group urged that the term Ex-Post be dropped. The process being undertaken is simply a scenario analysis and the ex-post terminology is confusing.

23. The Group urged the CCE to undertake scenario analysis at the largest scale possible and ICPs to use their best available sites with both chemical and biological data for DM applications.

24. The Group applauded the continuing efforts of the CCE to co-ordinate DM in support of the needs of the Convention. The Group also noted the positive co-operation with and contribution of EMEP[1] in providing data.

25. The Group discussed and fully supported the generic approach to the scenario assessment (ex-post assessment) proposed by ICP Waters and encouraged consistent approaches to be followed by DM assessments undertaken by ICP IM and by ICP on Assessment and Monitoring of Air Pollution Effects on Forests.

26. The Group noted that the sulphur deposition values provided for the scenario (ex-post) analysis, specifically the NAT 2020 and PRI 2020, are significantly lower than the former Gothenburg/CLE values supplied for the 2007/08 CCE call for DM assessment. The Group also noted differences in deposition of oxidized nitrogen between these scenarios. Dynamic model predictions of acidification status of lakes in Norway based on those scenarios is significantly improved compared to 2007/08 CLE.

27. The Group urged the widest possible use of DM outputs in the revision of the Gothenburg protocol. Dynamic models are the only tool with which to assess the time scales of recovery. Target loads already exist and should form the basis of a GAINS model optimization.

## F. Future

28. The Group agreed that a further meeting in 2011 would be appropriate to consider progress in dynamic modelling of N as a nutrient in terrestrial and freshwater systems, interaction between air pollution and climate change, biological responses and the contribution of dynamic modelling to the revision of the Gothenburg Protocol.

[1] Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe