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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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Progress in activities of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe in 2017 and future work: integrated assessment modelling

Integrated assessment modelling

Report by the Co-Chairs of the Task Force on Integrated Assessment Modelling

Summary

The present report describes the results of the forty-sixth meeting of the Task Force on Integrated Assessment Modelling under the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (Paris, 2-3 May 2017) and a workshop on local air quality measures (Utrecht, the Netherlands, 15-16 February 2017). It provides the main findings from these meetings and recommendations for the future involvement of global and local networks in developing future air quality policies.

In accordance with the Task Force mandate set out in the 2016-2017 workplan for the implementation of the Convention (ECE/EB.AIR/133/Add.1, items 1.1.2.1, 1.1.3.1-1.1.3.3 and 1.1.4.2) and also in the informal document submitted to the Executive Body for the Convention at its thirty-fourth session, "Basic and multi-year activities in the 2016-2017 period" (items 1.5.2, 1.5.4, 1.5.6-1.5.8), the task force reviewed recent changes in the

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Greenhouse Gas and Air Pollution Interactions and Synergies model and results of scenario analyses, and exchanged national and international experiences with integrated assessment modelling.

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I. Introduction

1. The present report describes the results of the forty-sixth meeting of Task Force on Integrated Assessment Modelling under the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP), which was held in Paris on 2 and 3 May 2017, and a workshop on local air quality measures — "Modelling urban and regional measures for improved air quality" — organized in Utrecht, the Netherlands, on 15 and 16 February 2017. It provides the main findings from these meetings and recommendations for the future involvement of global and local networks in developing future air quality policies. The full reports from these meetings and the presentations made at them are available online.[1]

2. The main focus of the Task Force is to enable development of cost-effective policy strategies under the Convention on Long-range Transboundary Air Pollution and to highlight links with other policy processes, such as the implementation of the United Nations Sustainable Development Goals. Under the current workplan the Task Force is making efforts to link assessments at the European scale to analyses at the local and hemispheric scales. The objective of further integration across scales could shed light on:

(a) The cost-effectiveness of (European) regional versus local measures in protecting health and ecosystems;

(b) The effectiveness of regional versus global measures, especially for issues such as the abatement of ozone precursors, short-lived climate pollutants and long-lived heavy metals and persistent organic pollutants.

3. The Utrecht workshop on local air quality measures was attended by 60 experts, representing Belgium, Croatia, Czechia, Cyprus, Denmark, the European Commission, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden and the United Kingdom of Great Britain and Northern Ireland. Other bodies represented included AirClim, the EMEP Centre for Integrated Assessment Modelling (CIAM), the EMEP Steering Body, the European Environment Agency, the European Environment Bureau, the European Urban Partnership on Air Quality and the Oil Companies' European Association for Environment, Health and Safety in Refining and Distribution (CONCAWE). Several local experts presented local experiences, e.g., regarding Antwerp, Birmingham, Copenhagen, Genoa, Helsinki, Lisbon, Madrid, Milan and Paris. The workshop was co-organized by the Forum on Air quality Modelling in Europe (FAIRMODE), which is led by the Joint Research Centre of the European Commission.

4. At the forty-sixth Task Force meeting 46 experts attended, representing the following Parties to the Convention: Belarus, Denmark, European Union, Finland, France, Germany, Ireland, Netherlands, Norway, Portugal, Sweden, Switzerland, United Kingdom and United States of America. Other bodies represented were AirClim/European Environment Bureau, the Arctic Monitoring and Assessment Programme, CIAM, the Climate and Clean Air Coalition, the Coordination Centre for Effects (CCE), CONCAWE, the EMEP Meteorological Synthesizing Centre-West, the EMEP Steering Body, the International Cooperative Programme on Effects of Air Pollution on Natural Vegetation and Crops (ICP Vegetation), the International Council on Clean Transport, the Organization for Economic Cooperation and Development and the Task Force on Techno-economic

[1] See www.iiasa.ac.at/TFIAM/past-meetings.html

Issues. The meeting was organized together with the Task Force on Hemispheric Transport of Air Pollution.

II. Workshop on local air quality measures

5. The objectives of the Utrecht workshop were to assess the current possibilities to answer the following questions:

(a) What high-impact local or regional measures are available to reduce concentrations of particulate matter or nitrogen oxide?;

(b) What tools are available to assess the health benefits of local and regional measures?;

(c) How cost-effective are local and regional measures compared with additional national or European measures?;

(d) What are the opportunities for and barriers to a multi-level approach?

6. The Chair of the EMEP Steering Body presented the complex interactions between the local, national and continental scales for managing air pollution. She noted that local air quality was affected by transboundary sources, but cities were also sources for transboundary dispersion of emissions and local air quality governance would have transboundary impacts. Multi-scale action plans were required for developing efficient air quality plans.

7. The Head of CIAM presented the share of transboundary sources to average air quality in European and Asian cities. He noted that even in New Delhi, with 20 million inhabitants, local sources only contributed 40 per cent to the average concentrations of fine particulate matter ($PM_{2.5}$). He also presented the cost-effectiveness of European-scale measures and the Greenhouse Gas and Air Pollution Interactions and Synergies (GAINS) model methodology developed for the Pollution Management and Environmental Health Program for Hanoi to assess the cost-effectiveness of measures implemented in the city, the neighbouring cities and nationwide.

8. The main findings from the workshop are:

(a) There are no effective local measures to reduce particulate matter concentrations during peak pollution episodes (with the exception of cities that are not substantially affected by surrounding sources);

(b) Regional and transboundary policy coordination remains essential;

(c) Low emission zones and traffic and shipping management are the local measures most often applied. For example, promotion of cycling, the use of public transport and shoreside electricity for ships seem to be cost-effective local measures. Control of domestic wood burning and combining urban energy policy with air pollution policy seem promising. At the national and international level, measures to reduce ship emissions are cost-effective. At the street level, photocatalytic paint does not seem to be effective. Scrubs could form barriers between car exhausts and pedestrians. Street trees reduce dispersion of pollution;

(d) Fewer restrictions on the use of economic instruments could enlarge the choice of policy instruments at the local level;

(e) Reduction of agricultural emissions and reduction of tyre wear are a blind spot in many local air quality plans;

(f) Health is currently not a central issue in local air quality plans. Now that air quality limit values are met for most of the European population, and acknowledging that still substantial health benefits can be gained, the focus of local modelling and measurements should shift towards assessment of the impact of measures on average population exposure;

(g) By calculating the costs per life years gained the effectiveness of local, national and European-wide measures can be compared. It remains important to assess co-benefits of air pollution abatement on climate, noise and nature, to assess who will pay for or gain from measures and to what extent inequality issues (e.g., the accumulation of energy poverty or unequal exposure to air pollution and noise) can be addressed jointly.

9. The workshop participants recommend further developing a methodology to include the cost-effectiveness of local and regional measures in future air quality strategies aimed at long-term targets for health and the environment. They also recommend including more local knowledge in international networks that support air policy formulation. In that regard, participants call on national and international authorities to stimulate (and fund) a larger involvement of local experts.

III. Hemispheric air pollution

10. During the forty-sixth meeting of the Task Force, a substantial part of the meeting was devoted to hemispheric air pollution. The objectives were to:

(a) Assess the status of models;

(b) Assess available scenarios;

(c) Define policy packages or measures to be explored further;

(d) Learn from national, regional and sectoral analysis;

(e) Define further cooperation between the Task Force on Integrated Assessment Modelling and the Task Force on Hemispheric Transport of Air Pollution.

11. The Co-Chairs of the Task Force on Hemispheric Transport of Air Pollution confirmed that the findings of the first phase of cooperative experiments (HTAP1)[2] on the near-linear relationship between emissions of ozone precursors in the Northern Hemisphere and background ozone levels were still valid. Methane was an important driver of future ozone trends. Ozone peaks, however, seemed more related to local sources in a non-linear way. Exposure of the population to high levels of particulate matter and nitrogen dioxide was predominantly caused by local sources, but constituted a universal phenomenon in urbanized areas that could be tackled with internationally coordinated action.

12. The Co-Chairs said that the experience from the Task Force on Hemispheric Transport of Air Pollution was that international collaboration was important for driving knowledge development. Regular workshops and meetings helped align the research of

[2] HTAP1 (or HTAP 2010) is the first comprehensive assessment of the state of the science with respect to the intercontinental transport of air pollutants in the Northern Hemisphere. The final assessment consists of five separate documents. More information is available from http://www.htap.org.

different research groups, but were increasingly difficult to organize when connecting to multiple global actors.

13. A representative of the Meteorological Synthesizing Centre-West updated the Task Force on differences between the HTAP1 and HTAP2[3] results for ozone import into Europe.[4] Owing to differences in the definition of source regions, the important role of shipping emissions for ozone formation over Europe could be seen more explicitly in HTAP2. For European ozone concentration (background levels), it was more important to implement technical control of nitrogen oxides (NO_x) and non-methane volatile organic compound (NMVOC) emissions in areas outside Europe and to implement European and global reductions of methane, than to implement further European controls on NO_x and NMVOC. Because of global warming, the lifetime of ozone and its precursors was expected to decrease, which might reduce the relative importance of ozone transport into Europe. However, further analysis was needed to consider simultaneous changes to climate, emissions in Europe and emissions in the rest of the world.

14. A representative of CIAM presented the available hemispheric emission scenarios for air pollutants. Air pollution projections of the Shared Socio-economic Pathways (SSP) had been developed under the Intergovernmental Panel on Climate Change. The range of the SSP emission projections was larger than in the previous Representative Concentration Pathways used for the Panel's Fifth Assessment Report. HTAP2 was using the ECLIPSEv5a[5] scenarios with several policy assumptions: GAINS hemispheric transport of air pollution (HTAP) current legislation (CLE) and maximum technically feasible reductions (MTFR). The GAINS HTAP-MTFR scenario led to lower emissions than the SSP scenario with lowest emissions. The SSP3 scenario was the SSP with the highest emissions of sulphur dioxide (SO_2) and NO_x for 2050, as it was based on an increased use of fossil fuels and modest autonomous development in air pollution control. However, the SSP3 emissions for 2050 were lower than the GAINS HTAP-CLE projections. GAINS HTAP-CLE assumed no further steps than current legislation.

15. A GAINS International Energy Agency-New Policy Scenario (IEA-NPS) had been developed for the Agency in 2016, assuming full implementation of the pledges under the Paris Agreement the CIAM representative reported. That scenario had showed a significant decline in emissions of SO_2 and black carbon, especially in Asia.

16. The CIAM representative further mentioned a review of emission scenarios in Asia made during the past 20 years that had demonstrated the importance of what was assumed regarding the timing of air and energy policy implementation and also the level of enforcement. The analysis had also shown that dedicated air pollution control had been important for the control of SO_2 and NO_x emissions in China and India, but demographic trends (aging of the population), rising energy use and urbanization counteracted health benefits of air pollution control.

17. The representative of CIAM also presented recent developments in estimating current and future methane emissions. The importance of methane for global warming had increased. Concentrations were up 144 per cent from preindustrial levels, and the climate metric for methane (Global Warming Potential – GWP100 value) had been re-evaluated over the past 10 years and increased from 21 to 32 times more potent than carbon dioxide

[3] Ibid.
[4] See http://aerocom.met.no/cgi-bin/aerocom/surfobs_annualrs.pl?Project="HTAP2".
[5] See http://www.iiasa.ac.at/web/home/research/researchPrograms/air/ECLIPSEv5.html.

(CO_2) per kilogram emitted. Globally, there was a fairly large amount of control options with negative costs. Examples of non-conventional options to reduce methane emissions included converting methane currently flared into liquid methanol, reducing the use of antibiotics for animals and changing human diets.

18. Assessments with the TM5-FASST[6] model of the European Commission's Joint Research Centre showed ozone and particulate matter concentrations and impacts based on air pollution emissions from 56 regions around the world and for different emission control scenarios. Ozone levels would increase over Europe if no further control was implemented. Tentative results also showed that winter and summer ozone concentrations reacted differently to emission reductions. Air pollution control and methane control would help to reduce ozone concentrations.

19. HTAP experts confirmed that background ozone, in addition to an accumulation of mercury and some persistent organic compounds, were influenced by sources in other continents. Primary $PM_{2.5}$ and other pollutants were transported to a lesser extent between regions, with most of the intercontinental $PM_{2.5}$ transport associated with dust and fires. However, the estimated health impacts from transcontinental contribution to particulate matter exposure were comparable to the transcontinental contribution to ozone exposure.

20. A representative of ICP Vegetation gave an update on the ozone critical levels, stressing the importance of the flux-based approach to assess ozone impacts. Global model calculations showed that more than 9 per cent of global wheat production had been lost owing to ozone damage and that especially biodiversity in global biodiversity hotspot areas were at risk from ozone. ICP Vegetation was also engaged in outreach activities, including the Tropospheric Ozone Assessment Report, which was expected to be published in 2017.

21. It was noted that the workplan of the Arctic Council's Arctic Monitoring and Assessment Programme offered opportunities for cooperation on joint thematic assessment reports. Issues for cooperation could be related to short-lived climate pollutant emissions (including ozone and black carbon), shipping, domestic wood burning or nitrogen. Specification of the issues would depend on Convention decisions on priorities, inter alia, on the basis of the recommendations by the ad hoc policy review group of experts on the 2016 scientific assessment[7] of the Convention (ad hoc policy review group).

22. A representative of the Climate and Clean Air Coalition presented an overview of objectives and ongoing activities, e.g., on black carbon and the development of national actions plans. The Coalition sought cooperation with the Convention and the scientific expertise available within the Convention to improve emission inventories and impact assessments.

23. A representative of the Organization for Economic Cooperation and Development presented the future global economic costs from emissions of air pollutants if no action was taken. The analysis included not only the economic values of health endpoints, but also the impacts on economic growth from reduced labour productivity, additional health expenditures and reduced crop yields. Those market costs constituted up to 5 to 30 per cent

[6] TM5-FASST is freely available to use. See European Commission, "FASST - FAst Scenario Screening Tool" (24/03/2017), accessible from http://tm5-fasst.jrc.ec.europa.eu/.

[7] See Rob Maas and Peringe Grennfelt, eds., *Towards Cleaner Air: Scientific Assessment Report 2016* (Oslo, 2016) and United States Environmental Protection Agency and Environment and Climate Change Canada, *Towards Cleaner Air: Scientific Assessment Report 2016 – North America* (2016, online report).

of the total welfare costs of air pollution and would be growing significantly over time if no further action was taken.

IV. Updates on European scientific research

24. A representative of CIAM presented the latest developments of the GAINS model. The current focus was on updating emission projections with respect to base year values and key (PRIMES model) scenarios. A recent review had shown that emission inventories reported by the Parties to the Convention for past years were still varying between submission years. Those variations implied difficulties in the GAINS modelling for base years and for scenarios.

25. A representative of CCE noted that the 2015 call for critical load data had now (2017) been reported by 13 national focal points and the data reported was currently under review.

26. In view of the uncertain future of CCE, the Task Force recommends to the Working Group on Effects that:

(a) It request the International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends (ICP Modelling and Mapping) national focal centres to continue their work into 2018 for the CCE call for data on biodiversity critical loads;

(b) It report those results to the thirty-fourth meeting of the Task Force of ICP Modelling and Mapping in April 2018 for review by the fourth joint session of the EMEP Steering Body and the Working Group on Effects in September 2018;

(c) It maintain and digitally safeguard the national focal centre data on critical loads of biodiversity until they could be submitted to a new ICP Modelling and Mapping programme centre to be established by the Executive Body to implement the 2018-2019 workplan.

V. National experiences

27. The Task Force took note of national presentations from Belarus, France, Germany, Ireland, the Netherlands and the United Kingdom on recent scenario analyses. In several countries scenario work had started to support a national air quality plan. Implementation challenges differed — from high abatement costs (Belarus), meeting the national ceilings of volatile organic compound emissions (France), air quality limit levels in streets due to high NO_x emissions from diesel cars (Germany), to increasing methane emissions from cattle (Netherlands). There had also been promising experiences, e.g., by including energy and traffic policy measures in air quality strategies.

VI. Workplan items

28. The Chair noted that the forty-seventh meeting of the Task Force would take place in Brescia, Italy, from 7 to 11 May 2018. The Task Force meeting was to be arranged back to back with a meeting of the International Federation of Automatic Control. National experiences with the development of national air quality plans would be on the agenda.

29. Several parties requested a follow-up workshop on local air quality management to strengthen the links with local experts. Such a workshop could potentially be focused on integrative approaches for clean air in cities, including urban planning and transport, energy and health policy.

30. The Task Force considered that specific policy-relevant questions identified in the report by the ad hoc policy review group could be addressed in thematic assessment reports, technical notes or papers to be produced jointly by small teams of experts drawn from various Convention bodies and other international organizations, such as the Arctic Monitoring and Assessment Programme or the Climate and Clean Air Coalition. The topic(s) for such thematic assessment reports should be further prioritized, but could be about certain sectors (e.g., shipping or wood burning), substances (e.g., ozone or nitrogen) or themes (e.g., climate or energy security). Such assessment reports ideally would cover emissions, projections, impacts and the costs and benefits of mitigation measures.

31. Several parties highlighted the need to add the assessment of the costs and benefits of abatement measures for (energy use-related) heavy metals and persistent organic compounds to the work of the Task Force.