

THE 2007 TF HTAP INTERIM ASSESSMENT REPORT

Background

The TF HTAP has as an objective to prepare an assessment report by 2009 to inform the CLRTAP about its findings on HTAP and particularly on the source-receptor relationships for transcontinental transport of air pollution. In addition to this 2009 report, the TF is expected to provide an interim report on its findings in 2007 to inform the CLRTAP in its review of the 1999 Gothenburg protocol, which addresses tropospheric ozone, acidification, and eutrophication. Both reports are to be accepted by the TF annual meetings (2007 and 2009) and reported to the fall EMEP SB for adoption and communicated to the EB. The reports will be published in the UNECE series for traceability and transparency.

Possible Outline of the 2007 Interim Report

The 2007 interim report will have to rely to a large extent on already existing evidence and studies of hemispheric transport of air pollution. The authors should refer to the list of policy-relevant science questions posed by the TF at its first meeting (see Annex I). Specific numbered questions from this list are referred to in the descriptions of relevant chapters below.

0. Executive Summary (3 pages)

This summary will be drafted after the other chapters are completed, drawing heavily upon the conclusions and recommendations chapter. The summary will address the key tasks of the TF “understanding the HTAP” and “quantify the transcontinental influence.” The conclusion should not be binding the work to be performed for the 2009 assessment. Most likely, the EB wishes to know if intercontinental transport of ozone, fine particles, and their precursors (including NO_x, CH₄, CO, SO_x, and organic compounds) is significant in terms of exceedances of policy objectives and what the key uncertainties are. Strictly, the report only has a bearing on the review of the Gothenburg protocol. Therefore, mercury and POPs will not be addressed. Ideally, most of the text of this section will be cut and pasted into the chapter on hemispheric transport in the “main report” of the review of the Gothenburg Protocol. [Lead Authors: Terry, André; 3 pages]

1. Introduction (1-2 pages)

This very brief chapter will introduce the TF HTAP in the context of CLRTAP and the purpose and organization of the interim report.

2. Assessing Transport Processes (Conceptual Overview) (6 pages)

This chapter will introduce the issue of hemispheric or intercontinental transport and the approaches to assess HTAP using an integrated approach to systematic observations, process studies (including short term intensive observations) and modelling. It will emphasize the critical role of emissions and approaches to defining their uncertainties. It will include conceptual or qualitative descriptions of the atmospheric transport processes relevant for the intercontinental transport of different pollutants of interest. It will include descriptions of the role of deep convection and frontal systems (conveyor belt) in vertical transport and westerly long waves for horizontal transport and differences

between the continents of these processes. It will also discuss the linkages between intercontinental transport and climate change.

Specific questions of interest to the TF (from Annex I) that may be addressed include:

1.2 How do the transport pathways differ by pollutant? By source region? By season?

1.3 What processes need to be better understood to describe the relative significance of intercontinental transport?

1.4 How do processes at the intercontinental or hemispheric scale affect processes at the local or global scales? (Synoptic scale meteorological events/cycles; Hadley circulation; etc.)

6.1 How will meteorological changes predicted by climate modeling studies affect major transport or chemical processes?

6.2 Are there significant feedbacks between the transported air pollutants and regional climate and meteorology?

3. Observations of Intercontinental Transport: Existing Evidence, Current Capabilities, and Future Needs (12 pages)

This chapter will be divided into two sections: the first will summarize existing observational evidence of intercontinental transport and the second will discuss current observational capabilities and future needs.

The first section will discuss existing observational evidence for or estimates of HTAP trends or events. The review will address source apportionment analyses based on surface observations from different regions, as well as evidence from satellites and field campaigns. It will address evidence from observations of pollutants of interest as well as concentrations of long-lived species such as CFCs, HCFCs, SF₆, etc.

Specific questions of interest to the TF (from Annex I) that may be addressed include:

1.1 What evidence do we have of transport pathways and mechanisms from intensive field studies? From observations? ...

2.1 What observational evidence exists for attributing pollutant concentrations or deposition levels to source regions or countries?

The second section will review the adequacy of current capabilities to observe intercontinental transport, including surface networks, remote sites, vertical soundings, aircraft, satellites, etc. It will address the representativeness or adequacy of existing monitoring data for characterizing intercontinental transport across the Northern Hemisphere and identify future needs. It will discuss the coordination and interoperability of ongoing, systematic observations and of periodic, intensive field studies and the differences in the coordination and quality assurance efforts needed in each of these activities. It will draw upon the work of EMEP CCC, WMO GAW, and the IGACO strategy, and will address outreach to regions beyond the LRTAP Convention. The section will also address how observations can inform the estimation of emissions inventories and the evaluation of models.

Specific questions of interest to the TF (from Annex I) that may be addressed include:

3.2 Do we have a sufficient database of observed concentrations and deposition levels to evaluate the predictions of current models? How can this observational

database be improved for the purposes of evaluating models? Should we develop a set of standard observational platforms and measurements to enhance data consistency globally?

3.3 Do we have sufficient observational data bases to track long term progress and change in transport and deposition patterns?

4. Emissions Inventories and Projections (6 pages)

This chapter will examine available emission inventories and projections for assessing HTAP and will include a critical discussion of uncertainties. The chapter will draw upon information from ACCENT, GEIA, JRC (EDGAR), TFEIP and other efforts. This chapter should include a discussion of how observations and models can be used to better inform emissions estimates, and vice versa.

Specific questions of interest to the TF (from Annex I) that may be addressed include:

3.4 Do we have sufficient data on emissions and the trends in driving forces needed for making reasonable future projections? How can this data be improved?

5.1 How might emission quantities and spatial distributions change over the next 20 to 50 years?

5.2 How should future emission scenarios be constructed?

6.3 Are there significant feedbacks between transported air pollution and potential changes in land use, vegetation, or ecosystems, especially with respect to natural emission sources?

5. Estimates of Intercontinental Transport from Global and Regional Models (12 pages)

This section will review available global and regional models (both Eulerian and Lagrangian) and estimates of intercontinental source-receptor relationships developed using these models. It should discuss how modelling will evolve in the next 10 years as numerical weather prediction models begin to assimilate ozone, aerosols and precursors. The associated demands for real-time observations should be addressed here and in Chapter 3. The section should include a discussion of model evaluation, past model intercomparisons, and review methods for estimating source-receptor relationships. Results from the model intercomparison work being organized under the TF HTAP should be reported here.

Specific questions of interest to the TF (from Annex I) that may be addressed include:

1.1 What evidence do we have of transport pathways and mechanisms from ...model predictions?

2.2 Using predictive chemical transport models, what are possible methods for calculating source-receptor relationships? At what spatial resolution (geographic region, individual countries) can such methods be applied reasonably?

2.3 How can models with different spatial resolutions be nested within one another to provide an appropriate level of spatial resolution for the entire hemisphere or globe?

- 2.4 What improvements are needed to global and regional transport models to better simulate atmospheric processes to enhance source-receptor predictions?
3. How confident are we of our ability to predict these source-receptor relationships? What is our best estimate of the quantitative uncertainty in our estimates of current source contributions or our predictions of the impacts of future emissions changes?
- 3.1 What metrics and techniques are most appropriate for evaluating global and regional model simulations with observations and for quantifying uncertainties?
- 3.5 What physical or chemical processes must be better understood to improve our confidence in our estimates of source-receptor relationships? What is the minimum level of certainty in our understanding of these processes that must be attained before reasonable/useful estimates can be made?
- 4.1 Is there a simple relationship between changes in emissions and changes in pollutant concentrations and deposition levels?
- 4.2 How is the predicted relationship affected by the spatial resolution of the model?
5. How will these source-receptor relationships change due to expected changes in emissions over the next 20 to 50 years?
- 6.4 Are there predictive relationships between climate system indices that can be used to estimate the impact of changing climates on hemispheric transport of air pollutants?

6. Activities of the TF (3 pages)

(perhaps as an annex)

7. Conclusions and Recommendations

This chapter will be written after the completion of the other chapters. It will consist of three main sections: a) a summary of the state of understanding of key processes and linkages to other scales, b) a synthesis of estimates of transport magnitude from the Observations and Modeling chapters, and c) a synthesis of recommendations for future research from each chapter.

The Process

The drafting of the 2007 report would have to build on a rather small drafting team of leading authors and supported by some additional experts. The lead authors would be identified and "decided" at the TF meeting 2006. Hence it has to be on the Agenda for the 2006 meeting as well. Further amendments of interested experts could be made at a later stage. A full draft should be completed by April 2007 to be circulated and discussed at the annual spring meeting of the TF HTAP. The draft will then be fed into the fall EMEP SB meeting and EB annual meeting. In principle, the TF would seek consensus agreement on the executive summary to be submitted to the main report of the Gothenburg Protocol review.

To achieve this goal, the schedule looks like:

June 2006	List of Lead Authors
October 2006	Emissions Workshop (opportunity for some discussion)
November 2006	Outline of Chapters submitted to WGSR?
January 2007	Observations Workshop (opportunity for some discussion)
March 2007	Drafts of Chapters to due to Co-Chairs
April 2007	Full Draft circulated to TF
June 2007	Full Draft discussed by TF
September 2007	Full Draft submitted to EMEP SB and Exec Sum to WGSR
December 2007	Full Draft and Exec Sum submitted to EB

The Lead Authors

Chapter	Possible Lead Authors	Possible Supporting Authors
Exec Summary	Terry Keating André Zuber	All Lead Authors
Introduction	Terry Keating André Zuber	
Assessing Transport Processes (Conceptual Description)		
Observational Evidence, Capabilities, and Needs		
Emissions Inventories and Projections		
Estimates from Global and Regional Models		
Activities of TF	André Zuber Terry Keating	
Conclusions and Recommendations	André Zuber Terry Keating	All Lead Authors

Annex I

TF HTAP Policy-Relevant Science Questions

1. How does the intercontinental or hemispheric transport of air pollutants affect air pollution concentration or deposition levels in the Northern Hemisphere for ozone and its precursors; fine particles and their precursors; compounds that contribute to acidification and eutrophication; mercury; and persistent organic pollutants?
 - 1.1. What evidence do we have of transport pathways and mechanisms from intensive field studies? From observations? From model predictions?
 - 1.2. How do the transport pathways differ by pollutant? By source region? By season?
 - 1.3. What processes need to be better understood to describe the relative significance of intercontinental transport?
 - 1.4. How do processes at the intercontinental or hemispheric scale affect processes at the local or global scales? (Synoptic scale meteorological events/cycles; Hadley circulation; etc.)

2. More specifically, for each region in the Northern Hemisphere, can we define source-receptor relationships and the influence of intercontinental transport on the exceedance of established standards or policy objectives for the pollutants of interest?
 - 2.1. What observational evidence exists for attributing pollutant concentrations or deposition levels to source regions or countries?
 - 2.2. Using predictive chemical transport models, what are possible methods for calculating source-receptor relationships? At what spatial resolution (geographic region, individual countries) can such methods be applied reasonably?
 - 2.3. How can models with different spatial resolutions be nested within one another to provide an appropriate level of spatial resolution for the entire hemisphere or globe?
 - 2.4. What improvements are needed to global and regional transport models to better simulate atmospheric processes to enhance source-receptor predictions?

3. How confident are we of our ability to predict these source-receptor relationships? What is our best estimate of the quantitative uncertainty in our estimates of current source contributions or our predictions of the impacts of future emissions changes?
 - 3.1. What metrics and techniques are most appropriate for evaluating global and regional model simulations with observations and for quantifying uncertainties?
 - 3.2. Do we have a sufficient database of observed concentrations and deposition levels to evaluate the predictions of current models? How can this observational database be improved for the purposes of evaluating models? Should we develop a set of standard observational platforms and measurements to enhance data consistency globally?
 - 3.3. Do we have sufficient observational data bases to track long term progress and change in transport and deposition patterns?
 - 3.4. Do we have sufficient data on emissions and the trends in driving forces needed for making reasonable future projections? How can this data be improved?

- 3.5. What physical or chemical processes must be better understood to improve our confidence in our estimates of source-receptor relationships? What is the minimum level of certainty in our understanding of these processes that must be attained before reasonable/useful estimates can be made?
4. For each country in the Northern Hemisphere, how will changes in emissions in each of the other countries in the Northern Hemisphere change pollutant concentrations or deposition levels and the exceedance of established standards or policy objectives for the pollutants of interest?
 - 4.1. Is there a simple relationship between changes in emissions and changes in pollutant concentrations and deposition levels?
 - 4.2. How is the predicted relationship affected by the spatial resolution of the model?
5. How will these source-receptor relationships change due to expected changes in emissions over the next 20 to 50 years?
 - 5.1. How might emission quantities and spatial distributions change over the next 20 to 50 years?
 - 5.2. How should future emission scenarios be constructed?
6. How will these source-receptor relationships be affected by changes in climate or climate variability?
 - 6.1. How will meteorological changes predicted by climate modeling studies affect major transport or chemical processes?
 - 6.2. Are there significant feedbacks between the transported air pollutants and regional climate and meteorology?
 - 6.3. Are there significant feedbacks between transported air pollution and potential changes in land use, vegetation, or ecosystems, especially with respect to natural emission sources?
 - 6.4. Are there predictive relationships between climate system indices that can be used to estimate the impact of changing climates on hemispheric transport of air pollutants?
7. What efforts need to be undertaken to develop an integrated system of observational data sources and predictive models that address the questions above and leverages the best attributes of all components?