

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 Steering Body for adoption and communicated to the CLRTAP Executive Body. The reports will be published in the UNECE series for traceability and transparency.

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 (1 page)

This summary will be drafted as the Task Force's contribution to the main report of the Gothenburg protocol review. The 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 "understanding the hemispheric transport of air pollutants" and "quantify the transcontinental influence." The conclusion should not be binding the work to be performed for the 2009 assessment. The authors will attempt to summarize the consensus view as to whether 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.

1. Introduction (1-2 pages)

This very brief chapter will introduce the Task Force in the context of LRTAP Convention and the purpose and organization of the interim report.

2. Conceptual Overview of Hemispheric or Intercontinental Transport Processes (6 pages)

This chapter will introduce the issue of hemispheric or intercontinental transport and the approaches to assess intercontinental impacts 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 affecting intercontinental transport events and changes in hemispheric background concentrations for 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 Task Force (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. Observational Evidence & Capabilities Related to Hemispheric or Intercontinental Transport (12 pages)

This chapter will be divided into three sections addressing: long-term monitoring programs, intensive field studies, and satellite observations. Each section will summarize existing observational evidence of intercontinental transport events and changes in hemispheric background concentrations, current observational capabilities, and future needs. It will address evidence from observations of pollutants of interest as well as concentrations of long-lived species such as CFCs, HCFCs, SF₆, etc. It will address the representativeness or adequacy of existing monitoring data for characterizing intercontinental transport across the Northern Hemisphere and changes in the hemispheric loadings and identify future needs. 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.

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?

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 for Assessing Hemispheric or Intercontinental Transport (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, EDGAR, TFEIP and other efforts.

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 Hemispheric or Intercontinental Transport from Global, Hemispheric, and Regional Models (12 pages)

This chapter will review available global and regional models (both Eulerian and Lagrangian) and estimates of intercontinental source-receptor relationships developed using these models. It will be divided into three main subsections: a) methods for diagnosing or quantifying hemispheric or intercontinental transport, b) estimates of transport of ozone and its precursors, and c) estimates of transport of aerosols and their precursors. The chapter 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 6. 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. Integration of Observations, Modeling, and Emissions for Assessing Hemispheric or Intercontinental Transport

This chapter will discuss the need to integrate information from observations, models, and emissions inventories to better understand intercontinental transport. 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 address the integration and interoperability of observations and modeling information and the use of observations to evaluate model estimates and inform the development of emissions inventories.

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

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?

7. Activities of the Task Force (3 pages)

This brief chapter, which may be included as an annex, will summarize the completed, ongoing, and future activities of the Task Force.

8. Conclusions and Recommendations

This chapter will be written after the completion of the other chapters. It will comprise the body of the official report to the EMEP Steering Body. 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 (3) and Modeling (5) chapters, and c) a synthesis of recommendations for future research from each chapter.

The Process

The overall outline for the report was discussed and accepted by the Task Force at its June 2006 meeting. A call for nominations to a roster of potential authors was sent out in July. Based on this roster, the Task Force Co-chairs have prepared the list of proposed coordinating lead authors and lead authors provided in Annex II.

The coordinating lead authors will have the main responsibility for drafting the 2007 report. The lead authors will be asked by the coordinating lead authors to provide contributions to and review of the relevant chapter or section. The coordinating lead authors may also solicit contributions from others in the scientific community as appropriate. To the extent possible, outlines and drafts will be posted on the task force website for comment by the Task Force and broader community at different stages.

All coordination will be conducted via email and side discussions at the October and January workshops. At this time, we do not have a plan for a face-to-face meeting of the authors. However, if one is necessary, it is likely to be scheduled for February or March 2007.

A full draft of the report should be completed by April 2007 to be circulated and discussed at the annual spring meeting of the TF HTAP (30 May – 1 June 2007). The draft will then be fed into the fall EMEP Steering Body meeting and Executive Body annual meeting. In principle, the Task Force will seek consensus agreement on the executive summary to be submitted to the main report of the Gothenburg Protocol review.

The proposed coordinating lead authors and lead authors are now being contacted and invited to participate. If they accept their proposed role, they will be asked to submit an annotated outline of their chapter or section by 10 November 2006.

The future milestones in the process are as follows:

27 September	Invitation to coordinating lead authors and lead authors
13 October	Acceptance by coordinating lead authors and lead authors
18-20 October	Emissions Workshop (Beijing)
10 November	Annotated outlines of chapters/sections due to TF Co-Chairs to be posted on www.htap.org for comments
30 November	Annotated outline submitted to Working Group on Strategies and Review
24-26 January	Observations Workshop (Geneva). First draft of chapters 1 to 6 posted on www.htap.org for comments
1 March 2007	Redrafted chapters due to Co-Chairs of the Task Force
16 April 2007	Full draft circulated to the Task Force
30 May – June 1	3rd Task Force Meeting (London). Full draft discussed and executive summary adopted by Task Force
15 June	Full revised draft submitted for translation for the EMEP Steering Body and executive summary for the WGSR (September 2007)
October 2007	Full draft and executive summary submitted to Executive Body (December 2007)

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?

Annex II

Proposed List of Authors for 2007 TF HTAP Interim Report

Chapter	Coordinating Lead Authors	Lead Authors
0. Executive Summary	Terry Keating André Zuber	
1. Introduction	Terry Keating André Zuber	
2. Conceptual Overview	Owen Cooper Andreas Stohl	Ruth Doherty, Peringe Grennfelt
3. Observations	Hajime Akimoto David Parrish	
a. Surface Networks	Kjetil Torseth Joe Prospero	Shiro Hatakeyama, Rich Scheffe
b. Field Campaigns	Dan Jaffe Stuart Penkett	Russ Dickerson, Mat Evans
c. Satellite Observations	David Edwards Randall Martin	Lorraine Remer, Tony Hollingsworth, Ulrich Platt, John Burrows
4. Emissions & Projections	David Streets Zig Klimont	He Kebin, Toshimasa Ohara, John van Aardenne, Kristin Rypdal, Syed Shoaib Raza
5. Regional, Hemispheric, & Global Modeling	Frank Dentener Greg Carmichael	
a. Methods for Diagnosing or Quantifying Transport	Dick Derwent Michael Prather	Martin Schultz, Qinbin Li
b. Ozone	Arlene Fiore Oliver Wild	Hiroshi Tanimoto, Don Wuebbles, Carey Jang
c. Aerosols	Michael Schulz Rokjin Park	Peter Hess, Isabelle Bey, Dorothy Koch
6. Integration of Observations, Modeling, and Emissions Information	Len Barrie Daniel Jacob	Oystein Hov, Rudy Husar, Brendan Kelly, Jill Engel-Cox
7. Activities of the Task Force	Terry Keating André Zuber	
8. Synthesis, Conclusions, and Recommendations	Terry Keating André Zuber	All Coordinating Lead Authors