Sonja Vidic (Chair, EMEP Steering Body)

Cc: EMEP SB Extended Bureau

Subject: Advice from TF HTAP on future O_3 boundary conditions to be used in EMEP and GAINS model simulations.

Ispra, Washington, 26.10.2012

This letter is in response to a request to the co-chairs of the Task Force Hemispheric Transport Air Pollution (TF HTAP) regarding advice on the ozone (O_3) boundary conditions to be assumed for the new GAINS source-receptor relationships. These boundary conditions are to be included in the EMEP model and transferred to the GAINS model. Time periods to be considered are 2020-2030 (central year 2025) and the 2040-2050 (central year 2045) time periods, and are to be compared to the conditions representative for the period 2000-2010 (central year 2005).

We base our advice on an extended analysis of results obtained from a wide range of models and published in the TF HTAP 2010 assessment report. An extended analysis of the results is currently being finalized and will be submitted to the journal Atmospheric Chemistry and Physics (O. Wild et al, in preparation, 2012). The analysis in this latter work forms the basis of our reply, and considers a spatially explicit parameterization using an ensemble of 14 global model results. This ensemble is used to estimate O_3 changes due to anthropogenic emissions based on a range of global scenarios published recently in various scientific assessments. From this analysis the following recommendations are made:

The modeling frameworks should assume:

1) 3 cases for boundary conditions, high-median-low, representing a range of possible future O_3 scenarios and corresponding to a range of peer reviewed emissions scenarios.
2) The boundary conditions, derived from HTAP models, assume changes in global anthropogenic emissions of NO_x, VOCs, and CO as well as changes in global methane concentrations. They are based on keeping EU emissions constant, thus allowing extraction of changes due to 'external' conditions.
3) It is sufficient to parameterize O_3 changes across Europe's western boundaries using Mace Head annual average concentration changes.
4) The central (median) case, corresponding to an approximate zero ppbv O_3 change, should be the basis of a reference simulation and a full set of source-receptor calculations.
5) Analysis of past O_3 records suggests that a number of factors may be contributing to O_3 changes making it important to cover a range of possible boundary conditions. The recommended low and high O_3 change cases correspond to clusters of global anthropogenic emission scenarios. Climate model results suggest several feedback processes that may increase or decrease O_3 boundary conditions. Although not explicitly considered by the HTAP recommendations, the high and low cases may also encompass to some extent the range of possible changes in O_3 at the boundaries that are due to unaccounted anthropogenic emissions and/or other factors such as climate change or natural variability. We recommend that the low and high boundary conditions are included as sensitivity studies to provide alternative reference simulations. It is not necessary to perform a full set of source-receptor simulations on top of these reference simulations.

The assumptions behind these recommendations will be discussed more comprehensively in the paper by Wild et al. (ACP, 2012, in preparation).

The following table gives the perturbation of annual ozone boundary conditions (ppb) compared to 2005, to be used in the model calculations. The ozone perturbations are rounded to integer numbers,

and reflect approximate low-median-high cases, but not necessarily the maxima or minima over all analyzed scenarios.

	Annual **2020-2030**	Annual **2040-2050**
low	-1	-3
median	0	0
high	3	5

With kind regards,

Terry Keating
Frank Dentener
Co-chairs Task Force Hemispheric Transport of Air Pollution.