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Atmospheric Chemistry and Physics Discussions

Interactive comment on "GEM/POPs: a global 3-D dynamic model for semi-volatile persistent organic pollutants – 1. Model description and evaluations" *by* S. L. Gong et al.

Anonymous Referee #1

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The paper submitted by Gong and coauthors is rather important and represents essential contribution to further understanding of POP global distribution in the environment. The modeling tool GEM/POPs presented in the paper comprises important features that create possibilities to investigate global atmospheric transport of semi-volatile POPs such as PCBs in more details. In particular, the most significant features can be the integration of online meteorological model, atmospheric chemistry modeling, and aerosol dynamic in one modeling system. In this respect this modeling tool provides unique features and makes it possible to study the role of atmospheric particles in atmospheric transport of POPs and their removal from the atmosphere. The application of this model to the evaluation of global dispersion and fate of POPs for which

global information of emission is (or will be) available will be very interesting.

In general the paper is rather well structured providing short but informative model description, input requirements of the modeling system, and results of simulations and their evaluation. What is missing is the conclusions section, however, may be it will be added later in the second paper which is mentioned to follow this one.

Specific comments

The introduction stated that early POP box models failed to yield the detailed spatial and temporal distribution of particular POPs. Seems to be this is too strong and should be rephrased to reflect that they were developed to investigate processes and fate of POPs in general, without the aim to obtained detailed spatial and temporal information. I would not say this is a limitation in this respect.

The section 4.3 is discussing the impact of aerosols describing the spatial distribution of the simulated fraction of PCB particulate phase to the gaseous one. In particular, for PCB180 the ratio is almost 100. It is stated that observations have also shown similar pattern of distribution. However, in next several sentences it is written that the range of this ratio for PCB180 is 0.06-4.17 and observations themselves are characterized as rather uncertain (particle phase concentrations are extremely low, see 3406 line 21). It would be reasonable to make this part of the description in a more clear way.

It would be useful if evaluation of modeling results would include some statistics (for instance, comparison of mean annual computed and observed concentrations) and thus would complement the ‘reasonably simulated’ with something like ‘differences are within a factor of 2, 3, or more’ or regression plots where it can be seen that the model underestimated or overestimate measured concentrations.

Some minor comments

It might be useful to add some information on physical-chemical properties of selected PCBs used in model parameterization (may be to add it as a table).

ACPD

7, S1088–S1090, 2007

Page 3400, lines 14-15: references to dynamical 3D models are given, however next paragraph adds one more model reference (Gusev et al., 2005). Does it differ from them significantly as it was not mentioned between them?

Page 3401, line 11: it is written that NO3 radicals and O3 can also play significant role in the process of POP degradation in the atmosphere. However, there is no any information in the section 2.2.1 if they are included in the model or not.

Page 3403, lines 1-7: The soil module of GEM/POPs has three layers (1cm, 3cm, and 7 cm). Is the profile of POP concentrations in the upper 1 cm layer taken into account? Some papers mentioned that the upper thin soil layer can play very significant role in the exchange of POPs between the atmosphere and soil.

Page 3404, line 11-21; it is not rather clear what is the spatial resolution (vertical and horizontal) in the ocean transport module. It might be good to supply reference to the lake module where the reader can find its description.

Page 3406, lines 3-4: it is written that GEM/POPs combines modeling and observed data on soil concentrations of PCBs, what was the methodology for combining/assimilation? Was it done also for seawater concentrations?

Page 3407, line 25: it is written that modeling results show a good agreement of the magnitudes of three PCBs. It seems that this paragraph is devoted to the Arctic site Alert. At the same time in the figure only simulated PCB28 is shown for the Alert site.

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7, S1088–S1090, 2007

Interactive Comment