

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.

S. L. Gong et al.

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We would like to thank the reviewer for the detailed review of our manuscript which gives us the opportunity to clarify some points. In the following we quoted each review question in the square brackets and added our response after each paragraph.

Corrections/clarifications

[The latter part of the title should be altered to: “1. Model description and evaluation of air concentrations”, as currently only the air concentrations are evaluated and not the deposition or exchange fluxes as presented in the model description.]

Done.

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[It is not clear whether the emission data utilised in the GEM/POPs model and described in section 3.2, refer solely to emissions to the atmosphere or emissions to other media (i.e water).]

The emissions data was all for the emissions to the atmosphere.

[This is a global model, yet most of the focus is on the Northern Hemisphere. While this is OK, given that the paper evaluates model data against observed data from the Northern Hemisphere, Figure 1 (soil concentrations) should be extended to represent the globe (akin to Fig. 5)]

We did not extend the figure to the globe for two reasons: (1) the initial soil concentration data from MSC-East model were only for the Northern Hemisphere and (2) the soil observation data were also mostly for the NH.

[Table 1 presents soil concentrations from China. Where do these data come from re: reference? Furthermore, these numbers are also very precise (thousandth of a ng!). Is this correct/necessary?]

The PCB data from China were analyzed by our own laboratory (Tom Harner's group) at Environment Canada. We agree with the comment on the precision of the measurements and have changed the data accordingly.

[Section 4.1 What do the authors mean when they state that only gaseous PCBs were statistically significant in the comparisons between modelled and observed data at Alert? I suspect that the observed particle-bound concentrations are below method detection limits or are too erratic to allow for a meaningful comparison to the modeled results. Could the authors clarify this statement re: statistical significance?]

Since the particle-bound PCB concentrations are usually below method detection limits, the usable number of observations is very low so that we stated that “only gaseous PCBs were statistically significant in the comparisons”. However, we agree with the comments made by the reviewer and have changed the sentence to the following:

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“Since the observed particle-bound concentrations are usually below method detection limits or too erratic to allow for a meaningful comparison to the modeled results, only gaseous PCBs were utilized for the study.”

Discussion points:

[Figure 3 is very useful and highlights similarities/differences between modelled and observed data and also provides information on the seasonal profile for three PCB congeners. In general, the model performs well and reflects the seasonal profile observed at these sites. However, there are some notable exceptions, namely Rorvik and Alert (PCB-28 in particular). At Rorvik, the atmospheric profile is almost the exact opposite to that modelled at Alert, with a notable decrease in concentrations during the summer months. Indeed, Rorvik appears to be the only site that shows this behaviour. Is this also the case for other sites at 50–60°N in the model domain and what features within the model result in this profile, which is neither modelled or observed further south (i.e. IADN sites) or further north (i.e. Arctic sites)?]

This is a very interesting question. We have checked the other sites from our model that are close to Rorvik and found the same trend of lower PCB28 summer concentrations. If we look closely to the Figure 3a, it can be found that even for the observation data of year 2000, there are also lower concentrations of PCB28 for July, August and September. Furthermore, the observations at Stórhöfði of Iceland also showed lower PCB28 concentrations from July to November of 2000. There is one thing common to these sites: they are all coastal sites. We speculate that the seasonal variations of the oceanic concentrations of PCB28 and the sea-surface temperature may play a role in the these features that were not observed or simulated in other locations.

[The authors may want to consider evaluating their modelled PCB air data against the air concentrations derived from passive samplers that have been deployed at numerous sites around the globe. The authors should examine recent papers by Pozo, Harner et al.]

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We understand the importance and values of the passive sampling network for POPs. For the reasons stated below, we are not using the passive data for this model evaluation. This is what we have added in the paper:

“There are two types of monitoring data sets for global PCB distributions that are obtained from active and passive samplers, respectively. Active measurements use a high volume sampler that takes air through a filter. POPs’ concentrations are then analyzed from the deposits on the filter. This type of technique has been used in a number of international, long-term monitoring programs such as NCP (Northern Contaminant Program), EMEP (Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air pollutants in Europe) and IADN (the Integrated Atmospheric Deposition Network). Trends and spatial distributions have been obtained from these sites. Recently, passive air sampler types have been developed and used in air monitoring of POPs (Harner et al., 2006). These samplers are small and relatively inexpensive and simple to deploy. Initial data set has been used to evaluate some modeling results (Shen et al., 2006). However, due the nature of the passive sampling, longer sampling time is needed than the active samplers and consequently temporal resolution of the data is rather coarse, i.e. one data per 2 to 7 months. Most of the data from the passive sampling network were not available before 2004. Since this study was focused on year 2000, only data from the active sampling networks were used to compare with the modeling results.”

Minor corrections

[P3399, Line 5: into a few climate zones] Done

[P3399, line 9: have been proven] Done

[Equation 10: Font size of ‘Cp’ needs increasing (numerator on right hand side)] Done

[P3406: 3.2 Metrological data) Corrected to “Meteorological”

[P3409, line 23 simulated atmosphere PCBs] Corrected to “simulated atmospheric

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PCBs”

[Line 25 reflects that the ability]

Changed to “This illustrates that the ability of the GEM/POPs to address the relative importance of various congeners in the atmosphere is rather robust.”

[P3410 line 14: easily be engaged]

Changed to “The transport and deposition processes are governed by the principles of gaseous molecules, which makes them easily engaged in long range transport.”

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 3397, 2007.

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