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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 – Part 2: Global transports and budgets of PCBs" *by* P. Huang et al.

Anonymous Referee #1

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General comment

The manuscript submitted by Huang and co-workers presents and discusses the output of a global 3-D model as applied for selected PCBs in year 2000. It forms the 2nd part of an accompanying study, for which the first paper details the model description, parameterisation and evaluation against observed air concentrations. Obviously, if a model has been shown to accurately represent the observed fate of specific pollutants, it may become a useful tool to understand processes for which are not easily understood from measurements alone. Thus, the key aim of the 2nd study is to apply the GEM/POPs model to evaluate key atmospheric pathways of three different PCBs on a

global scale. In principle, the study may deserve to be published, because it discusses the global atmospheric behaviour of selected PCBs in greater detail than related efforts carried out in the past. However, given the large uncertainties in emission data and process descriptions (e.g. air-soil exchange) used to drive the GEMP/POPs model I think there is an urgent need to critically compare and contrast the actual model predictions with relevant findings from complementary studies that are available in the literature. Secondly, I miss a section that discusses the wider implications of the model results, notably in the context of current and future monitoring strategies as detailed below.

Specific concerns

As indicated above, I miss a critical comparison of predicted model outputs with related studies that have been carried out in the past. Specifically, it is my opinion that the paper has a limited recognition of valuable studies that could and should have been used to evaluate model predictions (beyond the model evaluation detailed in the first paper). The authors are thus kindly requested to discuss and evaluate their findings of the 2nd paper on the basis of the following studies: a) Global soil data: Meijer et al 2003 Environ Sci Technol 37: 667-672. b) Dry and wet deposition estimates to the global oceans: Jurado et al. 2004 Environ Sci Technol 38: 5505-5513 and Jurado et al 2005 Environ Sci Technol 39: 2426-2435, respectively. The authors are furthermore encouraged to look out for additional studies that may provide additional information of relevance. For example, the model results suggest that re-emission from soils is a significant source of PCB-28 into the air on a global scale. However, there has been a debate in the scientific literature on the relative importance of primary and secondary sources in controlling contemporary atmospheric levels of PCBs for more than a decade with obvious implications for control strategies (see e.g. Harrad et al 2004 Env Pollut 85:131-146, Jaward et al. 2004 Environ Sci Technol 38:34-41; Hung et al. 2005 Atmos Environ 39:6502-6512). According to Meijer et al 2003, the global surface soil burden of PCB-28 is estimated to be 190 tonnes, whereas the GEM/POPs model predicts that the annual net (re-)emission of PCB-28 from soil should be approximately

ACPD
7, S660–S663, 2007

EGU

41 tonnes (Table 1). Thus, please elaborate and discuss potential implications of the model outputs in the context of other studies with respect to this specific example and beyond.

Given the high temporal and spatial resolution of model outputs, I think it would be nice if the authors could offer some brief thoughts regarding current and future air monitoring strategies. For example, current air monitoring strategies under the Stockholm Convention of POPs seems to advocate for the use of passive air sampling devices (which captures mainly the gaseous fraction). Indeed, studies aiming to support the work under the convention have already been published (e.g. Pozo et al. 2006 Environ Sci Technol 40: 4867-4873). Relevant questions to be discussed in the context of critical knowledge/monitoring gaps could be: Is it feasible to use data from GAPS and related efforts to evaluate predicted spatial patterns? Will a passive air sampling approach be sufficient to evaluate model predictions, or is there a need for alternative monitoring strategies or targeted sampling campaigns? Are there regions for which there may be specific needs for further measurements (given the model outputs)?

Minor issues

Page 3838, line 25: What is meant by “insoluble”?

Page 3839, line 7: It is somehow misleading to cite an old paper dealing with HCHs, when PCBs have been studied as well using global non-steady state multimedia fate models. See Wania and Daly, 2002 Atmos Environ 36:5581-5593; Wania and Su YS, 2004. Ambio 33: 161-168. Macleod et al 2005. Environ Sci Technol 39: 6749-6756 and Hung et al. 2005 Atmos Environ 39:6502-6512.

Page 3840, line 4: A verb is missing at end of line. This paper is (devoted?) toĚ?

Page 3840, line 6: Please be more explicit or rephrase what is meant by “current PCBs”?

Page 3844, line 8: Please add latitude of Arctic Circle at first mention and not on line

ACPD
7, S660–S663, 2007

EGU

19. Besides, I thought the Arctic Circle was found at 66.33 N and not 66.50 N?

3846, line 7: favourable conditions (not favourite)?

Page 3849, lines 1-10 and last sentence of abstract: The finding that long-range transport of PCB-28 is limited by OH-radical degradation and heavier PCBs by atmospheric deposition has been recognised previously (e.g. Wania and Daly, 2002 Atmos Environ 36:5581-5593).

Page 3849, lines 12-13: Please rephrase sentence starting with “The areaĚ” (to many “as”). I assume it would be OK if “as” is deleted in front of “half” and “twice”.

Page 3849, line 20: What is meant by “More features”?

Reference list: Ref Gong et al. JGR is given with year 4007.

Figure 3: Inner figure presents PCB-28 as PCB028.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 3837, 2007.