Atmos. Chem. Phys. Discuss., 5, S5490–S5494, 2005
www.atmos-chem-phys.org/acpd/5/S5490/
European Geosciences Union

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impact of the regional climate and substance properties on the fate and atmospheric long-range transport of persistent organic pollutants – examples of DDT and γ-HCH" *by* V. S. Semeena et al.

Anonymous Referee #1

Received and published: 13 February 2006

The here presented paper describes the applicability of a new global distribution model for selected persistent organic pollutants (POPs). Special attention was paid to the distribution and fate of two types of insecticides; a-hexachlorocyclohexane (a-HCH, lindane) and p,p'-dichlorodiphenyltrichloroethane (DDT). The model is described as a combination of previously developed modules based upon the Atmospheric General Circulation Model (AGCM) and has been applied for scenario evaluation of earlier release events through application as insecticide in Asian regions and its consequences

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for global transport and fate of DDT and Lindane.

General comments

The here described model approach is one of the most comprehensive atmospheric circulation models available so far. Many earlier models lack a sufficient scientific implementation of temperature related processes influencing circulation and distribution of airborne anthropogenic contaminants. However, the general approach describing temperature influences through adsorption on particles (θ doubles per 4.9K for PAHs according to *Pankow* 1991) is very general and is not sufficiently describing temperature influences for DDT and a-HCH. Based upon general chemical modeling (structure activity relationship calculation), individual temperature dependence for single POPs can be calculated. The authors are advised to check whether available chemical modeling can add valuable information on the environmental behavior of the target chemicals.

Although general parameters describing microbiological transformation are included for the ocean compartment (page 12580), it is stated that the chemical transformation in the atmosphere is exclusively governed through OH-radical reactions. However, there are many other photochemical and catalytical reactions possible and also shown in atmospheric chemistry. Catalytic reactions on surfaces are especially important when particulate matter is involved. Reactions on surfaces will enhance photochemical accessibility. Particulate matter can serve as catalyst for atmospheric photochemical reactions. However, how to implement these compound selective processes into such a comprehensive model approach is not a trivial task.

However, as in many available model approaches, the role of particulate matter in atmospheric transport and fate of persistent organic pollutants is described as a static parameter (based upon the *Junge-Pankow* equation which is already an considerable progress compared to earlier approaches). However, taken into account the dynamic of particle formation and aging including seasonality, aerosol formation over the oceans,

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secondary particles, conglomerates, mixed particles etc. It is suggested to implement, in a later version, a more complex module on particle formation and characterization, which also influences transformation and degradation during the atmospheric transport.

In order to allow the interested reader to appreciate the high quality of the here presented model approach, a more pronounced “quality control” paragraph in the manuscript.

In this chapter, the chosen model approach should be discussed and compared with other available models like the EMEP models and other CTM approaches. A more comprehensive comparison with empirical data available should be implemented

The model approach presented here is a highly advanced and comprehensive model and, thus, well suited for a scenario assessment used in the here presented study in order to assess the global distribution properties of legacy POPs like Lindane and DDT.

Questions to be addressed:

1) Does the paper address relevant scientific questions within the scope of ACP?

The manuscript is highly relevant and the topics addressed are within the scope of ACP

2) Does the paper present novel concepts, ideas, tools, or data?

Although the model is based upon previously described concepts, the here described approach is a clear progress compared to earlier models. Thus, the paper describes advanced concepts and tools important for environmental scenario assessment.

3) Are substantial conclusions reached?

The concept of the publication is based upon model assessment. As a general conclusion of the study is could be shown that the model is appropriate for transport and fate evaluation of airborne persistent pollutants.

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4) Are the scientific methods and assumptions valid and clearly outlined?

The scientific methods used are scientifically valid and completely presented.

5) Are the results sufficient to support the interpretations and conclusions?

Although only marginal quality control is presented in the paper, it is assumed that the data interpretation and conclusions are based upon a well-validated atmospheric transport and fate model.

6) Is the description of experiments and calculations sufficiently complete and

precise to allow their reproduction by fellow scientists (traceability of results)?

No empirical experiments have been performed. However, the model is based upon empirically derived input data, which are scientifically validated, traceable and complete.

7) Do the authors give proper credit to related work and clearly indicate their

own new/original contribution?

The model described is based upon earlier versions documented and cited in the presented manuscript. In addition, theoretical background of the model approach is based

upon early meteorological theories developed by *Junge and Pankow*. Thus, all related work is given proper considerations and reference.

8) Does the title clearly reflect the contents of the paper?

The title is appropriate and reflects well the content of the manuscript.

9) Does the abstract provide a concise and complete summary?

The abstract provide a complete summary of the study.

10) Is the overall presentation well structured and clear?

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The manuscript is well structured and the clearly formulated.

11) Is the language fluent and precise?

The language is precise.

12) Are mathematical formulae, symbols, abbreviations, and units correctly

defined and used?

All formulas and equations are correctly listed and abbreviations are introduced immediately upon use in the manuscript

13) Should any parts of the paper (text, formulae, figures, tables) be clarified,

reduced, combined, or eliminated?

A more comprehensive paragraph on quality control measures as well as some comparison with other available models should be implemented (see general comments)

14) Are the number and quality of references appropriate?

The references are reflecting the state science in the research field

15) Is the amount and quality of supplementary material appropriate?

No supplementary information is provided

Overall recommendation:

The Manuscript is, thus, recommended for publication with minor revision.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 12569, 2005.