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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The EMEP MSC-W chemical transport model – Part 1: Model description" *by* D. Simpson et al.

Anonymous Referee #2

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The paper contains a relatively detailed description of the most recent version of the EMEP chemical transport model. It documents modeling choices made by the EMEP developers for the various components of the model; in some places there is some interesting discussion of the reasons for these choices, but in most cases there is just a list of the corresponding equations and formulations. A lot of the material presented can be found in previous papers, reports with descriptions and/or applications of the model but also in textbooks. There is little that is new here (no substantial new concepts, ideas, methods, or data) something that is obvious in the conclusions section.

I do understand the need to document the contents of a complex CTM for future reference. However, I believe that this could be accomplished in a few pages of supplementary material in the forthcoming EMEP evaluation paper using the references to

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previous work. This shorter description could be quite helpful for the reader too, because I had a hard time identifying the most recent changes in the model. Unfortunately there is little discussion of the effects that these changes had on the CTM predictions. A discussion of the effects (e.g., the sensitivity of the model to process descriptions) could be a lot more interesting for the readers than the current list of model contents.

Some detailed comments:

Sections that are quite long and could be shortened significantly using mainly references to previous include: meteorology, biogenic emissions (including dust and sea salt), gas and aqueous-phase chemistry, dry deposition, outputs,

The treatment of convection is a little confusing. Is it used during simulations over Europe or not? If it is not used why is it described?

There is little discussion of issues related to the aerosol size/composition distribution and processes that depend on particle size. Does the current EMEP model still use a two-mode approach describing just the fine and coarse PM? What is the effect of this simplification on its PM predictions?

The new EMEP model uses the MARS thermodynamics model. However, this does not treat sodium chloride and dust components. This should have a significant impact on fine and coarse PM predictions (e.g., partitioning of nitrate) in coastal areas and areas affected by dust. It is not clear how coarse nitrate is treated.

Despite the recent studies showing that POA is semi-volatile, the current version of the model treats it as non-volatile. This should lead to serious over-predictions of the POA in areas affected by primary anthropogenic emissions based on the available Aerosol Mass Spectrometer measurements.

There is little description of the aerosol-cloud interactions especially given the limited size resolution in the aerosol module. How is the initial cloud composition determined? What happens when a cloud evaporates? How is the effect of sea-salt and dust on the

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cloud pH taken into account?

The emission fluxes used are derived from annual emission estimates. The monthly and daily distributions of these emissions are quite important and should be included if possible in the supplementary material. Some summary information about the emissions (e.g., annual emissions) could be useful.

Summarizing, my recommendation is to shorten the paper considerably (to the point where it may become supplementary material to a future paper) relying on the references where appropriate. The focus should be on what is new in the model (something that is not clear now) and how these new additions affect the results. Some evaluation of these new pieces would be useful. The paper could use a discussion of the strengths and weaknesses of the model compared to the other available CTMs.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 3781, 2012.