Geosci. Model Dev. Discuss., 7, C429–C435, 2014
www.geosci-model-dev-discuss.net/7/C429/2014/

Geoscientific Model Development Discussions
Open Access

Interactive comment on "HEMCO v1.0: A versatile, ESMF-compliant component for calculating emissions in atmospheric models" *by* C. A. Keller et al.

C. A. Keller et al.

ckeller@seas.harvard.edu

Received and published: 28 April 2014

Response to Reviewer 2

We thank reviewer 2 for the comments and updated the manuscript accordingly. Please find below the detailed replies.

1.1) Table 1 lists all emission inventories readily available in HEMCO. Here species from different inventories are mixed. e.g. CO,NOx,SO2 from EDGAR, VOCs from RETRO, NH3 from GEIA. Using different species which originate from similar sources

from different inventories with different methodologies could lead to inconsistencies. While I think that it is reasonable to do so this issue needs to be discussed and the choices made need to be explained.

We added the following sentence to section 2.2: "[These files] correspond to the standard emission settings currently used in the GEOS-Chem chemical transport model" in order to clarify that the emission fields listed in Table 1 do not represent a new emission inventory but rather reflect the emissions setup currently used in the standard version of GEOS-Chem. The choice of these emission inventories have been discussed and validated in many publications, see e.g. Fairlie et al. (2010); Millet et al. (2010); van Donkelaar et al. (2006); Xiao et al. (2008); Yevich and Logan (2003).

1.2) Furthermore, it seems that the model is lacking a large fraction of PM2.5 (e.g. primary sulphate particles, primary nitrate particles, unspeciated primary particles). Is there a reason for this?

The listed emission fields correspond to the data used in GEOS-Chem. GEOS-Chem does not represent PM2.5 explicitly. Rather, PM2.5 is obtained through linear combination of 6 individual GEOS-Chem tracers, as described in detail under http://wiki.seas.harvard.edu/geos-chem/index.php/Particulate_matter_in_GEOS-Chem. When using HEMCO in models with other species definitions, it may be necessary to convert emission data accordingly and/or add species-specific emission data to the data library. This issue is addressed in more detail in section 2.1 of the revised manuscript.

1.3) It is not clear which particle fraction (PM2.5, PM10, or PMC) is covered by the inventory "Mineral dust aerosols" Zender et al., 2003 Please specify this.

GMDD
7, C429–C435, 2014

1.4) Please add the grid resolution of each dataset into the table

The horizontal resolutions of the base emission inventories are now given in Table 1, as are the dust size bins used by the dust extensions and the sea salt aerosol mode sizes.

2) In section 2.5 you write that the regridding method can only process datasets on a lat/lon grid. Yet, in table 1 you indicate that also EPA SMOKE data can be used as HEMCO input. As the SMOKE data is usually on a Lambert Conformal Conical Projection, how did you do the interpolation. Has this to be done externally (e.g. with the MAPL (Modeling Analysis and Prediction Program Layer) software toolkit)? If so you should indicate which projections can be interpolated by this software.

Data on Lambert Conformal grids (such as the EPA inventories) can directly be used in an ESMF environment since MAPL supports this grid type. This capability has not yet been implemented to the stand-alone version of HEMCO, and a regridded data set of the EPA emissions is used in this case. The horizontal resolutions of all base inventories are now added to Table 1 of the manuscript. We also added more details on the regridding capabilities of HEMCO (standalone and when coupled to ESMF) to sections 2.2. and 2.5.

3) Please adhere to the guidelines of GMD From the GMD homepage under "Manuscript Types" for Model Description papers: "All papers must include a section at the end of the paper entitled "Code availability". In this section, either instructions for obtaining the code (e.g. from a supplement or from a website) should be included, or a contact point should be given where the code can be obtained on request; or the reasons why the code is not available should be clearly stated."

GMDD
7, C429–C435, 2014

The webpage is given in the last sentence of the Conclusion. I would suggest to add a "Code availibility" section just before the Acknowledgements and put that sentence there.

We thank the reviewer for pointing this out. A code availability section has been added as suggested.

4) As the HEMCO code is not available on the given webpage yet, I was unable to assess the source code. As I expect the paper to be published after revisions I would encourage the authors to give access to the model source code as suggested in the paper.

We were reluctant to release model code prior to peer-review. The HEMCO source code, data libraries and some sample configuration files will be made available once the paper is published.

5) My major criticism of this paper is the lack of a use case. I might expect too much of a model development paper. But I think that there should be an exemplary CTM run to show the benefits of HEMCO for global modellers. E.g. a comparison of a CTM run with emissions from a single global inventory like EDGAR compared to a CTM run using the described HEMCO setup. It is common knowledge that more information does not neccessarily lead to better results. However, when putting so much effort in improving the emission dataset there needs to be a kind of "proof of concept" to illustrate the benefits and also possible shortcomings of the applied method.

We expanded Figure 2 to provide an illustrative example of the utility of HEMCO

GMDD
7, C429–C435, 2014

as a user interface between emission data and CTMs. We also modified line 1-5 on page 3 ("Here, we present the Harvard-NASA Emission Component version 1.0 (HEMCO), a software interface for atmospheric models that automates the implementation of new inventories and allows the construction of user-specified combinations of existing inventories and scale factors on a per region and/or per species basis.") and line 8-11 on page 6 ("They correspond to the standard emission settings currently used in the GEOS-Chem chemical transport model") to clarify that the goal of HEMCO is to streamline the way users pass emission data to the CTM, and not necessarily to improve upon the emission data sets themselves (see also reply to point 1). Previously, users of GEOS-Chem had to hardcode new emission fields, scaling factors, etc., whereas this is now handled externally through the HEMCO configuration file.

6) I agree with the first reviewer that the paper is a bit too compact at times. Especially the HEMCO extensions explained in section 2.6 and the data library in section 2.2 (see also comments 1.1 to 1.3). Also the interpolation capabilities need to be described in more detail (see comment 2).

We extended section 2.6 to provide more information on the HEMCO extensions, including a more detailed discussion on the example application and a modified version of Figure 3. As already discussed under comment 2, more details on the interpolation capabilities of HEMCO were added to the manuscript in section 2.2 and 2.5.

7) I would ask the authors to give an example for all configuration files. This could be given as a supplematary similar to Fig. 2. This could then be considered the "manual" part of the publication.

GMDD
7, C429–C435, 2014

Sample configuration files - including the full configuration file used in the standard version of GEOS-Chem (using all the inventories listed in Table 1) - will be provided along with the HEMCO source code. We hope that these files will serve as a good starting point for users who wish to modify/create their own configuration files.

References

Fairlie, T. D., Jacob, D. J., Dibb, J. E., Alexander, B., Avery, M. A., van Donkelaar, A., and Zhang, L.: Impact of mineral dust on nitrate, sulfate, and ozone in transpacific Asian pollution plumes, Atmospheric Chemistry and Physics, 10, 3999–4012, doi:10.5194/acp-10-3999-2010, 2010.

Millet, D.B., et al.: Global atmospheric budget of acetaldehyde: 3-D model analysis and constraints from in-situ and satellite observations, Atmos. Chem. Phys., 10, 3405–3425, 2010.

van Donkelaar, A., Martin, R. V., and Park, R. J.: Estimating ground-level PM2.5 using aerosol optical depth determined from satellite remote sensing, J. Geophys. Res., 111, D21201, doi:10.1029/2005JD006996, 2006. Xiao, Y., Logan, J. A., Jacob, D. J., Hudman, R. C., Yantosca, R., and Blake, D. R.: Global budget of ethane and regional constraints on U.S. sources, J. Geophys. Res., 113, D21306, doi:10.1029/2007JD009415, 2008.

Yevich, R. and Logan, J. A.: An assessment of biofuel use and burning of agricultural waste in the developing world, Global Biogeochem. Cy., 17, 1095, doi:10.1029/2002GB001952, 2003.

Interactive comment on Geosci. Model Dev. Discuss., 7, 1115, 2014.

GMDD

7, C429–C435, 2014