Geosci. Model Dev. Discuss., 3, C152–C154, 2010
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Geoscientific
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Discussions

Interactive comment on "Current status of the ability of the GEMS/MACC models to reproduce the tropospheric CO vertical distribution as measured by MOZAIC" *by* N. Elguindi et al.

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Received and published: 8 July 2010

The authors are grateful to the valuable comments by the reviewer. We think that this manuscript is suitable for GMD because it presents work that was carried out for a project whose main goal is to develop an operational data assimilation system for chemically reactive gases. The validation results presented in this study were used in developing such a system, so we do feel it is well suited to this journal. Below is our response to your other concerns.

MOZART-V3 was used for all the simulations, however there were some minor upgrades/changes that were made specifically for the GEMS/MACC project. We agree

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that the model versions referred to in the paper are really only relevant to the GEMS/MACC community, therefore we have changed all references to MOZART-V1 and MOZART-V10 to MOZART-V3, while specifying the differences between the models in Section 2.2 as follows,

"Note that the stand-alone version of MOZART is a later version than that which was coupled to the IFS model. The main upgrades are that the RETRO ship emissions have been replaced by estimates based on Corbett et al (2003) and the East Asian anthropogenic emissions have been replaced by the REAS inventory (Ohara et al, 2007) but keeping the original RETRO seasonality. In addition, several chemical reaction rates have been updated to JPL-06 (Sander et al, 2006)."

Regarding the assimilation scheme, we have add the following brief description in Section 2.2 and added the url where one can find a copy of the technical report in the reference section,

'MOPITT V3 total column data (Deeter et al, 2003) are assimilated using ECMWF's 4D-VAR data assimilation system. The data are thinned to a resolution of 0.5 deg x 0.5 deg and are only assimilated over land between 65N and 65S. Averaging kernel information from the MOPITT data is not used, because it was not available at the time the GEMS simulations were run. The model equivalent of the observation is calculated as vertical integral. The background errors statistics for the CO assimilation were determined with the NMC method (Parrish and Derber 1992). For this, 150 days of 2-day forecasts were run with the coupled system initialized from fields produced by the free running MOZART CTM, and the differences between 24-h and 48-h forecasts valid at the same time were used as a proxy for the background errors.'

While we agree with the reviewer that averaging kernels would have clearly been a better option, unfortunately they were not available at the time, and we still feel that the preliminary assimilation technique used here does improve the models simulations, albeit not in all respects such as the LRT of biomass burning emissions. Therefore we

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would like to keep the ASSIM results in the study and have tried to be more clear about the shortcomings of our paper. For example,

in the Conclusion section we add the following to the second to last paragraph,

"...., showing that the method used for assimilation does not provide enough information about the vertical profiles and is therefore not sufficient to compensate for other model inadequacies."

and to the last paragraph,

'One possible shortcoming of using the MOPITT V3 data without averaging kernels is that the assimilation could be biased to the a-priori profile. Therefore, in the current MACC (follow up project to GEMS) reanalysis, that will cover the period 2003-2010, averaging kernel information is used for MOPITT V4 data. This allows one to separate the contributions of measurement and a-priori information in forming the total column and should lead to improvements in the CO analysis.'

Interactive comment on Geosci. Model Dev. Discuss., 3, 391, 2010.