

Interactive comment on “African CO emissions between years 2000 and 2006 as estimated from MOPITT observations” by F. Chevallier et al.

Anonymous Referee #2

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General Comments: The manuscript entitled African CO emissions between years 2000 and 2006 as estimated from MOPITT observations by Chevallier et al., presents new estimates of CO emissions from Africa biomass burning that were derived using an inversion of the MOPITT CO retrievals. Initial emission estimates are used in a forward run of a new version of the LMDZ CTM to construct a pseudo-distribution of CO in the middle troposphere, uncertainty was added, and a Bayesian synthesis inversion was applied to optimize surface CO emissions and provide an estimate of their error. The optimized fluxes were then run in the forward model and compared to independent measurements of surface CO. The results provide a unique estimate of time-varying CO emissions from African biomass burning. I think this manuscript contains two interesting topics: 1) the estimates of CO emissions from biomass burning

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in Africa, and 2) the simplification of the LMDZ full chemistry model and addition of a framework for the inversion of multiple species. The first is clearly evident in the title, abstract and text. The second topic is not as well presented.

The primary topic of this work is to constrain estimates of CO emissions from African biomass burning based upon inversion of remotely sensed CO from MOPITT. It does this well using an approach previously developed and applied by the first author. The description of the process is clearly described. A few comments/questions are provided below.

I see the second topic of this manuscript as the new version of the LMDZ-INCA CTM that runs with simplified chemistry. The new version was developed for simultaneous inversions of multiple species, although I think this is somewhat lost in the manuscript and could to be emphasized earlier in the text. Inverting for multiple compounds is still relatively unique and is worthy of additional discussion in the manuscript. In section 2.3, the authors might should that the model also provides the a priori atmospheric distributions for CH₄ and HCHO. The description of the inversion scheme should explicitly describe how the multi-species inversion (was each species run in series?), and figure or Table of the optimized CH₄, MFC-OH and HCHO could be added.

This manuscript should fit well in Biogeosciences special issue Carbon cycling in the Sub-Saharan Africa. This is a very good paper I recommend publication after consideration to the comments listed below.

Specific Comments:

P. 3847, l. 15-20. The work requires CO fire emissions over the period 2000-2006. The data in Van der Werf et al. extends through 2004 and EDGAR 32FT2000 through 2002. How were the priors for 2005 and 2006 estimated?

P. 3848, section 2.1. Previous studies have shown that model results can be quite sensitive to the meteorology. How was this error estimated and accounted for?

BGD

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How does the model parameterize vertical mixing? Could the inversion bias emissions because the MOPITT retrieval is most sensitive at 700 to 350 mb and rather insensitive to the surface?

P.3851, l.,19-22. Does the model also generate a distribution of CH₄, OH and HCHO?

P.3856, section 3.2, Figure 3. The MOPITT averaging kernel must have been applied to the model CO vertical profiles but I do not see it mentioned.

P.3856, Figure 3. The optimized fluxes improved model to observations by 25%. What is the difference between the a posteriori CO distribution and MOPITT?

P. 3858. The conclusions should include a short summary on how the errors in the optimized emissions could be reduced and what is needed to better reproduce the observations.

Technical Corrections:

Abstract l 4-5. What is a variation scheme?

P. 3847, l. 23-26: The sentence beginning: In addition to these two information pieces, should end at ...radical OH. The rest of the sentence is unclear.

P. 3847, l.6. Provide a reference for the CO budget.

P. 3848, l. 3-5. I suggest this sentence be rewritten as Carbon monoxide is produced from the combustion of fossil fuels and biomass and from the oxidation of hydrocarbons.

P. 3853, l. 15. Particles per billion or particles per million should be part per billion or part per million.

P.3856, l.11. Why are the observations (uncertain)?

P. 3858. l.19. help constraining should be help constrain.

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