

## ***Interactive comment on “Assimilation of TES CO into a global CTM: first results” by N. A. D. Richards et al.***

### **Anonymous Referee #2**

Received and published: 8 January 2007

TES CO measurements are assimilated using GEOS-Chem model for November 1-15, 2004. The effects of TES assimilation are evaluated using MOPITT measurements on November 15, two MOZAIC profiles on the same day, and a combined MOZAIC profile of November 14 and 15. TES instrument appears to have high-quality CO measurements based on these limited evaluations.

I think that the intention of this work is to evaluate TES measurements. There are indeed many interesting characteristics of TES CO measurements found in this work. In order to know if these “characteristics” are robust, more than 1-day MOPITT and 2-day MOZAIC data will be needed in evaluation, I think. The methodology used in the study is sound. The representativeness of the results is questionable. Even for “first results”, I would suggest an assimilation period of at least 5 weeks (1 week for the

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

system to settle as shown in Figure 1 and 1 month for evaluation). Another concern is that most people will use TES data after limb mode was switched off in May 2005 (simply because most of TES data will eventually be gathered in this mode). To make the paper useful for people using TES products, I would choose a period after May 2005. I would have done what was suggested here. The following comments are offered assuming that the authors still want to publish the current work.

1. The limitations of evaluations (in terms of a short assimilation period and very limited evaluations for really just 1 day) should be made clear in both abstract and conclusions.
2. Retrieval algorithms of TES and MOPITT need to be described. MOPITT has 1-2 pieces of independent information in the vertical. How many pieces of information are available from TES needs to be clearly stated. The implications of this work on TES measurements after May 2005 should be included.
3. The global bias of 30-100% of CO in GEOS-Chem is surprisingly large. Here a longer evaluation period is necessary to show that this result is robust. Figure 2 shows that TES did not improve model results after assimilation north of 30 N and GEOS-Chem is low by about 30%. Figure 3, on the other hand, shows that TES assimilation leads to higher CO concentrations and assimilated results are very close to MOZAIC. Is this because MOZAIC values are lower than MOPITT? So MOPITT could have a significant positive bias compared to MOZAIC on that day?

Other comments:

1. P. 11730, line 7. Where are the regions of Step & Stares obs? Do they affect the evaluations of model results much?
2. P. 11730, line 4. Comparing 14 levels to the number of independent pieces of vertical information can easily show that the resolution is high enough.
3. P. 11730, line 18. Change “less than” to “more than”.
4. P. 11731, section 4. It will be useful to discuss other assimilation methods that have

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)

been used (in the introduction section). Describe how observation and representativeness error covariances are calculated.

5. P. 11732, line 9. How is 20% error determined?

6. P. 11732, line 12. The model grid is 4x5. With a horizontal correlation length of 125 km, effectively it is assumed that there is no correlation of error between grids. Is this reasonable? Shouldn't the correlation length be affected by model resolution?

7. P. 11733, line 4. Did Arellano et al. use the same biomass burning emission inventory as this work? If not, the statement needs to be changed.

8. P. 11733, line 17. "Forecast" is the assimilated result, right? It is unclear in the text.

9. P. 11734, line 14. MOPITT has no more than 2 pieces of information. Listing that many values in Table 1 is misleading. Two values will be enough. The sequence of pressure level is peculiar.

10. p. 11735, lines 13 and 29. Both statements are misleading because TES measurements below 825 hpa were not used in the assimilation.

11. p. 11736, line 6. The result in Figure 3 does not simply imply that TES measurements have a low bias up to 10 ppb. The "original" model results are low. If TES measurements are the same as MOZAIC, the assimilation results will still be low. In other words, the agreement in the upper troposphere suggests that TES measurements have a positive bias compared to MOZAIC. By checking out K matrix, one can calculate how much a TES positive bias is needed to "correct" the model low bias. There is also the issue of how many pieces of information TES measurements have.

---

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 11727, 2006.

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)