

Interactive comment on “Characterizing mega-city pollution with TES O₃ and CO measurements” by C. Shim et al.

Anonymous Referee #2

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Review of the manuscript "Characterizing mega-city pollution with TES O₃ and CO measurements" by C. Shim et al.

In this manuscript, Shim et al. present a comparison of TES CO and O₃ data with GEOS-chem mode results and in-situ observations during the MILAGRO/INTEX-B campaigns in March 2006. The main results of the paper are that overall reasonable agreement is found between in-situ measurements and satellite data if only collocated measurements are used and that the ratio of TES O₃ and CO over the Mexico City Metropolitan Area is indicative of photochemical O₃ production. From this the authors conclude that TES data are suitable for analyzing pollution outflow from that region.

Use of satellite data for measurements of tropospheric pollution is an exciting and

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promising new field, and the TES instrument has a large potential for many applications in this direction. However, in my opinion, the present study is flawed in several aspects and I can not recommend it for publication in ACP. I'm also sceptical that much can be done to improve the manuscript as I think that the data set shown simply does not provide the information needed for the type of analysis the authors propose.

My main concerns are that

* The results displayed in Fig. 5 and 6 show no indication of enhancements over the MCMA in TES data, neither for O₃, nor for CO. There are comparable or even larger values at the same latitude in all three plots. In my opinion, studying pollution outflow from the area must be based on a clear difference in signal between the polluted area and the background.

* The manuscript discusses three separate vertical layers for O₃ and CO. However, it is stated in the text that there are only 1.2 degrees of freedom for signal in the TES CO columns and therefore the three layers are correlated to a large degree.

* The averaging kernels shown in Fig. 3 go down to 1000 mbar and have a maximum in the 600 - 800 mbar region. However, as stated several times in the text, a large part of the area is at high altitude (750 mbar), and thus measurements over the MCMA have a very different averaging kernel. My guess is that for measurements over MCMA, the peak in sensitivity is well above that layer, indicating that TES has very little sensitivity to pollution outflow over this region.

* The ratio of O₃ to CO might be of the right magnitude compared to the in-situ measurements. However, I a) do not understand why in-situ measurements can be compared to TES data directly without considering the averaging kernels and b) from Fig. 5 and 6 do not see how the authors attribute the observed values to pollution from MCMA as I do not see an outflow pattern and c) think that the ratio must be strongly influenced by the shape of the a priori as the number of degrees of freedom is only 1.2 for CO.

Minor comments:

- * there is a problem with section numbering and references
- * several sentences are mixed up and need editing
- * the possible impact of clouds on the TES measurements is not mentioned at all
- * the impact of different spatial resolution in aircraft, satellite and model measurements is not discussed appropriately. Given the horizontal variability seen in the aircraft data, I do not understand how the authors come to their estimate that this should lead to a typical error of only 5%

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 15189, 2007.

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