**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Five blind men and an elephant: can NASA Aura measurements quantify the stratosphere-troposphere exchange of ozone flux?" *by* Q. Tang and M. J. Prather

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We thank reviewer #3 for helpful comments and suggestions, which do complement the other two reviews. We agree with most of the comments and address them as follows.

General comments

Agreed. The artificial high bias in the UT is introduced by applying the TES operator, instead of by the TES operator itself, smearing the model's high bias relative to TES in the LS into the UT. The text will be rephrased as suggested by the reviewer.

Yes, the figures seem too small mainly because ACPD uses landscape rather than portrait layout. These figures are designed to show in two-column space on portrait pages. If the paper makes to ACP with portrait page layout, they should larger and clearer. We will revise the figures per detailed recommendations where possible.

Minor comments

Abstract - line 1: What does 'instantaneous' mean in this context? . . .

"Instantaneous" refers to single profiles of Aura L2 swath data without averaging. The next sentence says that L2 swath data are used. We chose to use "instantaneous" in the beginning to avoid duplicating. With sondes, we consider concident to be within one hour of the Aura overpass, but with modeling we actually do the instantaneous coincidence, interpolating between 30-minute model swaths to the nearest minute. This is in contrast to many model comparisons that simply select a local solar time to compare with all swaths.

26899, line 28: The model sees a whole elephant,...

It is surely likely that the model simulates a different animal, elephant or mammoth, as the instruments observe. What we need here is a consistent ozone field as an intercomparison platform allowing us to connect different Aura ozone measurements and evaluate if they are consistent with each other (but can be different from the model). So, we think our analogy is appropriate.

26900, line 20: 'full' chemistry by whose definition? Not mother nature's presumably.

Full chemistry includes most of the major tropospheric chemistry mechanisms. Details are given in the reference Carver et al., 1997. We will revise text to make clear that our "full chemistry" is just that as stated here and is indeed not complete in any sense.

26900, line 28: Could you expand on why the other definitions are more awkward for your model

Again, the details are in the reference Prather et al. (JGR, 2011) and demonstrate the advantage as well as accuracy of e90-tropopause. As the purpose of this paragraph is to give a brief overview of the model, we think such detailed information is not needed here.

26901, line 20: Actually, not that many studies use L3 data...

Many studies use averaged L2 data, which are essentially L3 data. The sentence changed to "... use averaged L2 data or L3 data which ...".

26902, line 13: 'nearest and above the' is odd wording.

This is actually the wording from the HIRDLS documentation.

26903, line 8: Does OMI even have 3-6 layers in the troposphere? ...

Yes, OMI (OMO3PR V003) does report numbers for 3-6 layers in the troposphere, but only contain ∼1 DOFS. We will try to make these two paragraphs more parallel, but it will be difficult as there is information specifically for one instrument. OMI also has averaging kernel. The problem of applying the satellite operator is also true for OMI (see page 26906 line16).

26904, line 9/10: Linear interpolation in log pressure I think should be the way is done (and probably the way you do do it).

We think linear interpolation in pressure instead of in log pressure is a more reasonable method, as it is essentially interpolate by air mass rather than geometric height. Since we are interpolating mole-fraction and not number density, interpolation in pressure preserves column integrals.

26906, line 24: 'rest OF THE analysis'

Yes, changed.

26908, line 25: 'underestimates' is unclear here, ...

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Changed to "... underestimates the magnitude of the folding at 125 hPa."

26909, line 20, 'on contrast' -> 'by contrast'

Yes, changed.

26910, line 6: The sentence that starts here feels like it should go before the one about tropopause height.

Agreed.

26901(26910), line 28: It is my understanding that such MLS anomalies likely ...

We are not familiar with the MLS retrieval algorithm. The sentence will be changed to "12° N (Fig. 4e), and are likely due to contaminations from thick clouds."

26911, line 24: 'mismatches' is rather unclear ...

The sentence will be changed to "TES, however, does not show the intrusion ..."

26915, line 9: 'normally DISTRIBUTED error'? (or Gaussian?)

Yes, changed to "normally distributed error".

Figure 2. Numbers on contours are hard to read, perhaps use discrete rather than continuous colors.

In the caption it says, "The thin black contour lines represent ozone of 60, 80, and 150 ppb." Also, only the 100 ppb contour (the thick black line) is important here. So, we intend to leave the figure as is.

— Follow up on response to reviewer #2 C12653, last paragraph: It is my understanding that there are circumstances when TES can resolve boundary layer ozone. These are typified by high thermal contrast between the surface and the lower troposphere. Perhaps this is one such case?

We are not sure if there are cases that TES can resolve the boundary layer ozone, as

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we have not seen such cases. To our knowledge, the cases of high thermal contrast between the surface and the LT, if any, are really rare, especially in cases of highly polluted boundary layers (e.g., metropolitan regions). As we clearly stated in the response to reviewer #2, this is not such a case.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 26897, 2011.

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