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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Tropospheric column ozone: matching individual profiles from Aura OMI and TES with a chemistry-transport model" *by* Q. Tang and M. J. Prather

Anonymous Referee #1

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Review

ACPD paper 10.5194/acpd-12-16061-2012.

Tropospheric column ozone: matching individual profiles from Aura OMI and TES with a chemistry-transport model

By Q. Tang and M. Prather.

Overview

This paper presents an analysis of two years (2005-2006) of OMI and TES measurements of the tropospheric ozone column (TCO). Because of differences between OMI and TES in terms of spatial coverage, sensitivity, a priori and other factors the authors use results from a chemistry-transport model for the attribution of differences between OMI and TES measurements. Results indicate that many large OMI-TES differences can be explained by these different instrument and measurement characteristics, and that remaining biases are of the order of a few percent. Furthermore, using a similar methodology, differences between TES daytime and nighttime measurements turned out to be also related to different measurement characteristics, leaving few/small differences to be explained.

This paper is well written and well structured and contributes to some important questions with regard to measurements of tropospheric ozone from space, which are notoriously difficult for a variety of reasons. Results of the study are important for further scientific use of OMI and TES TCO measurements. Furthermore, results provides indications about the quality of OMI TCO data based on profile measurements, which, as the authors correctly state, is currently not (yet) available, thus to some extent filling a current void.

Overall, I rate this paper as good and recommend publication after some questions and minor issues are taken care off.

Comments

Page 16062, line 23, Abstract. Use of past tense (‘highlighted”). Given that the Abstract is written in the present tense, I think this should also be the case here.

Page 16062, line 25, Abstract. Change to “This study also highlights . . .”, given that in line 23 a first “highlight” is mentioned.

Page 16063-16064, Introduction. The introduction is very clear and nicely explains what problems are encountered in the use of OMI and TES TCO in scientific studies, but I miss the exact motivation for this study. It will probably be something like “Because of these issues in using these TCO measurements, we present a detailed analysis of

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. . . etcetera”. Please provide a brief motivation as to why this study, preferably on page 16064, after line 6.

Page 16066, line 10, Section 2. It is stated that “Given the limited DOFS in the troposphere, their integrated TCO is expected to be less dependent on the AK, . . .”. I don’t understand, less dependent than what? And why should that be the case? Both UVVIS and IR measurements of the TCO suffer from reduced vertical sensitivities (depending on the wavelength due to line of sight angles, albedo and the temperature structure of the atmosphere). That doesn’t change by combined levels of a profile to a column product. Please clarify.

Page 16067, lines 4-6, section 3. It is noted that certain biases are larger in July that in January, and as possible explanation it is mentioned that this could be due to larger TCO variations over NH mid-latitudes during summer compared to winter. For now I challenge that notion, as I would think that TCO variations are larger in winter than in summer (summertime NH = smaller tropopause height variations, less strat-trop exchange). However, whether or not this could be the case could be clarified by looking at model results: is variability in summer indeed larger than in winter.

Page 16067, lines 11-12, section 3. CTM-OMI correlations appear much higher than CTM-TES correlations on a profile-to-profile basis. One thing that could be tested is whether or not the sampling could be causing this by doing the CTM-OMI comparison on the CTM-TES sampling. If that results in a similar lower correlation for CTM-OMI, you know that it is the sampling that is an issue here.

Page 16067, lines 18-25, section 3. One question that came up here is to what extent the comparison OMI-TES improves if monthly means are used. This study obviously focuses

Page 16068, line 13, section 3. It is found here that OMI misses the low ozone part of the Pacific. It appears very well possible that this is related to the OMI a-priori, which is a zonal mean and given the wave-one structure of tropical ozone thus not representative of the Pacific low-ozone, and reduced sensitivity to the lower troposphere (OMI thus being filled by too high a priori values). Is there a way to get to that conclusion based on this analysis? If so, I would suggest adding it specifically as it highlights the importance of including the vertical sensitivity in satellite TCO measurements – which is still overlooked issue.

Page 16069, lines 2-3, section 3. The latitudinal jumps in the averages are attributed to the OMI a priori. But why? Because of jumps in the a-priori? It is not mentioned, so please explain.

Page 16069, line 8, section 3. It is stated that the inability of OMI to report low TCO values is likely the result of OMI's fitting algorithm (based on personal communication with X. Liu). Please elaborate in very general terms on why this is the case. What specifically hampers the retrieval? Because this statement is based on personal communication there is no way to check this claim.

Page 16069, lines 15-19, section 3. It is argued that overestimation of ozone over biomass burning areas may be related to low sensitivities in the lower troposphere. But that should have been taken into account by the averaging kernel, and thus quantifiable. Apparently averaging kernels do not explain these differences, so I wonder if this conclusion is substantiated. There are other possibilities – aerosol effects come to mind – but without additional information that is mere speculation. If there is no clear evidence that the vertical sensitivity is a play here, this should be rephrased and the vertical sensitivity should be avoided. Please clarify.

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Interactive Comment