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Atmospheric Measurement Techniques Discussions

Interactive comment on "Verification of the AIRS and MLS ozone algorithms based on retrieved daytime and nighttime ozone" *by* Wannan Wang et al.

Anonymous Referee #2

Received and published: 24 July 2020

General comment: This is an interesting paper comparing day versus night difference between AIRS IR total column ozone and MLS stratospheric/mesospheric column ozone. By testing differences in day-night column ozone amounts from AIRS and MLS it was determined that there are discrepancies between the AIRS day versus night total ozone. The authors list several potential reasons for this. This paper is publishable and I recommend publication after some small corrections/modifications to the current version. The authors may consider adding a few more references and discussion. Listed below are some comments.

Line 44: The BAMS SOTC report also includes annual updates every year beginning

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2013 of tropospheric ozone including trends and effects from El Nino.

Lines 56-58: Central to your analysis is the assumption that true diurnal variability of atmospheric ozone affects mostly just the BL and the upper stratosphere/mesosphere, neither of which contributes much to either AIRS total column ozone or MLS stratospheric column ozone. This seems to be a valid assumption.

In the Introduction you discuss details driving diurnal variability, especially for stratospheric and mesospheric ozone where you give some numbers. For tropospheric ozone diurnal variability, a study by Strode et al. (2019, Atmos. Env.) using a photochemical transport model indicated that diurnal variability in global tropospheric column ozone appears very small, at most only ∼1-2 DU in some regions such as central Africa, India, and east Asia (their Figure 11).

Strode et al. provides at least some estimated numbers in DU for global tropospheric ozone diurnal variability that you might include for your paper. These are small diurnal changes in tropospheric column ozone which further reinforce your conclusion that the main issue seems to be an over determination of day-night differences in AIRS total ozone. I.e., as you discuss in Section 3.3, your Figure 5 for 60S-60N shows much larger inferred day-night AIRS minus MLS (TOR) differences of about 5 DU, with most of it coming from AIRS total ozone.

Line 215: More specifically for MLS it is mostly for the SH Antarctic region and it seems to be very large. The abrupt change of about 30 DU in 2015 for MLS in Figure 5e for the Antarctic region suggests that something changed significantly with the MLS v4.2 retrieval (and for the better). In addition, there are huge day-night differences for MLS in Figure 5f that are greatest in September-October during the Antarctic ozone hole with numbers of 60-70 DU.

It is also noteworthy that AIRS day versus night total ozone differences appear smaller at ∼2-3 DU in both polar regions compared to ∼5 DU for 60S-60N. (I may not have inferred these numbers very precisely since vertical scales are all different for the three

regions.) In your paper you mention AIRS day-night differences associated with ocean scenes via cloud patterns and also mostly over dry land areas likely related to surface emissivity issues. This seems to be consistent with AIRS in Figure 5. Your Figure 5 is very interesting and you might discuss more about the features.

Line 140: "...accuracy was estimated at ∼40 or ppbv +5% (∼20 140 ppbv or +20% at 215 hPa)." Please clarify sentence.

Line 255: "...(< 1 DU for the upper atmospheric SCO), expect in the upper stratosphere and mesosphere." Please clarify sentence.

There are other typos and wording/sentence issues throughout the paper that you will find upon re-reading the current manuscript.

Please also note the supplement to this comment:
https://amt.copernicus.org/preprints/amt-2020-194/amt-2020-194-RC2-supplement.pdf

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