Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC1
https://doi.org/10.5194/amt-2022-187-RC1, 2022

Comment on amt-2022-187

Anonymous Referee #1

Referee comment on "Performance of AIRS ozone retrieval over the central Himalayas: use of ozonesonde and other satellite datasets" by Prajjwal Rawat et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2022-187-RC1, 2022

General comments

This paper assessed AIR ozone profile product against collocated references at the central Himalayas. They performed statistical comparisons with ozonesonde measurements and correlated satellite measurements as well as evaluated the capability of AIRS measurements to capture the atmospheric ozone variabilities inferred from summer monsoon activity, biomass burning, and stratospheric intrusions. The scope of this paper is well within AMT. However, I could not recommend this paper for publication.

Major comments

- Figure 4 and section 3.1: In this section, this author discussed the spatial variation of ozone along with the ozonesonde flight path. However, it is wrong. The associated figure shows the vertical variation of ozone along with the flight path. The spots filled with green to red color represent the stratospheric air masses (o3 > 100 ppb). The horizontal drifting of balloon could be a problem in the polluted boundary layer, but the ozonesonde site used in this study is located in the Himalayan Mountain. The horizontal drifting does not matter with AIRS and ozonesonde comparison.
- 428-437 (page 19)

- This author related the positive values of MI with strong monsoon and negative values with weak monsoon. Actually, the monsoon index taken from Wang et al. (2001) represents the strength of the Indian summer monsoon index. The seasonal pattern of MI presented in this paper (large negative values in winter) is not consistent with that shown in Wang et al. (2001) (nearly zero in winter). You should check if there is any bug in calculating monsoon index and need a better understanding on the monsoon index of Wang et al. (2001).

- In Figure 6, the weak summer monsoon could be associated with drier airs, but not for lower cloud cover and higher surface temperature as well as larger ozone amount near surface (larger net ozone production).

- Line 432 “Thereby anti-correlation between ozone and monsoon index”. This analysis is wrong. This anti-correlation is not driven from the interannual variations of the summer monsoon strength and its impact on ozone abundance. It is driven from the global seasonality of ozone (low in winter and high in summer) and not understandable monsoon

index.

- Line 435: Secondary ozone peak is a common feature found over the summer monsoon affected area, due to fair weather after termination of summer monsoon rainfall season and before the appearance of winter monsoon. The biomass burning could contribute on the secondary ozone peak, but you need to demonstrate it.

- Figure 8: I don't think that the comparison results are not inconsistent each other to characterize AIRS ozone profile quality. In manuscript, the author just describes the number of differences/R without "why", mostly.

- The AIRS-sonde differences are significantly larger at 800-600 hPa in summer than other seasons, but the correlation is larger in summer than other season. Please describe "why"

- For comparison in 300-100 hPa, the differences are much larger in spring and winter than in other season, but the correlation is significantly larger in winter and summer than in others. Please describe "why"

- Section 3.4 Assessment of AIRS retrieval algorithm with IASI and CrIS radiance.

- line 506: Figure 9.a, the ozone peak layer is not identified.

- line 509: You should compare the averaging kernels with AIRS, IASI, and CrIS, to show the impact of different measurement characteristics on ozone profile retrievals.

- Line 523-528: In this analysis, the number of difference/R is noted, without "why".

- Figure 10

- This study used OMI L3 total column ozone and OMI/MLS tropospheric column ozone without any citation and acknowledge.

- This validation study should characterize the errors in AIRS total column during Fall. The bimodal peak is not found in the UTLS and troposphere. In hence, it could be inferred from stratospheric ozone retrievals. Please make a similar plot for the entire/upper/lower stratospheric column ozone and corresponding a priori column. In hence this validation study could recommend the useful vertical range of AIRS ozone profiles.

- Figure 10.b : MLS is used to evaluate AIRS column ozone integrated between 400 hPa and 70 hPa in spite that MLS is not recommended for use below 216 hPa.

- Line 560: I don't think that UTLS ozone retrievals could be improved by using more accurate surface emissivity.

- (Figure 10.c) This paper related the tropospheric ozone peak in spring and fall observed in Himalaya mountain site with the biomass burning in northern India. I am wondering if the burning area is closed to ozonsonde site? It could be helpful to show the MODIS fire count map with ozonesonde site. In addition, please take a look at surface measurements (O3, CO) to see the seasonality caused by the biomass burning.

- Figure 11.

- I am wondering if stratospheric intrusion cases are completely removed for comparing the ozone profiles with and without Biomass burning events (Figure 11.a) and if the burning contaminated measurements are completely removed for comparing the ozone profiles with and without downward transport events. And please specify how to define the

cases of downward transport events.

6 Figure 12.

Comparing UV radiative forcing (RF) derived from OMI/AIRS/ozonesonde is meaningless in this study for evaluating the AIRS ozone profile product. That is because that Figure 10 already let us know that AIRS total ozone should be not used for scientific analysis.

Minor comments

- This paper describes that the AIRS/IASI and CrIS data is based on 9.6 um, but also the applied algorithm is based on IR + MW retrievals. Please take care of this inconsistent description.
- 187-188 (8page): It is clear to remove "associated with cloud fraction less than 80 %" in this sentence and adding "The AIRS data is flagged as best quality when cloud fraction is less than 90 % and other criteria (RMS?)".
- 189-191 (8page): that cloud fraction does not exceed -50 +/ 12 %, except in July and Aug when cloud fraction is ~~: In manuscript, the maximum cloud fraction of ~ 65+/-20% % is highlighted. I am confused about the importance/meaning of this maximum value. The maximum value of cloud fraction could be close to 1 over the world.
- 253-259 (11page): This paragraph is out of this 2.1.4 section ozonesonde.
- 241-242 (10page): (3-5) % (5-10) % è 3-5 %, 5-10 %
- 382 (17 page) : different collocated data sets (~) è ozonesonde and AIRS, respectively. The ozonesonde convolved with AIRS averaging kernels and AIRS a priori are also compared.
- 385 (17 page) : Please replace "mentioned" with better one.
- 440 (19 page) : both ozonesonde and ozonesonde (AK) è ozonesondes with and without smoothing into AIRS vertical grids or original ozonesonde and smoothed ozonesondes.
- 480(21page) : The histogram remainder between è The histogram of differences between
- 500-502 (22 page): I don't understand why the different number of entire channels between sensors should be related to the ozone retrieval performance. All retrievals use IR near 9.6 nm.

Please also note the supplement to this comment:
https://amt.copernicus.org/preprints/amt-2022-187/amt-2022-187-RC1-supplement.pdf