REVIEW OF Rawat et al (2022), Performance of AIRS ozone retrieval over the central Himalayas: Case studies of biomass burning, downward ozone transport and radiative forcing using long-term observations, FOR AMT

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SUMMARY & RECOMMENDATION

This paper uses AIRS (on NASA's Aqua satellite platform) long-term observations of ozone centered over the central Himalayan mountains to: (1) evaluate the AIRS ozone product with ozonesonde and other satellite observations and (2) determine sources for observed trends. The work is novel as it is a first time analysis of these products in this region using ozonesondes and satellite observations.

The paper does lack a clear, concise final interpretation of the results in the Conclusion section, which makes determining the authors' main conclusions difficult. Although one specific conclusion mentioned, which is interesting to note, is that lower differences with the ozonesondes are observed in the lower and middle troposphere and stratosphere with nominal underestimations of less than 20%. The abstract does highlight these results, so more attention is needed in the final section of the paper. Below are listed other several areas where additional information is desired and a few comments. Publication with minor revisions is the recommendation.

STRENGTHS OF THE PAPER

There are BLAH important elements of the analysis that make it appealing, original, and thorough:

- The careful statistical analysis of the evaluations between AIRS and the ozonesondes (ground truth) including the use of the satellite averaging kernels to make more accurate comparisons.
- The use of other widely-used satellite products and other satellite IR sensors for comparison to AIRS.
- Histograms that show nicely the vertical and seasonal variability of AIRS as compared to the ozonesondes.
- The attempt to show the application of the AIRS dataset for studying observed trends.

The above analyses and their interpretations explain why this paper merits publication.

AREAS OF IMPROVEMENT FOR THE REVISED PAPER

- Generally, there appears to be updates in the references used throughout the paper (latest revised draft), but still found the paper lacking newer publications cited. For example, there are newer publications for ozonesondes than Smit et al. (2007). There is the latest ozonesonde report that came out last year (and references therein) that should be cited: Smit, H. G. J., Thompson, A. M., & the Panel for the Assessment of Standard Operating Procedures for Ozonesondes, v2.0 (ASOPOS 2.0). (2021). Ozonesonde measurement principles and best operational practices, GAW Report 268. World Meteorological Organization. Retrieved from https://library.wmo.int/doc_num.php?explnum_id=10884.
- This leads to the next comment: Has this ozonesonde data been reprocessed to make sure it accounts for an instrument-specific corrections as well as others? Were these ozonesondes

EnSCI or Science Pump or something else? These corrections need to be applied to the ozonesonde data for comparisons with satellite products to be more accurate (see reference above) and this additional guidebook for data reprocessing: Smit, H. G. J., & the Panel for the Assessment of Standard Operating Procedures for Ozonesondes (ASOPOS). (2012). Guidelines for homogenization of ozonesonde data, SI2N/O3S-DQA activity as part of "Past changes in the vertical distribution of ozone assessment". Retrieved from http://www-das.uwyo.edu/%7Edeshler/NDACC_O3Sondes/O3s_DQA/O3S-DQA-Guidelines%20Homogenization-V2-19November2012.pdf .

- In some of the figures, the ozonesonde data convolved with AIRS averaging kernels looked worse in comparison to AIRS than original ozonesonde data. No specific comments were noted on this so this should be addressed in the paper. For example, why would this be case?
- The satellite-derived balloon-burst climatology (McPeters et al., 1997) used to calculate the total ozone column is an outdated climatology. There is a newer one used more commonly now: McPeters, R. D., & Labow, G. J. (2012). Climatology 2011: An MLS and sonde derived ozone climatology for satellite retrieval algorithms. Journal of Geophysical Research, 117, D10303. https://doi.org/10.1029/2011JD017006. For example, Stauffer et al (2022) used this in the latest paper on the global ozonesonde network.

  Stauffer, R. M., Thompson, A. M., Kollonige, D. E., Tarasick, D. W., Van Malderen, R., Smit, H. G. J., et al. (2022). An examination of the recent stability of ozonesonde global network data. Earth and Space Science, 9, https://doi.org/10.1029/2022EA002459.

  The use of an older climatology could explain some of the discrepancies observed in total column ozone comparisons and the recommendation is to redo this analysis with more recent climatology.

- Final recommendation: an overhaul is needed on the final section of the paper to state the final conclusions more clearly, similar to what is in the paper abstract.