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Atmospheric Measurement Techniques Discussions
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Interactive comment on "Version 2 Ozone Monitoring Instrument SO_2 Product (OMSO2 V2): New Anthropogenic SO_2 Vertical Column Density Dataset" *by* Can Li et al.

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The paper presents a new version of OMI SO2 algorithm and a dataset based on that algorithm. The new dataset has several improvements over the previous PCA-based OMI PBL SO2 dataset. It is an important step forward in the satellite SO2 retrievals. The paper is well-written and can be published after some minor revisions.

We thank the reviewer for the positive review and several good suggestions. We have made changes to the manuscript following the suggestions. Please find below our point-to-point response to specific comments.

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Discussion paper

Comments: The authors did not mention temperature dependence of SO2 absorption. It could play a role, for example, in the Norilsk case, when the different between winter and summer temperature could be as large as 50 degrees C.

Thank you for pointing this out. We have performed some calculations assuming different temperatures (243 K and 293 K below 2 km) and found that the temperature dependence of SO2 cross sections could have contributed to the Norilsk case, although the effect is likely less than 10% (see figure in the supplement for this reply). We have added the results of these calculations in the updated supplemental information (Figure S3 in the revised version). We have also added some discussion to sections 3.3 and 4.2 of the revised manuscript.

P.6, l. 162. I wonder if the row anomaly had any impact on the number of selected PC. What % of total variance is typically explained by them?

We exclude row anomaly affected pixels in the PCA and retrievals, so the row anomaly would have a minimal effect on the number of PCs, if any. We have clarified this in the revised manuscript. When we first developed the PCA-based retrieval technique, we did test the algorithm on row-anomaly affected pixels, and we found that we could not obtain retrievals with suitable quality. Thus the decision was made to exclude them from the algorithm.

P. 10, l. 294 The condition that pixels with large SCDs (> 1 DU) are excluded could be too restrictive since the determined standard deviations were as high as 0.3 . What would happen if, for example, the limit was set to 2 DU?

We have updated Figures 2 and 3 in the revised manuscript using a 2 DU threshold for SCDs instead of 1 DU. At lower latitudes, there are no discernable changes due to this replacement. At higher latitudes, we notice that the standard deviation increases for some (relatively few) segments. Overall, the use of different thresholds does not affect our general conclusions.

p. 14, l. 410. It is not clear what these low correlation coefficients represent. The correlation coefficient depends on spatial resolution of the data as well as on the geographical region. From Figure 7, it looks that the correlation coefficient between a and c should be much higher if, for example, North Korea is excluded.

We agree that the low correlation coefficient is not conclusive. We have removed the discussion related to this issue in the revised manuscript.

p.14, l. 417. This seems contradicts to the sentence above (l. 409) that says about winter snow/ice enchantment of SO2.

While the presence of snow/ice surfaces can enhance signals, for India and for most areas in China, the number of days with snow cover is actually rather low, and the sample size is generally too small for long-term data analysis. Warm season provides more retrievals that can be used to reduce noise through averaging. We have clarified this in the revised manuscript.

Figure 4, l. 664. Correlation coefficient with what? A linear function? How can we interpret these values? I think, you are trying to say something about statistical significance of the trend. Why do not you just give error bars for the slope?

Thank you for the suggestion. We have removed the correlation coefficient and added the 95% confidence interval for the slope in each panel of the figure.

Please also note the supplement to this comment:
https://amt.copernicus.org/preprints/amt-2020-186/amt-2020-186-AC2-supplement.pdf

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