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Interactive comment on "Changes in satellite retrievals of atmospheric composition over eastern China during the 2020 COVID-19 lockdowns" *by* Robert D. Field et al.

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Received and published: 20 August 2020

This paper thoroughly discussed the changes in atmospheric composition caused by the blockade policy during the 2020 COVID-19 lockdowns and separated the long-term trend's influencing factors. The author also discussed the dependence of the long-term trend analysis on the starting year and the influence of the starting year to the trend analysis. Questions and suggestions are as follows:

1. AIRS adopted the result of 500 hPa with the highest detection sensitivity in CO products. The data quality of this layer is reliable. However, for CO, whether the information in this layer comes more from the impact of transmission than local emission interference? Is there any information about a layer > 500 hPa with the detection sensitivity

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[Discussion paper]

lower than 500 hPa? Can this result compare to the results in this paper?

2. 4b) shows the SO2 distributions. Was the peak of SO2 caused by the high value of a province in South China or the overall high values? Compared to FIG. 4b) and FIG. 4A), the high values are more prominent and significantly different from the other years. What are the reasons?

3. Figure 3 and Figure 4 are not clear. Both figures show monthly changes from 2005 to 2020. However, this paper focuses on the comparison between January 23 and April 8, and the same period in history. Is it better to add a bar chart only focuses on this period?

4. Inline 291, the author stated, "these differences were not consistently significant when daily values were calculated from the median of individual retrievals." Does it possible that the high noise biased the result. The observed data also confirmed this because there was no obvious increased SO2 level during the epidemic period in the Wuhan area. For SO2 with even more considerable uncertainty in atmospheric detection, the consistent result of median value, and the ground-based observation, does it possible that the quality of Omi's satellite SO2 data affects the analysis results? Moreover, if the author can get a consistent conclusion based on the TROPOMI data?

5. This paper discussed South China and central China separately. What is the relationship between them? Line 377 points out that the decrease in Central China is larger than in South China because of the decrease in the NO2 in Wuhan. When doing a similar analysis, we found that the higher the NO2 concentration is, the greater the reduction is. The decrease in South China is smaller than that in Central China, which may be higher than that in Central China (such as Beijing), which is more sensitive to the lockdowns.

6. Line 410, the change of CO trend is attributed to the fact that biomass combustion sources are not affected by the epidemic situation. The possible main reason could be the CO data of 550 HPA does not reflect the influence of human resource, which is

related to the data resources used in this paper. Therefore, this paper concludes that the epidemic situation does not affect the contribution of biomass combustion sources to CO is limited. The limitations of CO data used in this paper on the conclusion should be pointed out, and the impact of the reduction of anthropogenic emissions caused by blockade on CO also needs further discussion.

7. Through the method described in this paper, the changes in atmospheric composition, which are not caused by the epidemic situation, are removed. Can the paper conclude the impact from the epidemic or the combined impact of meteorological factors and the shutdown caused by the epidemic? If it is the latter, it is important to discuss the contribution of meteorological factors.
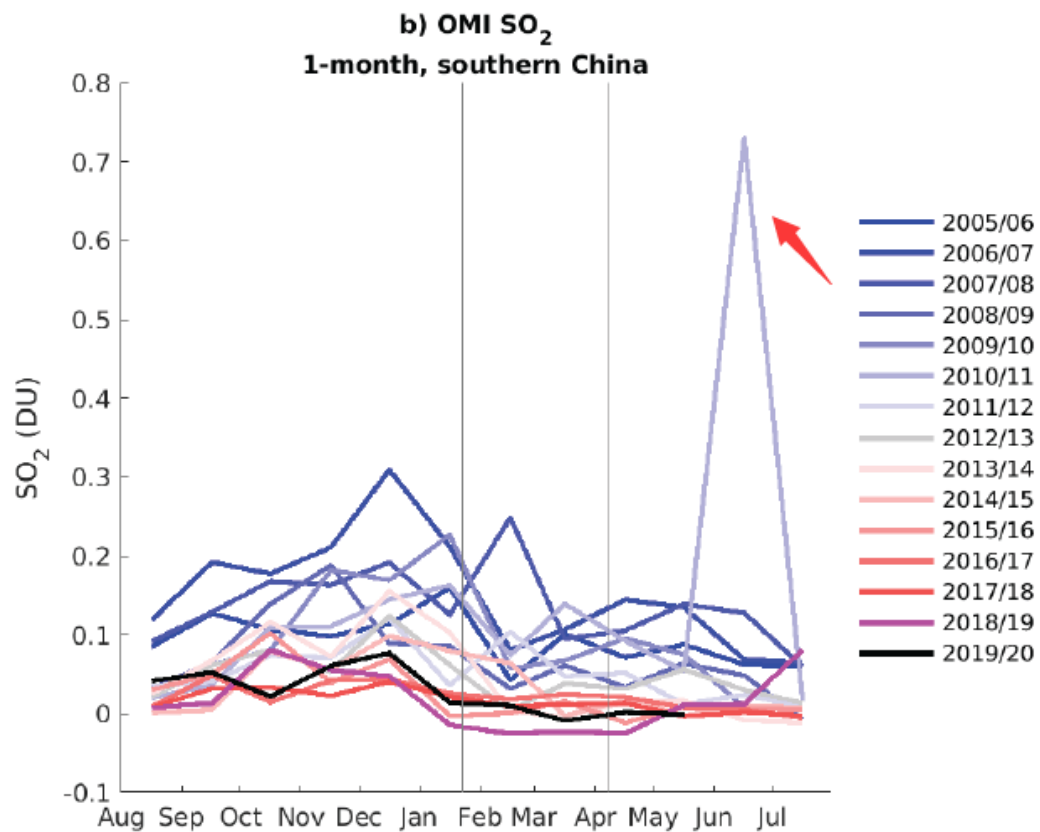
8. Page 11, Line 409. "We considered transboundary smoke transport as a possible reason . . ..". According to the higher CO level over the Upper Mekong region in 2020, it can be inferred that the CO in southern China increases by transboundary smoke transport (Fig. 2a), so the relevant meteorological environment should be discussed.

9. I suggest future work should be provided analyses on the interaction and relationship between trace gases such as NO2 and CO, and further innovate the study methods by finding the internal mechanism of air pollution and provide the basis for the air pollution source identification.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-567, 2020.

b) OMI SO$_2$
1-month, southern China

Legend:
- 2005/06
- 2006/07
- 2007/08
- 2008/09
- 2009/10
- 2010/11
- 2011/12
- 2012/13
- 2013/14
- 2014/15
- 2015/16
- 2016/17
- 2017/18
- 2018/19
- 2019/20

Fig. 1. Fig.4b

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