This paper updates existing SO2 emission inventories over China by using OMI observations and CTM. New source areas missing from the bottom-up inventories are identified and SO2 emission trends are interpreted. However, it is not very easy for readers to follow the contents, in particular the methodology part. I strongly suggest the authors spend some time on improving this part.

General comments:

1. The introduction section needs to be improved. I suggest focusing on literatures related to authors' own work, instead of a very general introduction. The relationship between the previous studies and this work needs to be clarified. More recent work, e.g., Krotkov et al., 2016, van der A et al., 2017, needs to be included.

2. The method developed by Martin et al., 2003 works very well for NOx, because NOx lifetime is relatively short and it does not bring significant uncertainties by ignoring transport between grid cells. However, this is not the case for SO2. A further analysis is necessary to convince the method is still solid for SO2.

3. In section 4.2, the authors tabulate the significant differences between inventories, but without any explanations for the reasons. I suggest a similar analysis as conducted in your recent work (Ding et al., 2017) to explore the possible reasons.

Specific comments:

1. Page 2, line 14, the meaning of "usable manner" is confusing. Please consider rephrasing it.

2. Page 2, line 38, please consider rephrasing "emission fields".

3. Page 3, line 16, please state the reason for the given error of 50%.

4. Page 3, line 27, please clarify the reason why the emissions in "great Beijing areas" is best represented.

5. Figure 1. It is not easy to distinguish the differences between graphs using the current legend.

6. Page 8, line 3, please clarify the sources of the uncertainty of the CHIMERE SO2 columns.

7. Page 9, line 21, it is not accurate to say "the OMI observations are point daily measurements". The OMI observation cannot be treated as a "point".

8. Page 9, line 29. How many levels of CHMIERE output are used in this study? It says 8 here, but 7 before.

9. Page 9, line 30. What is the "OMI 58 AK levels"?

10. Page 17, line 19. What is the definition of "SO2 emission fields"?