This study focuses on improving SO2 top-down emission inventory over snow-covered surface. The snow-covered Vertical Column Densities (VCDs) are involved in SO2 emission estimation process for the first time. By creating new AMFs and then VCDs under snow-covered conditions, SO2 emissions of snow-impacted sources can be reevaluated, as more measurements in winter season become available. As a major anthropogenic source of SO2, emissions from power plants in high-latitude regions have shown significant improvement. I recommend publication after some minor corrections mentioned below.

We would like to thank the reviewer for his favorable comment.

At the end of section 2.3, I suggest to place the extension of SO2 observations by including snow-covered pixels in a broader context by also referring to the NO2 product of OMI and TROPOMI, which is already including snow-covered pixels based on similar principles (see the TROPOMI ATBD of NO2, and Van der A et al., 2020, https://doi.org/10.1038/s41612-020-0119-z)

Thank you for your comment. We added references to the papers that discuss OMI and TROPOMI snow-covered pixels in the NO2 data products.

Line 66: "...and volcanic SO2 is is used ...". An "is" too many.

Corrected

Line 141: An 10% empirical correction is applied to the OMI VCDs. Is this a positive (+10%) or negative correction (-10%)?

It is a positive (+10%) correction. We added this information.

Line 246: "...norther Russia..." should be "... northern Russia..."

Corrected

Line 457: "In summary, is it worth..." should be "In summary, it is worth..."

Corrected