Review of *EGUsphere manuscript "First results of SO_2 columns from FY-3F/OMS instrument observations*

General Comment

Overall, the manuscript presents valuable first results from the FY-3F/OMS SO_2 retrieval, demonstrating the instrument's potential for monitoring volcanic and anthropogenic emissions. However, in its current form, the manuscript would benefit from additional analysis and a more optimized and coherent organization of the content.

In particular, parts of the manuscript contain subjective explanations already well-documented in the literature (e.g., the detailed description of Ring effects), also pointed out by previous reviewers. The use of a constant AMF effectively scales the data linearly, which may limit the physical representativeness of the retrievals. If vertical profiles are unavailable, the use of model-based or at least geometric AMFs should be considered. Section 5.2 (error propagation) primarily describes DOAS and RTM sensitivity tests but does not quantify retrieval uncertainties for OMS; thus, a more robust discussion of SO2 VCDs structural and algorithmic errors is needed. The current approach of varying DOAS and AMF input settings cannot substitute for a proper uncertainty propagation analysis. Additionally, the treatment of cloud-related errors remains largely unexplored, despite their known influence on trace gases retrieval accuracy.

Finally, the validation and comparison are limited to only a few days of data, which constrains the robustness of the evaluation, although the results show great promise for OMS, as demonstrated for the volcanic regions. Given that volcanic and anthropogenic emissions often persist over longer periods, extending the analysis to include more days or averaged results (particularly for anthropogenic regions) would provide stronger and more representative conclusions that will also reduce noise in retreivals. Many of these comments appear similar to those from previous reviewers; however, they still need to be carefully considered and addressed by the author.

Detailed Comments

Figures 2 and 3: The discussion appears more focused on justifying methodological choices rather than contributing substantive value to the present work. Moreover, the analysis is based on a single day, lacking statistical support. I suggest summarizing these results concisely and clearly stating that the 312–326 nm range is used for the current retrieval.

Figure 4: All tested wavelength ranges fall outside the 312–326 nm region, and no narrower intervals (e.g., 315–325 nm) were explored. Please clarify this choice. Additionally, it would

strengthen the analysis to include a comparison with TROPOMI SO_2 retrievals to evaluate the consistency in magnitude and better validate the selected wavelength range.

Section 3: I agree with previous reviewers that the manuscript includes several subjective explanations already well documented in literature (e.g., detailed Ring effect discussion).

You earlier compared wavelength choices thoroughly, yet in the Ring effect section, you mention using fixed input values "used in the DOAS fitting for all OMS measurements, without considering the variations of the Ring spectrum due to different atmospheric conditions and viewing geometries**."** Does this imply those variations have minimal influence on your retrieval or slant columns (SCDs)? Please clarify.

Section 4.5: What are the typical scattering weights or averaging kernels (AKs) of OMS SO_2 retrievals?
Your use of constant AMFs simply scales the data linearly. If vertical profiles are unavailable, model-based profiles (or at minimum, geometric AMFs) should be considered, a common practice in such retrievals. You refer to Section 5.2 for AMF and error details, but this section primarily describes RTM runs under various settings without quantitative error estimates relevant to your retrieval. A more robust discussion of structural uncertainties is needed.

Section 5: I disagree with treating DOAS and AMF runs under different settings as an error analysis. The final SO_2 **VCD** product should be analyzed for uncertainty propagation. Figures 20–22 focus only on clear-sky conditions; what about **cloud-related errors**? Where is the σ_SO_2 analysis for OMS VCDs? Showing only sensitivity to inputs does not address true retrieval uncertainty. I recommend shortening Section 5 (also suggested by reviewer 1) to focus specifically on the OMS SO_2 uncertainty, rather than on running the software (DOAS/RTM) under different settings.

Specific Comments

(Line numbers refer to the tracked‑changes version of the manuscript.)

Line 38 : Please correct — not all satellites provide a global view; only low-Earth orbit (LEO) instruments offer near-global coverage.

Lines 75–80: The description of the "spectral dimension to track dimension pixel" is somewhat confusing. Does this choice also affect the spatial resolution and is such an approach typical for other trace gas retrievals as well? If so, please elaborate. Otherwise, you may focus only on the VIS band for clarity.

Equatorial overpass time (10:00 AM): Please clarify whether this refers to **local time** or **UTC**. Although it may be obvious to some, this clarification would benefit many readers.

Section 3: Please specify that the VIS band in the **312–326 nm** region is chosen (line 89).

When listing retrieval steps in Section 3, please remove words such as *"Firstly," "Secondly,"* etc., if numbers are already provided.

If these are the first OMS SO_2 retrievals, please clarify what "initial" means, is this the first-ever retrieval, or an early version used for calibration/validation prior to final algorithm release? (**Line 17 and line 96**).

Line 97-99: Please explain why no cloud information (e.g., cloud fraction or cloud height) is retrieved here. Cloud properties can strongly influence both spectra and AMF values, and correct cloud filtering is essential. How were cloudy pixels handled in your retrieval? Please provide stronger justification for the statement.

Line 160: It would be helpful to include the expected **precision** of OMS SO_2 columns (either pre-launch or post-launch) to explain the occurrence of negative values.

Line 303: The statement *"the OMS SO_2 retrievals tend to be systematically overestimated or underestimated over the whole orbit"* — relative to what reference? Please specify.

Figure 8g: The interpretation is unclear without knowing the **precision** of OMS SO_2. Are the negative values due to limited precision? Also clarify whether the SO_2 columns in Section 4.1 represent **SCDs or VCDs**. Also, please check for consistency, you've used the term *SO_2 column* to refer to SCDs in some places as well.

Line 465: "It is worth noting that the retrieval errors for both OMS and TROPOMI are relatively large at the edges of the orbit."
While higher σ values are seen in Fig. 9h/i, these may also result from fewer pixels (data gaps) or TROPOMI's larger pixel size (roughly double that at nadir). Please clarify.

Figure 7: Please number each selected region and refer to those numbers in the text where discussed.

Figure 6: These are SCD values; please clarify whether **Figures 10–11** and others show **SCDs or VCDs**.

The repeated statement "We used all pixels from the TROPOMI DOAS SO_2 product instead of applying QA > 0.5", is concerning. The QA filter is crucial for high-quality data, as high SO_2

values can appear in cloudy scenes. How was cloud contamination accounted for if the QA filter was removed?

Figures 12–18: These show the great potential of OMS SO_2 data for identifying emission sources. However, as this is the first publication on the product, presenting more days of quality-controlled, averaged data (e.g., over volcanic or anthropogenic periods) would strengthen the conclusions.

Line 885: This is not a “box-AMF”; it represents **scattering weights**, which are then combined with an a priori profile to construct the AMF. Please correct.