

We would like to express our sincere gratitude to the reviewer for their thorough and thoughtful evaluation of our manuscript. We greatly appreciate the positive feedback and the encouraging comments on the overall quality of the study. The insightful reviewer observations have reinforced the importance of our findings, and we are thrilled that the reviewer found our work to be both scientifically sound and well-executed. We have carefully addressed all comments and suggestions in the revised manuscript, which we believe have further strengthened the clarity and quality of the work. The answers to the minor comments (black) can be found below (green) as well as the parts added to the manuscript (blue) as proposed by Reviewer #2. In addition all changes of the initial manuscript based on comments of both Anonymous Referees are tracked in the supplemental material.

Review of the manuscript titled “Satellite Aerosol Composition Retrieval from a combination of three different Instruments: Information content analysis” by Stöffelmair et. al.,

This manuscript focuses on retrieval of AOD and its components from the valuable space-borne instruments such as SLSTR on Sentinel 3A/3B, IASI and GOME-2 on MetOp A/B/C. Further, this study has used SCIATRAN and uses MERRA-2 reanalysis data to study information content of the conducted retrieval and suggested that 6 to 15 degrees of freedom for the determination of aerosol components dependent on AOD and the underlying surface.

This manuscript is well written and all the analysis are discussed in a very appropriate way. The information content analysis presented in this study will be meaningfully supporting the future AOD retrievals over various regions of the globe. I would recommend this manuscript for publication after these minor comments are addressed.

Minor comments:

1. Change the title, as in this study the satellite is being used to detect the AOD and its components, thus change the title as follows “Aerosol Composition Retrieval from a combination of three different space-borne Instruments: Information content analysis”. This title will be more appropriate. **Done**
2. Please correct the line 4 as “A simulation study has been carried out to analyse the information...” **Done**
3. The introduction is very well written and easy to follow.
4. The theory of information content and Optimal Estimation is also discussed in a very understandable way.
5. Please add a paragraph focusing only why SCIATRAN in particular is considered in this study and what are the advantages section 3.1 “Radiative transfer forward model”. **We added the following paragraph in this section:**

SCIATRAN is a well test radiative transfer model that can be used to compute radiances over a broad spectral range, in particular the UV-VIS and IR ranges needed for this study. A second reason is SCIATRAN's option to take into account different aerosol components as defined in MERRA-2.

6. Similarly, please add a paragraph focusing only why only these satellite instruments are used in this study and advantages of selecting these instruments in section 3.2 “Satellite Measurements and Observation Vector”. **We added to the first paragraph, more details to this are already in the introduction: In addition the spatial and temporal overlap of their measurements plays an import role in that**

choice. Moreover, the chosen combination of instruments allows for the possibility of a long time series through their predecessor and successor instruments.

7. Please improve the titles of all the figures, so that the readers can easily follow the figures. Captions are now more detailed, they can be seen in the attached track changes file.
8. Discuss why there is no data information available over Antarctica, may be add two to three sentences in the result section. Is added in the results section:

Data south of 62°S were measured at solar zenith angles of over 90° on this date in north-hemispheric summer. Under these conditions, the amount of reflected UV and VIS radiation is too low and the retrieval is not performed.

9. Separate the “Discussion and Conclusion” sections into two sections and also in discussion section add a paragraph about how the information content analysis can be useful for the existing and future satellite missions. Discussion and conclusion are separated and the following paragraph is added in the discussion section:

In addition the information content analysis can be useful as a tool to identify optimal sensor combinations and the choice of channels carrying the largest contribution to the information content for the specific target result (e.g. AOD, aerosol composition, surface properties). This information can be extracted from the Jacobian matrix K , which contains the sensitivities of each measurement to each variable in the state vector.

At the end, I would like to mention that this manuscript is short, concise, and the results are well discussed and contains valuable information for the enhancement of current and future retrieval process of AOD and associated components. I wish the authors in advance Merry Christmas and successful start to the new year!