

Response to referee #1

We thank the reviewer for his/her evaluation of our paper and useful comments that helped improve the manuscript. We appreciate reviewer's time and effort in reviewing the manuscript. Below are our responses to each comment. Reviewer's comments are in the standard font while the responses are in the italic font.

On behalf of the authors,

Alexander Vasilkov

General comments:

A general question I have is how to use this algorithm independently. As stated in the paper, the retrieved cloud information is intended for the NO₂ retrieval for OMI and TEMPO mission, yet the cloud algorithm needs NO₂ info for the fitting process. Isn't that a paradox? OMI has the NO₂, O₃, and H₂O retrievals from independent retrieval algorithms for the fitting process described in this paper; will TEMPO also have these trace gas retrievals as input to this cloud algorithm?

This is an important question. We added the following paragraph at the end of Section 2.3.

As implemented, the algorithm relies on optimal SCD retrievals of the O₃, NO₂ and H₂O trace gases, as well as preliminary cloud-fraction estimates. The latter is used exclusively over deep-water areas during the wavelength calibration and the Raman scattering (RS) removal. If needed, such cloud fractions can be substituted for appropriately adjusted reflectances, thus vying for self-sufficiency. The use of independent O₃, NO₂ and H₂O SCDs is an essential part of the algorithm that, especially for the scenes with heavy O₃ and NO₂ loads, leads to more accurate O₂-O₂ SCDs. The use of the trace-gas SCDs does not create any paradox when the NO₂ values would be used in order to retrieve cloud properties that should be incorporated into the NO₂ estimates. Note that in the implemented algorithm we use the NO₂ SCD estimates that can be obtained without any relevance on cloud properties. These cloud properties are used much later, during the conversion of the NO₂ slant columns to the NO₂ vertical columns. Opting for a complete self-reliance of the cloud algorithm, one may substitute the required O₃, NO₂ and H₂O SCDs for SCD estimates provided by the appropriate trace-gas climatologies.

Specific comments:

Page 2, Line 5-6: “ Other cloud parameters include the cloud phase, the cloud particle shape, and the particle size distribution that determine the cloud phase scattering function” is not a full sentence. I guess you want to say these parameter are not considered.

Thanks. We corrected the phrase:

Other cloud parameters: the cloud phase, the cloud particle shape, and the particle size distribution that determine the cloud phase scattering function are usually not considered.