Interactive comment on "Utilisation of O_4 slant column density to derive aerosol layer height from a spaceborne UV-visible hyperspectral sensor: sensitivity and case study" by S. S. Park *et al.*

General comments

The authors did substantial modifications on their new version of the manuscript. They took account most of the comments highlighted during the review process. I appreciate to see more details explicitly described in the different sections, like the methodology of the error analysis or a higher number of study cases in the last chapter. Moreover, the section about the sensitivity of the AEH retrieval to the different O_4 spectral bands is more concise and goes straightforward to the key message: the importance of the 477 nm band, compared to the other ones. The error analysis performed here look now more realistic. In particular, as expected, the analysis surface albedo and AODs (among other parameters) show to have large impact on the AEH retrieval.

The results presented at the end on real OMI observations, focused over ocean, show very large differences with the CALIPSO dataset. However, the authors make links with the error analysis and insist on the different parameters to improve (in particular the surface albedo, and the aerosol properties) prior to the retrievals. In spite of these differences, this work will be useful for the community who works on this topic.

I still have a few remarks, mostly minor. I would appreciate the authors to address them, before the final publication, as I believe they will help the readers.

Specific comments

1) Explanations about the LUT in Section 2.2

The authors compare their own retrieved O_4 SCDs to the OMI NASA products. For that, it is mentioned that the WinDOAS software is used, and then a Look-Up Table as described in Table 2. However, the link between these 2 elements is not completely clear.

I believe that a few lines should be added before the beginning of the 3rd paragraph. I guess that a number of simulations were performed with VLIDORT for different SZA, VZA values. And then a DOAS fit was performed to deduce O_4 SCD with WinDOAS. And finally, a LUT could be generated. Am I correct? Please explain it.

2) Surface albedo value of 0.1 in Section 4

I am not sure, but this value may be a little high for OMI observations over ocean. In my view, ocean surface is in general darker than land surface (although it can be highly variable depending on ocean conditions, as mentioned by the authors). Depending on seasons, OMI surface albedo values over land are usually (but not always) below than 0.1 in the visible. Could the authors explain or add 1 or 2 references justifying this value?

3) Sensitivity of AEH accuracy to AOD (Section 3.2.1)

This section is very interesting, and confirms that the feasibility to retrieve the aerosols altitude, from passive sensors, depends on the aerosol amounts. Later on, in the manuscript, it is also mentioned that angles (SZA, VZA) have a significant role. I believe that overall the continuum reflectance (which directly depends on these 3 parameters) drives the AEH accuracy (as the O_4 shielding effect, through the SCD, is constrained by the continuum reflectance magnitude). In case of low continuum reflectance, aerosols (and even clouds) have limited effects on the slant column It is somewhat mentioned in [Acarreta *et al.*, 2004]. You could refer to it. Moreover, such a sensitivity was found in [Sanders *et al.*, 2015] although a different spectral band was used.

This section and your plots look consistent with the findings of [Chimot *et al.*, 2015], where different approaches were employed for analysing the interplay between the OMI cloud retrievals, through the O_4 spectral band, and the presence of aerosols. Could you please verify and confirm this for consistency?

4) Review some typos / sentences

I would recommend, to perform a final check of the manuscript and to reformulate some sentences, where necessary. There are sometimes some incomplete sentences, or some formulations are not clear.

Below are given some examples, but this list is, I think, not exhaustive:

Page 6, Line 125: "This new algorithm is applied to the radiance data": I think here the author should say it was applied to the O2-O2 SCD, available in the OMI NASA product.

Page 6, Line 135: "atmospheric molecules and aerosol**S**" (final s to be added to "aerosol")

Page 14, Line 307: "On the other hand, the sensitivity of the O4I at 477 nm has significance to estimate AEH" => "is a significant variable to estimate AEH"

Page 14, Line 328: "materials" => properties

Page 15, lines 345-346: I do not understand the statement "from OMI … respectively". Please reformulate.

Page 15m Line 348: please justify the AOD uncertainty of 0.1 (reference?).

Page 16, Line 354: "for small AOD at low AEH, which has small shielding effect" => since here aerosols are at very low altitude (close to the surface) and O4 SCD increases, I think the term enhancement would be more appropriate than shielding. Indeed, in that case, aerosols have a similar effect than albedo, as they increase the sensitivity of most of the O4 column. They do not shield here the O4 column.

Page 16, Line 360: "decreases as the altitude" => do you mean aerosol altitude?

Page 17, Line 377: "scattering aerosol**S**" (s added)

Page 17, Line 378-379: "It effectively brings albedo effect dominant for aerosol layer". Please reformulate this, and use enhancement effect, as opposite to shielding effect.

Page 17, line 382: "which is corresponds to" => which corresponds to?

Page 18, Line 411: "noticeable effects **ON THE** phase function" (on the added)

Page 18, Line 418: "which set**S**"

Page 19, Line 434: "aerosol layer shut off" => aerosol layer attenuates

Page 19, Line 438: "by the albedo effect to the O4I is larger for the absorbing aerosol" => I do not understand the last part of this sentence. Please reformulate.

Page 19, Line 446: ""AEH increase**S** and AOD increase**S**"

Page 20, Lines 450-452: "However…the reference case": Please check English and formulation

Page 20, Line 457: "less" => lower or smaller?

Page 23, Line 521: "a half and a quarter" => 50% and 25%

Page 24, Line 556: What is FMF? I did not find this term earlier in the manuscript. Further, please define the CALIOP AEH. How did you compute it? Or was it available in the CALIOP product?

Page 25, Line 579: "on the date**S**"