Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC2
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Comment on amt-2022-156

Anonymous Referee #2

Referee comment on "Algorithm theoretical basis for ozone and sulfur dioxide retrievals from DSCOVR EPIC" by Xinzhou Huang and Kai Yang, Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2022-156-RC2, 2022

In this paper, the authors describe in a very comprehensive way the algorithm applied to DSCOVR observations to retrieve O3 and SO2 (for large volcanic eruptions) vertical columns using a direct-fitting approach.

The level of description of the algorithm is very high and unusual for publications, with the authors providing the basics of all involved processes in such a remote sensing application. Although this makes the paper quite long and perhaps not fully consistent with the editorial line, I find such papers useful for readers with less experience in the field.

The described algorithm itself is mature and provide high quality results and the derived retrievals are well characterized with solid error estimates. As the topic suits well AMT and I don’t have major issues, I would recommend publication after the minor and technical corrections below have been considered.

Minor comments:

P. 9 lines 4-5: This statement is not clear to me. I understand that cloud/aerosol-free pixels have low LERs but why selecting such clean pixels only would remove the high VZA observations? Is the selection based on the LER values themselves or on independent cloud parameters?

Fig. 4b: How are those GLER values computed? Are they based on the Cox-Munk BRDF as well? The figure shows VZA dependences for low SZA but for EPIC, the SZA increases simultaneously with VZA. What’s the influence of the SZA on GLER?

Fig. 7 and P. 11 line 24: please specify which data base is used.

Fig. 10: the use of % is confusing here. Does it mean that what's plotted here is (I_RRS-I_ELA)/I_ELA X 100? If yes, please clarify. Otherwise, don't use %

P. 21 line 7-8: please explicit the granularity of the climatology.

Figure 15: Please comment on the large differences at high SZAs (edge of the disc)

Algorithm 1/2 tables: Those tables are very useful. I think having flowcharts would be even nicer (keeping all references to Equations). Please consider doing this. Add also references to used data bases (minimum LER, cloud and snow parameters, O3/T° profiles).

SO2 flagging: P. 33 line 33 and P. 341: it is not clear to me how "the vicinity outside the Delta_omega contour" and "adjacent areas" are defined. Please be more specific. Also I don't understand what is the reference value to draw the omega_1 contour, which is said to be taken between omega_min and omega_max. What does it mean? Do you take the mean of the two values or any other value?

P. 34 line 6: what is the justification to take as initial SO2 value the difference between two O3 columns (omega_1 and omega_2)

P. 40 line 30: I don't think this is true that profile errors systematically increase for bright surfaces. In case of bright surfaces at ground level, the AK will be closer to 1 instead of having a strong decrease in sensitivity. So AKs will be much less altitude-dependent and errors due to the profile shape may be reduced.

Error estimates: It would be beneficial to add up all error terms to have an estimate of the typical total errors. Of course, respective contributions vary significantly depending on the observation and geophysical conditions but I would suggest attempting to provide such total error estimates for (1) favourable (e.g. no cloud/aerosol, low angles (2) difficult conditions (high angles, aerosols).

Technical corrections :

P. 1 line 18 : remove ‘the’ in ‘located the between’

P. 2 line 21 : add Metop-C

P. 2 line 29 : ‘an LEO’ --> ‘a LEO’

P. 5 line 22 : define μ

P. 14 line 2 : ‘is a smooth’ --> ‘in a smooth’ ?

P. 21 line 19 : should ‘n’ be ‘p’ instead for the number of e_k according Eq. 12 ?

P. 21 line 33 : O3 ‘climatology’ instead of ‘climatolgoy’

P. 22 line 27 : suppress repetition of ’the’

P. 24 line 16 : suppress repetition of ’the’

P. 24 line 3 : remove ‘for as applicable’

P. 24 line 25 : add Lerot et al., 2014

P. 27 line 26 : close bracket after ‘section 2.3’

P. 36 line 12 : ‘represent’ instead of ‘represents’

Fig 23 : Expand the Y scale for the O3 differences to increase the readibility (+/- 15% instead of 30%)

P. 50 line 5 : rephrase the ‘in this ATBD’ in ‘in this paper’

P. 50 line 21 : ‘laodings’ --> ‘loadings’