

We thank the Reviewers for their very thorough and constructive comments, which have helped to improve the quality of this paper. Below are our responses to their comments. The response (e.g., blue) follows each comment.

Comments from the editors and reviewers:

This paper introduces a method to retrieve cloud top heights from measurements in the wavelength range ~680nm to ~780nm in and next to the oxygen A and B absorption bands. Measurements are performed by the EPIC sensor which is operated on a satellite near the first Sun-Earth Lagrange point so that scattering angles are always 165° or larger.

I agree with each point raised by the first reviewer. While the science is probably sound as far as can be judged from the current manuscript, the manuscript requires major revisions and a further round of review before it might be published as a final paper.

Besides some language issues, the description should be improved, e.g. not all steps in section 3.2 can be followed. Section 4 could be split in two parts, since the first part is more about method description while the second part shows the results. Maybe

Sect. 2 + 3 + the first half of Sect. 4 could be merged into one section (called 'Theory and methods' or just 'Methods') with several subsections. A discussion of the results is missing. The conclusion section currently is more like a summary. A few minor remarks:

Author reply: Thank you very much for your comments, we have revised the structure of the paper as suggested : The original sections 2, 3 and half of section 4 have been merged into one section "Theory and methods", the other half of section 4 is categorized into another section "Application and validation of the CTP retrieval method".

- Line 14: "analytic transfer model": Do you mean your retrieval? In my view, even if it is a relatively simple retrieval and the term 'model' may not be completely wrong it should be called retrieval (or inversion or maybe 'inverse model' or 'retrieval using a analytic transfer model' or similar) because at least some readers will connect the term 'model' more with a forward model than with a retrieval.

Author reply: We have revised it to "An analytic transfer inverse model" as suggested. We also replaced the "analytic transfer model" by "analytic transfer inverse model" in all other places in the paper.

- Line 22: "a one-hundred-fold time reduction": Which time is reduced? (Computation time I guess) Compared to what? (line-by-line calculations?)

Author reply: We have revised this sentence as follows: "...To simulate the EPIC measurements, a program package using the double- k approach was developed. Compared to line-by-line calculation, this approach can calculate high-accuracy results with a one-hundred-fold computation time reduction...."

- Line 36: The spatial resolution of the sensor could be mention here. Also the scattering angle range ($\geq 165^\circ$) could be mentioned somewhere.

Author reply: We have revised as suggested: "...One of the Earthward instruments is the Earth Polychromatic Imaging Camera (EPIC) sensor, which can take images of the Earth with spatial resolution of 10 km at nadir. The EPIC continuously monitors the entire sunlit Earth for backscatter, with a nearly constant scattering angle between 168.5° and 175.5° , from sunrise to sunset with 10 narrowband filters: 317, 325, 340, 388, 443, 552, 680, 688, 764 and 779 nm (Marshak et al., 2018)..."

- Figure 1 caption: The model should be mentioned here. Currently it is mentioned only later in the text. Is the figure for 1013hPa? Is it only for O2 or for all atmospheric constituents?

Author reply: We have revised the Figure 1 caption as suggested:

“Figure 1: High resolution calculated absorption optical depth spectrum at oxygen A-band (a) and B-band (b) with DSCOVR EPIC oxygen A and B bands in-band and reference filters. Here the absorption optical depth spectrum is calculated by LBLRTM model with HITRAN 2016 database for the U.S. standard atmosphere.”

This figure is for U.S. standard atmosphere, which surface pressure is 1013 hPa. It is for all atmospheric constituents.

- Line 122: 'we are trying to develop' could be replaced by 'we develop'.

Author reply: We have revised as suggested.

- Line 134: 'outer space' could be replaced by 'TOA'.

Author reply: We have revised as suggested.

- Line 144: 'airmass and aerosol that located above or below cloud': also inside a cloud Rayleigh scattering and extinction by aerosols can happen.

Author reply: We have revised it as follows: "... For solar radiation at oxygen A-band and its reference band, they are also attenuated by airmass and aerosol through Rayleigh scattering and aerosol extinction..."

- Line 152: 'between solar and satellite sensors': You mean 'between Sun and satellite sensor'?

Author reply: Yes, we have revised as suggested.

- Line 154: 'layerd' should be 'layered'.

Author reply: We have revised as suggested.

- Line 284: 'and hard to tell directly' should be removed.

Author reply: We have revised as suggested.

- Line 371: 'decrease' should be 'increase' if I understand correctly.

Author reply: Here the “retrieved CTP (with considering cloud penetration)” is smaller than the “baseline CTP (without considering cloud penetration)”. Hence, we say “A decrease in retrieved CTP will ...” in this sentence.