Atmospheric
Measurement
Techniques

Open Access

Discussions

AMTD

Interactive
comment

Interactive comment on "Radiative transfer acceleration based on the Principal Component Analysis and Look-Up Table of corrections: Optimization and application to UV ozone profile retrievals" *by* Juseon Bak et al.

Anonymous Referee #2

Received and published: 3 November 2020

General comments:

Accurate calculation top-of-atmosphere radiances remain essential to ozone profile retrieval techniques, but the expense of doing on-line RTM calculations at sufficient accuracy for new sensors that collect very large amounts of hyperspectral data is becoming prohibitive. Mathematical and empirical methods which improve the computational efficiency while maintaining the demanding level of accuracy required for these calculations are necessary to take advantage of new data.

Printer-friendly version

Discussion paper

The focus here is on particular application of such methods to the estimation of UV radiances for ozone profile retrievals. Most important details about the radiative transfer model, assumed optical properties, and tuning parameters for the EOF binning characterization are well documented. The authors present their methods in sufficient detail to to reproduce and apply them independently. The techniques described in the manuscript are thus a useful contribution to the literature. The overall quality of the manuscript is excellent so I feel the paper can be published after making some minor revisions and addressing the comments below.

1. The paper concerns improving UV ozone profile retrievals which typically require some form of soft-calibration to account for errors in either the forward model, the measurements, or both. Were all soft-calibration corrections removed from the different retrievals before producing the results presented in figures 9 and 10? If not, how can the authors compare ozone profile retrievals from a mixture of RT configurations and soft-calibrations and attribute all differences to reductions in model approximation error? Presumably one expects the soft-calibration corrections for v2 should be smaller than v1. Is this the case?

2. I suspect there is no mention of Ring effect in the paper because that is dealt with by the authors' retrieval. I think this should be mentioned at some point in the manuscript.

3. At line 272, I suspect authors don't truly mean their multiple-scattering radiance spectra are "fully accurate," but rather these spectra represent the optimally configured model setup. If this is the case please correct the wording.

4. At line 418: will reducing errors in forward model approximations actually reduce random noise error? If that is the claim, what type of random noise errors are being referred to?

5. Is there an explanation for why the UV2 fitting residuals at low latitudes in figure 11 are somewhat larger for "PCA" than "VLD," but the reverse is true for UV1?

6. The Evaluation and Summary and Conclusions sections need further editing. I suggest breaking the long spans of text into shorter, more focused paragraphs, and reconsidering the amount of technical detail. For example, is it necessary to repeat the number of wavelengths on the OMI grid or the number of times the model is executed?

Technical and grammatical comments:

Line 49 – define LUT before using abbrev.

62 – suggest using "and" or "with" rather than "+"

101 – change "work" to "perform."

107 – reword "less spectral sampling to "fewer spectral samples"

188 – remove "correspondingly"

126 – "atm" should not be superscript

126 – "for layer 0"

132 – what is an "effective wavelength"?

138 – note on VLIDORT 2.8 seems somewhat out of place. Can this be said earlier?

145 – please indicate what ozone cross-sections were used.

192 – is there a typo on the n+NN subscript on G? Also commas are missing between n and i subscript for delta and omega.

308 – the meaning of the subscript "on" is not defined in eqn. (11a).

313 – the naught subscript (0) is generally used for the solar angle, not the view angle. Is it necessary to reverse this here?

321 – does "based on" mean "at"?

334 – Use of aq1 suggests a product of two quantities, a and q1. It would be easier to

understand a single character representing this quantity. Same with aq2 here and the qr term on line 334.

337 – I believe a minus sign is missing in front of eqn. (14c).

359 – remove periods near the end of eqn. (17).

396 – change "significantly eliminated" to "significantly reduced" or just "eliminated."

411âĂŤ change "in the highest" to "with the highest"

421âĂŤ what is being compared to the "runtime" configuration here?

431 – despite the very respectable in performance, the word "overcome" is a bit too strong. I feel a 3x improvement speaks for itself.

441 – change "correlated" to "in"

442 – replace "bins related" with "bins within"

444 – "…PCA approximation errors for our technique"

455 – what "OMI spectral fit" does is referred to here?

588 – what does the "List" column in Table 2 represent?

604 – in table 4, please abbreviate polarization correction as "pol. corr." rather than "polcorr".

625 – parentheses missing in the legend of figure 2.

640 – please indicate what VZA and RAA are these calculations were made for?

684 – typo: change "/" to "," just before (e).

685 – this figure would be more informative if the x-axis were latitude instead of along-track number.