

Response to Referee #4:

The authors greatly appreciate Referee #4 for re-reviewing our manuscript and providing valuable comments, which have helped to improve the quality of the paper in both sciences and writing. In the following, we present our responses to comments. The referees' comments are in blue italic and our responses are in black.

Main comments:

I forgot that I had reviewed an earlier draft of this paper and reviewed this version “independently” of the previous one. I find the same issues I had with the previous version. I think the paper is quite good on the whole, but there are a couple of unsolved problems:

1) MODTRAN 4.3 is outdated.

Responses: Thank you for your comment. You are right, the current version MODTRAN 4.3 is outdated, and a few spectroscopic data are updated in the new version, such as MODTRAN 5.2. For the relative coarse spectral resolution spectrometer (FWHM=7 nm for MS711 & 712 used in this paper), MODTRAN V4.3 is accurate enough, we compared the water vapor transmittances calculated by MODTRAN5.2 and MODTRAN4.3 as shown in Fig. 1 below, they are very close to each other. Moreover, the inversion algorithm uses the integrated transmittance of a narrow band near 0.94 and 1.37-micrometer instead of a single wavelength, and there is almost no difference for calculations by MODTRAN4.3 or MODTRAN5.2.

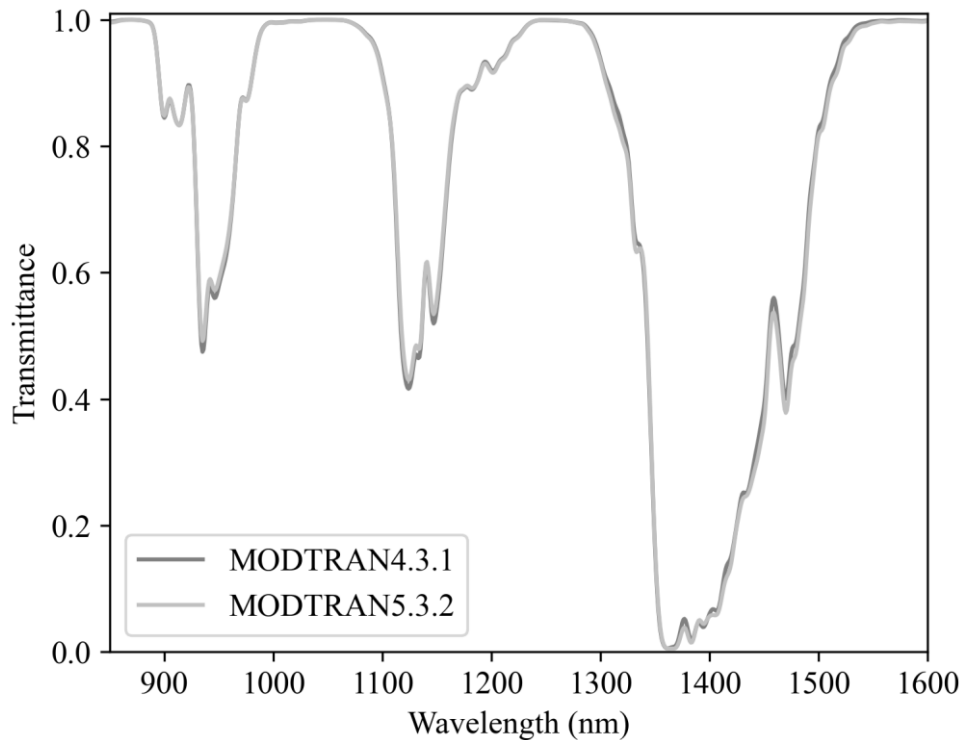


Figure. 1 Water vapor transmittances calculated by MODTRAN4.3 and MODTRAN5.2 under the same conditions, respectively (SZA=0°, PWV=1.0 g*m⁻², FWHM=7 nm).

2) *Fig. 11 shows that the slope, intercept and correlation coefficient are all worse for the 1.36 micron band, so the statement on L297 is not supported. Section 6 contains a similar statement.*

Responses: In Fig. 11, the PWV retrieved from CE-318 is used as the reference. Compare to the retrievals of CE-318, the PWV retrieved with the band near 940nm (BAND1) shows a little higher than that of the band near 1370nm (BAND2), the results from Band1 are closer to that of CE-318. From this point of view, the results from Band2 seem ‘worse’. However, all the retrievals cannot be taken as absolute true values. Through the radiative transfer model, the simulated retrievals show that (Fig. 5), the PWV retrieved from BAND2 is closer to the input which is assumed to be the “True” value. Therefore, we proposed that, for a dry atmosphere, a stronger water vapor band around 1370 nm can try to be introduced for PWV inversion if measurements are available. But the statement “the retrievals from Band2 are more

accurate” is not an accurate description, and we have revised it in the manuscript.
(Lines 254-257 and Lines 299-302)

Specific comments

1. L37: *“economical to build observation network” -> “it is economical to build an observation network with them”*

Responses: Thanks, we have revised it in the manuscript. (Line 37)

2. L55: *“940nm” -> “940 nm”*

Responses: Thanks, we have revised it in the manuscript. (Line 55)

3. L61: *Why is the “three-parameter formulation method” very sensitive to ‘air quality’? I don’t believe this is true since path lengths are geometric. Also “formulation method” is redundant in my opinion.*

Responses: Thank you for your comment, and you are right, it should be ‘air mass’, we have corrected it in the revised manuscript. (Line 61)

4. L65: *“easily not” -> “not easily”*

Responses: Thanks, we have revised it in the manuscript. (Line 65)

5. L78: *10-15 -> 3*

Responses: Thank you for your comment. We checked the manual and data again, you are right, the CE-318 can be set to run every 3minute, but normally it runs every 10–15 min. (Line 78)

6. L79: *resolution is the wrong word. ‘bandwidth’ is better. Are these values true for both UV bands and for the three visible bands and for the 4 near-IR bands?*

Responses: Thank you for your comment. We have revised it in the manuscript.
(Lines 79-80)

7. L86: *are -> is*

Responses: Thanks, we have corrected it in the revised manuscript. (Line 85)

8. L90: *Considering -> Consider*

Responses: Thanks, We have corrected it in the revised manuscript. (Line 89)

9. L91: *are -> is*

Responses: Thank you for your comment. We have corrected it in the revised manuscript. (Line 90)

10. L130: *'completely' is an adverb and does not belong here.*

Responses: Thank you for your comment. We have revised it in the manuscript. (Line 129)

11. L160: *Note that random noise cannot give a biased slope, non-zero intercept or any MB. This is simply a point of information, no need to change the wording.*

Responses: Thanks for the informative comments.

12. L169: *great -> greater*

Responses: Thank you for your comment. We have revised it in the manuscript. (Line 168)

13. L176: *extenuated -> attenuated*

Responses: Thank you for your comment. We have corrected it in the revised manuscript. (Line 175)

14. L194: *"under high aerosol loading atmosphere" -> "in an aerosol-laden environment"*

Responses: Thank you for your comment. We have revised it in the manuscript. (Line 193)

15. L223: *"above" -> "the above"*

Responses: Thank you for your comment. We have corrected it in the revised manuscript. (Line 222)

16. L255: atmosphere -> conditions

Responses: Thank you for your comment. We have revised it in the manuscript. (Line 254)

17. L257: atmosphere -> periods (or conditions)

Responses: Thank you for your comment. We have made revisions to the manuscript. (Line 256)

18. L295: "at the" -> "at"

Responses: Thank you for your comment. We have corrected it in the revised manuscript. (Line 295)

19. L296: "near-infrared band" -> "other near-infrared bands"

Responses: Thank you for your comment. We have made revisions to the manuscript. (Line 296)

20. L299: "a" -> "a dry"

Responses: Thank you for your comment. We have corrected it in the revised manuscript. (Line 299)

21. L300: This conclusion is not supported by the results. Please reword. Maybe consider limiting to even drier conditions.

Responses: Thank you for your comment. We have rewritten this description as. (Lines 297-302)

"The PWV retrieved from EKO instruments and CE-318 at the band near 940 nm are in good agreement..... However, under dry conditions, there is little difference between the retrieved PWV from BAND1 (around 940 nm) and BAND2 (around 1370 nm), simulations through radiative transfer modelling show that the retrieved PWV with band 1370 nm is closer to the "true"

value. Therefore, we proposed that a stronger water vapor band near 1370nm can be introduced for PWV retrieval at the dry atmospheres in case of the measurements are available. "