

Changes in the Revision

- (1) More details about the retrieval algorithm of MERSI-II PWV product are presented.
- (2) The analysis in section 4 is improved and section 4.2 is shortened.
- (3) The section 5 is removed.
- (4) The discussion is improved.
- (5) All figures are replaced.
- (6) Some related references are cited.
- (7) Some sentences are rewritten.
- (8) The English of the paper has been improved.

Responses to the Reviewer's Comments

Thanks for the reviewer to provide very useful comments and suggestions, and please see our responses in the following:

General Comments

(1) However, in my opinion section 5 is unnecessary and is not in line with the rest of the manuscript. I do not really see how it fits with the rest of the paper.

Response: Thank you. The detail of the retrieval algorithm of MERSI-II PWV is presented in the revision (lines 116-156, tracked manuscript).

(2) I recommend to seek help from a native speaker to revise the English writing.

Response: Thank you. The grammar, spelling, punctuation and phrasing of the paper has been improved.

(3) Regarding the use of IGRA PWV data, which is integrated up to 500 hPa, Zhang et al. (2018) showed that in tropical regions this can induce important dry bias (they reported a 9% error).

Response: Thank you. We consider the dry bias for the radiosonde PWV, and the related citation is added in the revision (lines 168-171). As discussed by Turner et al. (2003), the PWV obtained from radiosonde has an approximate 5% dry bias compared to that derived from the MWR. Therefore, there is an underestimation of PWV evaluation for taking the IGRA-derived PWV as a reference, and the bias found in tropical areas is ~9% (Zhang et al. 2018).

(4) MERSI-II uses solar radiation (NIR). Therefore, I think the solar zenith angle and the presence of clouds should be considered among the possible influence factors studied.

Response: Thank you and good suggestion. We have added the discussion about the effect of solar zenith angle and the presence of clouds, especially thin cloud (lines 137-138, 364-365, and 590-593).

Specific Comments:

(1) L50: Before the start of this paragraph I miss a small introduction to the fact that satellite retrieval methods can involve bands in different ranges of wavelengths (IR, NIR, VIS, MW,...).

Response: Good suggestion. The information of satellite-based retrieval of PWV is added in the revision (lines 60-62). Over the past few decades, the satellited-based

PWV retrieval algorithms are developed with the observations from different sensors, which mainly can be divided into four types according to the spectral region: (1) visible (VIS), (2) near-infrared (NIR), (3) thermal infrared (TIR), and (4) microwave (MW).

(2) From Eq. 5 it is clear that EE 15% is used, but this is not clarified in the text. Also, I would like the authors to clarify the Eq. 5, specifically the 0.05 value added to the $0.15 \cdot PWV_g$.

Response: Good suggestion. We have deleted the EE description in the revision.

(3) L179. Why the STD limit is 0.25 cm and not other value?

Response: Thank you. In the processing of satellite data, we hope to eliminate the PWV retrieval with a large variation in the selected 9×9 pixel box. But according to the comments from the reviewers, we are not using this criterion anymore and the data are recalculated.

(4) L267-268. Thin clouds are claimed to be the reason for MERSI-II underestimation during Summer. Can you provide some prove or reference for this claim? If not, maybe change the sence to a less definitive one.

Response: Thank you and good suggestion. We have rewritten this expression in the revision (lines 364-367). With abundant water vapor in summer, clouds are easily to form, however, thin clouds are difficult to be measured by satellite due to their low optical depth (Solbrig, 2009; Naumann and Kiemle, 2020). Therefore, the higher underestimation of PWV in summer is probably triggered by the weakened or covered radiation signal under the thin cloud.

(5) L333-337. I understand the logic of using one month data, but why April? This should be explained in the manuscript.

Response: Thank you. The section is removed in the revision.

(6) L343-344. Maybe this sentence should include a citation.

Response: Thank you. The section is removed in the revision.

Technical Corrections:

(1) L12: "626 sites" World-wide?

Response: Yes. The global evaluation is performed in this manuscript. The abstract and title is rewritten in the revision.

(2) L12-13: "both present the distribution opposite to latitude". Please rephrase this.

Response: Good suggestion. We have rephrased this sentence. The monthly averaged PWV from MERSI-II presents a decreasing distribution of PWV from the tropics to the polar regions.

(3) L15: "peak values". What is this?

Response: Thank you. This is the peak value in the histogram of the MB. The histogram of MB shows that the MB is concentrated around zero and mostly located within the range from -1.00 cm to 0.50 cm.

(4) L19: "falling" --> fall

Response: Thank you. This is changed.

(5) L20-21: please rephrase

Response: Thank you. This sentence is removed.

(6) L25: I would not use "part" here. Maybe "constituent" or "compound".

Response: Thank you and good suggestion. We have rephrased.

(7) L100: " m" should be micrometers.

Response: Thank you. This is changed in the revision.

(8) L164: "AERONET PWV and AERONET PWV". Maybe it could be something like "AERONET PWV with itself", to avoid repetition.

Response: Thank you and good suggestion. We have rephrased. The consistencies between the existing AERONET PWV and the temporal averaged AERONET PWV in various temporal discrepancy intervals from 1 h to 6 h with a step of 1 h, that is, 0–1 h, 1–2 h, etc., are analysed respectively.

(9) L311-312: Please rephrase this sentence (from "Obviously" to "interval")

Response: The section is removed in the revision.

(10) Fig. 6 and 7. I think X axis is the same (IGRA PWV), but it is labelled differently (PWV-RAOB, PWV-IGRA)

Response: The section is removed in the revision.

(11) Table 2. "Altitude" and "Latitude" got separated in two lines (Altitud-e, Latitud-e).

Response: Thank you. This section is deleted in the revision.