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:

(1) Line -106-7: Details about retrieval algorithm near-infrared Precipitable water vapor product from MERSI-II are missing and also give references.

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

(2) Which method was used to identify cloudless pixels?

Response: Thank you. the cloud mask (CLM) product of MERSI-II is used for the selection of cloudless pixels (lines 148-149).

(3) Section2.2: You have used Radiosonde & AERONET data as base for comparison with MERSI-II. But the Radiosonde & AERONET based data also associated with errors. Explain the possible sources of Radiosonde & AERONET errors in your analysis.

Response: Good suggestion. 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). The bias of AERONET is explored in the revision (lines182-184).

(4) Line 163: the consistency between the existing AERONET PWV and AERONET PWV measurements in various temporal discrepancy intervals from 1 h to 6 h is analyzed. I do not understand the paragraphs.

Response: Thank you. The paragraphs are rephrased in the revision (lines 214-216). 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 analyzed respectively.

(5) Line 177-178: For the MERSI-II, the spatial resolution at nadir is 1 km × 1 km for NIR bands, which are used for the retrieval of PWV. Therefore, we use the standard deviation (STD) of a box with 9×9 pixels to eliminate the invalid PWV measurement. In operation, we set a general principle that the STD of this selected box must be less than 0.25 cm and the value of the STD dividing the minimum within the selected box must be less than 1. Why you have set the limit of <0.25 cm? Why you have not set 1 or 2sigma STD to check the data quality.

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 box. But according to the comments from the reviewers, we are not using this criterion anymore and the data are recalculated.

(6) Line 172: Figure 1 Authors should recheck the caption.

Response: Thank you. We have replaced Figure 1 and the caption is improved.

(7) And line 189-191: In processing, all the PWV retrievals derived from MERSI-II within ±6 h of radiosonde release time are all collected and the closest PWV retrieval of MERSI-II within 100 km distanced from the IGRA site is selected and matched up with IGRA PWV. I could not catch the match up criteria applied by authors. Explain whether any interpolation technique used to interpolate the data from 1x1 Km to 100 Km.

Response: Thank you. There is no interpolation technique used here. The window of spatial distance is 100 km (however, it is replaced by 50 km in the revision), and the distance between the pixel of MERSI-II and the location of the radiosonde site can be calculated. And 1×1 km is the spatial resolution of the pixel. We have rephrased this in the revision (lines 248-250).

(8) Line 200-208: There is a lack of discussion about meteorological/physical interpretation in cause of High & Low PWV centers.

Response: Thank you. The interpretations in cause of High & Low PWV centers are presented in the revision (lines 265-270).

(9) Line 217-218: Give reference.

Response: Thank you. We have rephrased this sentence (lines 287-290).

(10) Line 230-232: The radiosonde ascents drift and vertical extent will be different over different geographical domains. Similarly, the collocations matchups of clear sky pixel retrievals will vary and hence the MB and MRB values also vary latitudinal.

Response: Thank you for your good suggestion. This part is deleted in the revision and the radiosonde ascents drift and vertical extent are discussed in the manuscript (lines 232-233, 299-301).

(11) Line 256-257: Why low CC values that smaller than 0.8213 are predominantly concentrated around the equator. Give some reasons.

Response: Thank you. It has been discussed in the revision (lines 343-348). There are large biases but small CC values over the equator, and that is possibly due to the following: 1) large residual IGRA PWV above 500 hPa (Boukabara et al., 2010); 2) high content and variation of PWV (Chen and Liu, 2016); 3) the covered surface with the reflectance does not linearly correlate with the wavelength (Gao and Kaufman, 2003); 4) a small number of samples. In addition, the temporal discrepancy can also lead to bias because the discrepancy in the equatorial region is slightly larger than in other regions overall. As discussed by Alraddawi et al (2018), for MODIS PWV, there are also noteworthy latitudinal decreases for MB, MRB and RMSE.

(12) Line 267: Give references.

Response: Thank you for the 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.

(13) Line 269-270: Whether RMSE values are higher under the wet conditions [summer (JJA), autumn (SON)] than under dry conditions [spring (MAM) and winter (DJF)].

Response: Thank you. Yes, there is a larger RMSE under the wet conditions than that under dry condition.

(14) Line280-281: Give explanation regarding underestimation of MERSI-II PWV with respect to IGRA PWV for all the months in the northern as well Southern Hemisphere.

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

(15) Line 286-287: Why the RMSE in the Northern Hemisphere is slightly smaller than that in the Southern Hemisphere. Give some possible reasons.

Response: Thank you. We have added explanations in the revision (lines 372-375). The RMSE in the Northern Hemisphere is slightly smaller than that in the Southern Hemisphere, where the greatest RMSE value is 0.49 cm in summer. There is a large oceanic coverage in the Southern Hemisphere, with a larger mean PWV than that in the Northern Hemisphere (Chen and Liu, 2016). Thus, this is a possible reason for large RMSE in the Southern Hemisphere, considering the increasing bias of the remote sensing PWV with the larger PWV value.

(16) Line 333: Rephrase the sentence.

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

(17) Line 348-350: the influence of haze is hardly corrected completely in the MERSI-II PWV retrieval algorithm. There is a high correlation between MERSI-II PWV and IGRA PWV, and the CC value is all above 0.8950. and the comparison of altitudes within 100-200 m presents a better performance.

Whether influence of haze correction is applied in retrieval of MERSI-II PWV? Please clarify and improve the discussion.

Response: Thank you. There is only the cloud detection in the retrieval with the cloud mask product. Therefore, the hazy with a low optical depth is hardly detected. There is no correction in the MERSI-II PWV retrieval algorithm, and this should be explored in the future. (lines 592-593).

(18) Line 356-367 Authors should mention values of MB and MRB.

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

(19) Line 388-391: It is not look like trend; It should be warm and seasonal variations of PWV. In the month of July, movement of monsoon trough towards foothill of Himalaya may increase the value of PWV. Whether Shimian site is located leeward side?

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

(20) Line 440:446: It is a simple comparison of two stations in respect of warm and cold seasonal variations of PWV. It is advised to do further case study combining the specific synoptic patterns (such as the background circulation, the thermodynamic conditions, etc.).

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