

Reply of comments

We are thankful for the valuable suggestions /comments of the learned referee for the paper Review of Inter-comparison of retrievals of Integrated Precipitable Water Vapour (IPWV) made by INSAT-3DR satellite-borne Infrared Radiometer Sounding and CAMS reanalysis data with ground-based Indian GNSS data. Ramashray Yadav et al.

Point wise reply is given below:

General observations:

The authors have made a good effort in the present study by evaluating inter-comparison of ground based GNSS, remote sensing by INSAT-3DR satellite and CAMS re-analysis model based observations. This type of study is very important for operational forecasting services especially tropical region where most of the weather system development is convective in nature and of course moisture development also affected global and local features (rugged terrains, plain, coastal, topography etc).

RC1: The authors are properly compiled the objective of the study in the manuscript and appropriate to publish in the journal. However, I have given few comments /suggestions to further improve the manuscript as follows:

Response: We agree with the general observations mentioned about the paper.

RC1: Title of the manuscript is too lengthy, possible to make short.

Response: We have revised the title of manuscript and made it short. As per the suggestion the revised title may be changed as “Inter-comparison Review of IPWV retrieved from INSAT-3DR Sounder, GNSS & CAMS Reanalysis Data”

RC1: During South West Monsoon season the Thiruvananthapuram (TRVM) has plenty of moisture available and ITCZ remain active while seasonal correlation coefficient with INSAT-3DR and GNSS is very low. Explain it and add appropriately in the text.

Response: The IPWV derived from INSAT-3DR is averaged over 30x30 Km which contains both sea and mountainous land together along with topographically diverse terrain pixels around the Thiruvananthapuram (TRVM), being a coastal station while IPWV derived from GNSS is column IPWV over the station. This is the reason why these are poorly correlated at coastal stations.

RC1: Why the author considered INSAT-3DR instead of INSAT 3D? Give reason or may be some important points about the difference between two satellites. So it makes the case to use of the INSAT-3DR data.

Response: The sounder payload of INSAT-3D and INSAT-3DR satellite are exactly same in terms of specification. The sounder payload of INSAT-3D satellited reached end of life in the month of May 2020 that's why INSAT-3DR sounder data are used in the present study.

RC1: "In this paper, CAMS & INSAT-3DR retrieval has been compared and statistically analyzed with GNSS data taking as reference". This is the paper objective only compare the two products from different sources? Mention the clear-cut objective and benefit of the study in last para of the introduction section.

Response: Necessary changes has been made as proposed (line-81-85).

RC1: Line 159: "The full aperture internal Black-body calibration is performed every 30 min or on **command based whenever**. This enables the derivation of vertical profiles of temperature and humidity". Explain it clearly the mechanism of calibration and correct the sentence appropriately. How it will be useful in operational forecasting and present work.

Response: Mechanism of calibration and how it is useful in operational forecasting and present work has explained in manuscript (line-166-173 & 175-177).

RC1: Line 179: You have used Ground based GNSS data as base for comparison with INSAT-3DR and CAMS data. But the GNSS based data also associated with errors and may behave differently over land, coastal and desert locations. Explain the possible sources of GNSS errors in your analysis after the sentence in the line 179.

Response: The other possible sources of error associated with GNSS data are mean temperature of atmosphere, dynamical pressure and isotropic errors. These errors will vary with location and time of observation. The same has been added in the revised manuscript (line-188-190).

RC1: Line 140: RMSE values for Jalpaiguri (JPGI) and Dibrugarh (DBGH) stations shown higher, is there any specific reason for this finding, is association of the data values is also behave same way?

Response: The observation points in case of Dibrugarh (DBGH) are more symmetrical (or association) than Jalpaiguri (JPGI) even RMSE values are higher (Figure 4).

RC1: Also please explicitly mention the importance of CAMS data in weather forecasting over Indian region in the manuscript.

Response: CAMS data is capable to capture large scale features of moisture flow and used to predicts large scale weather events such as western disturbances, cyclonic storm, monitoring of monsoon and same added in manuscript (Line 218-220)

RC1: It is suggested for future INSAT-3DR sounder PWV data performance over ocean and AERONET, PWV data as ocean play an important role and contributing differently thorough out the year.

Response: Yes, we agree with referee suggestions.

RC1: Besides these I could see other numerous minor typos/English grammar errors. I am listing few of them here and check carefully in whole manuscript.

Line No12: it may be retrieval data at the end

Line No 15: Complete the sentence-----appropriately.

Line 344 to 346: provide gap in mm in whole text whenever necessary and frame the sentence properly. Change it throughout the manuscript.

Line 403: use everywhere the same notation

Response: Necessary changes has been made in manuscript as proposed by referee.

We once again thank the reviewer for his/her constructive comments/suggestions which made us to improve the manuscript content significantly.