

Response to the Referee #1

Referee's comment: There is nothing new in the authors findings as INSAT-3d datasets are already validated against with different other datasets at different temporal scales. Also many existing articles are available that shows the importance of water vapor in predicting the storms. The authors neither show any improvements in the retrieval of INSAT-3D TPW nor show its applicability in statistical sense. Thus, I recommend 'Rejection' in its present form. Major concerns: 1) The motivation to the work is not clear as Ratnam et al. (2016) as already compared INSAT-3D datasets with other datasets.

Authors' response: It is to be noted that the India Meteorological Department (IMD) utilises the INSAT series of satellite data for day to day weather forecast on an operational bases. The timely availability of data is very important for issuing forecasting and nowcasting. To accomplish this on daily, monthly, and sub-divisional scale; satellite derived product is required for users, disaster management group and other services. Over of the period of time, for accuracy of satellite products and its authenticity, a proper calibration is required. In the present work, the GSICS calibration corrections (Global Space-based Inter-Calibration System) on Infra-Red (IR) sounder channels are incorporated at INSAT-3D Meteorological Data Processing System (IMDPS). TPW is derived using this corrected radiance. Subsequently, comparison of TPW with various other dataset is carried out for the validation purpose. This aims to produce corrections, ensuring the data consistency and allowing them to be used to produce globally homogeneous products for environmental monitoring.

In this paper, the analysis and validation justify the usefulness of current TPW product from INSAT-3D which was not exclusively studied by any other past study. Utilization of TPW product from INSAT-3D sounder is mainly in the nowcasting mode, operationally for weather purpose and it can also offer substantial opportunities for improvement in now casting studies. It is to be noted that TPW product utilised in the study incorporates the GSICS calibration corrections.

Referee's comment: How come one time RS observation serve as a representative of daily mean?

Authors' response: Twice observations over a day using RS were used for the comparison with daily TPW of INSAT-3D. Indeed, INSAT-3D TPW is not daily mean. Each RS was paired with

closest INSAT-3D TPW and patterned according to criteria suggested in Fuelberg and Olson (1991). The collocation criteria for INSAT-3D retrievals with RS and NOAA data are based on the following: (1) The absolute distance between the position (latitude and longitude) of the RS and the INSAT-3D retrievals has been considered as 0.5° (50 Km). This will minimize the differences arising from horizontal gradients. (2) The temporal difference between two sets of data is around ± 120 minutes depending on retrievals and location of the RS station. (3) The INSAT-3D/RS were matched at 0000 and 1200 UTC (refer line no. 172 to 179).

Referee's comment: INSAT-3D PWV measurements are available only during cloud free conditions then how the authors compared rainfall vs. pwv?

Authors' response: We use the mean TPW of INSAT-3D sounder while comparing with the rainfall/rain rate. Rainfall accumulated over a given day is compared with mean TPW of that day, if sky found to be clear over that day. When water vapor reaches to its saturation level in the troposphere, it becomes conducive for occurrence of rain. The higher TPW is expected prior/around the event of rain and vice-versa. Thus, the positive association between TPW and rainfall is obvious. Yes, since only clear-sky TPW is under consideration, there won't be one-to-one correspondence with rainfall. It is the limitation of this comparison.

Referee's comment: Literature survey is very poor.

Authors' response: Literature review has been updated (refer line no from 51 to 54).

Referee's comment: With one case study the authors are claimed that high TPW values can be used as a precursor to forecast thunderstorm. Is it true for all the thunderstorm cases as well as all high TPW will lead to thunderstorms?

Authors' response: As suggested by the reviewers, two more case study of thunderstorms has been included (refer line no from 275 to 303) in the modified manuscript. It can be seen that most of the thunderstorms analysis have good signature prior to the occurrence of weather events. This can be mentioned here that, IMD (Forecasters, FDP Storm, http://nwp.imd.gov.in/fdp_now/) is

regularly utilizing these data in pre-monsoon season for nowcasting services over the Indian region.

It was a mistake to consider higher TPW as a precursor to forecast thunderstorm. But along with other meteorological parameters (e.g., CAPE), higher TPW observed during thunderstorm events can be utilized for studying such events.

Referee's comment: The English is also very poor and difficult to follow.

Authors' response: The English correction is made and authors think that the manuscript is improved significantly.