Specific comments :

1. **Comment:** Line 87. When you mention GPM, are these IMERG data? GPM-IMERG is generally used.

Response: Yes, it is IMERG final run products. As per reviewer's suggestion, GPM will be changed to GPM-IMERG in the revised document

2. **Comment:** Line 140. Are the rain gauges (69 rain gauges) used for validation included in the GPCC? If not, please specify.

Response: The rain gauge data used for validation are not included in GPCC. It is evident from the GPCC's data contributors list (Wetter und Klima - Deutscher Wetterdienst - Our services - New data contributions to GPCC). The present study used data from the State Government of Tamil Nadu's Public Works Department (PWD). PWD is responsible for the execution of development works in the state and maintains a repository of meteorological station.

3. **Comment:** In Table 2, IMERG-GPM can go up to hourly.

Response: Yes, IMERG-GPM also has sub-daily and hourly data. The present study uses only daily resolution, which is mentioned as 'daily' in the Table. To bring more clarity, '#Temp' will be revised to 'Temporal resolution used in the present study' in the revised manuscript.

4. **Comment:** Why is there redundancy on the study regions in the methodology and study area in part 2?

Response: We thank the reviewer for observing the redundancy in the structure of the manuscript. We will merge sections 2.1 and 3.1. Considering Reviewer 3's comment number 11, Methodology has been added as Section 2. So, the revised section now looks like,

1. Introduction
2. Methodology
   2.1 Study region and Ground station
   2.2 Datasets
   2.3 Comparison of ground data with satellite and observational reanalysis-based data
      2.3.1 Grid scale comparison

2.3.2 District scale comparison

2.4 Evaluation metrics

3. Results
4. Discussion
5. Conclusion

5. **Comment:** Figure 1. It's a bit strange that the ground stations are very aligned. How is this possible? There are rain gauges in the mountains even though the area is supposed to be difficult to access.

Response: The appearance of a regular gridded station distribution is a result of how the data were selected for homogenous distribution within the districts. The datasets used in this study were collected from the Public Works Department (PWD) of Tamil Nadu, which collects and maintains meteorological data for the entire state. Additionally, each selected study region has a State-owned Agricultural University with many crop-specific research institutes, including the Wheat Research Station in Coimbatore, located at a higher altitude. These institutes provide both agro-meteorological and hydro-meteorological data, enabling coverage even in mountainous regions. According to Rajeev et al. (2005), the southern Peninsular region, where the study is located, has a higher density of meteorological stations. When these datasets are combined at the state level, the station data may appear to be distributed in a regular grid, even though the actual distribution is more varied.

A similar response has been addressed to Reviewer 2's Comment No: 6.

6. **Comment:** Line 253. Doesn't this already introduce a large bias for the data used for validation? In other studies, "point-gridded" is used. Because the location of rain gauges most often does not coincide with gridded precipitation products (GPP) grid centroids, a second strategy was implemented: the point-gridded approach. In practice, a cell is delineated around each rain gauge (cell size of 0.04, 0.05, or 0.1°... depending on the GPP; Table. 2). Then, the rainfall value in those new cells was estimated as the area-weighted mean (max. 4) of the GPP grid cells overlapping with the new cell.

Response: Previous studies have used interpolated ground station data to evaluate precipitation products (Liu et al., 2015, Duan et al. 2016, Shukla et al. 2019). Since the real stations are arranged almost in a regular grid, we can expect low interpolation errors. This is also shown by the LOOCV analysis below.

We performed a LOOCV analysis on the linear interpolated data to check for bias or uncertainty in the data. LOOCV was performed on linear interpolation based on assuming that the value of a station was unknown. The unknown station was estimated from the value of the neighboring stations based on linear interpolation. The analysis was systematically carried out in Python.

Table: LOOCV performance of Linear interpolation of precipitation at monthly timescale

Study Region	Mean RMSE (mm)	Percent Mean Absolute Error (%)
Coimbatore	39.22	36
Madurai	52.50	30
Tiruchirappalli	39.93	29
Tuticorin	42.32	25

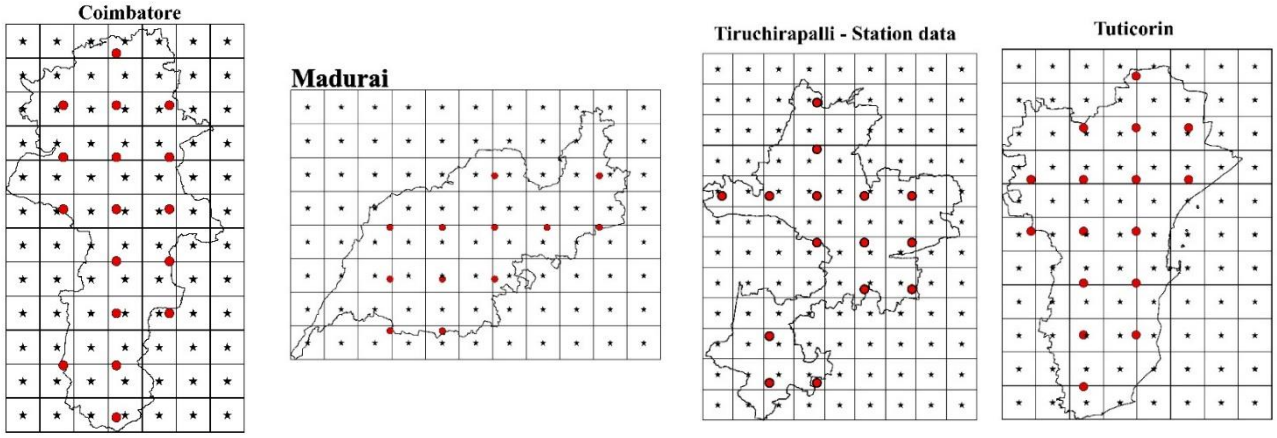

Figure: Linearly interpolated grids (0.1°) of the study regions along with the station data. In the figure above, red points denote the distribution of station datasets. The grids and the stars represent the linear interpolation. Only grids that are surrounded by at least one rain gauge station were included in the analysis to avoid uncertainties in the analysis.

Results.

7. **Comment:** Grid scale/district scale method are not really mentioned in the methodology part.

Response: We agree with the reviewer's comment that the methodology does not clearly mention the grid scale/district scale. The following section has been added to the revised manuscript:

2.3.1 Evaluation at Grid scale: The interpolated station dataset was used as ground truth to evaluate all the other downscaled precipitation products at 0.1° spatial scales. The evaluation was considered for grids having at least one rain gauge in the surrounding grids.

2.3.2 Evaluation at district scale: The gridded precipitation from all grids containing at least one rain gauge in the surrounding grids were averaged for to represent the district precipitation distribution. This way, district-level precipitation was estimated for station data and precipitation products. The developed district-level data was then evaluated, keeping the station value as a ground truth for the precipitation products.

8. **Comment:** Monsoon/Non-Monsoon not clear in the methodology.

Response: We agree with the reviewer's comment that Monsoon/Non monsoon description is not sufficiently mentioned in the methodology. The following section is added to the revised manuscript.

Since the study region has abundant rainfall during the monsoon months, which is significantly higher than the rest of the months, the study evaluated the performance of the products during the monsoon and non-monsoon seasons. The study region falls under the North East monsoon zone from October to December (Table 1). So, average precipitation values of October, November, and December were taken as monsoon months. The average precipitation for the rest of the year, i.e from January to September, was taken as Non-monsoon months.

Discussion

9. **Comment:** The first paragraph seems out of place and confuses the reader. Start directly by discussing the results.

Response: We removed the first paragraph in the revised manuscript and will start by discussing the results.

10. **Comment:** Line 665. Why are ERA-5 Land and MSWEP performing better than others? Algorithms used? Reanalyzed products? Is this the case for other studies?

Response: ERA5-Land performs better than other products as it was developed based on replay of land component with H-TESSEL model. This brings a special improvement compared to ERA5 and is producing best results compared to other products used in this study (Muñoz-Sabater et al., 2021). Similar results have been reported by Kolluru et al. (2020). MSWEP uses ensemble of different precipitation products which contributed to its best estimations; Nair and Indu (2017) also reported similar results for MSWEP performance in India.

11. **Comment:** Line 687. From what rainfall intensity does ERA-5 Land struggle to detect?

Response: ERA5Land struggles to detect precipitation intensity of more than 10mm /hour in Coimbatore, and hence, it mostly underestimates compared to the station data. In Madurai, higher underestimations are observed for intensity above 20 mm/hour. At Tiruchirapalli, precipitation intensity of 5 mm/ hour is accurately detected above which, ERA5Land overestimates. In Tuticorin, ERA5Land closely follows station data at all the precipitation intensity.

12. **Comment:** Line 694 – 704. The entire paragraph should be dispatched into other paragraphs to properly explain the reasons for the performance of precipitation products compared to others."

Response: In accordance with the reviewer's suggestion, the mentioned paragraph will be explained near the relevant results.

Technical comments :

13. **Comment:** Line 266. What do all the terms mean? *Pi, ...*

Response: Pi denotes the value of the precipitation Product at time I, whereas $\bar{P}$ denotes the average. The explanations will be added in the revised manuscript.

14. **Comment:** Line 283. Equation 7 not mentioned in the text.

Response: It will be included in the revised manuscript

15. **Comment:** Same for Eq. 8, 9, 10

Response: It will be included in the revised manuscript

16. Comment: Line 290. Equation 11 instead of Equation 7.

Response: It will be included in the revised manuscript

17. Comment: Equation 12 not mentioned in the text.

Response: It will be included in the revised manuscript

18. Comment: Line 302. Equation 13 instead of Equation 9.

Response: It will be included in the revised manuscript

19. Comment: Review all Equation numbers.

Response: Reviewed and revised in the revised manuscript

References

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Environmental Science and Technology, 20, 10179–10204, https://doi.org/10.1007/s13762-022-04524-x, 2023.

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