

Comparisons between the GSMaP and the IMERG Near-real-time products over the India

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1. Introduction & Purpose

Global Satellite Mapping of Precipitation (GSMaP), which is the Japanese product of the Global Precipitation Measurement (GPM) mission, is merged satellite precipitation product provided by JAXA, and there are multiple types (Kubota et al. 2020). The near-real-time version (GSMaP NRT: NRT) and the near real-time rain gauge adjusted version (Gauge NRT: GNRT) are provided approximately 4 hours after observation. The GSMaP algorithm was updated in December 2021, and algorithm version 8 (v8) was released, which is expected to be a more accurate product.

On the other hand, NASA provides a merged satellite precipitation product named as Integrated Multi-satellite Retrievals for GPM (IMERG). One of the IMERG product is IMERG Early Run Version 06 (IMERG-E), which is provided with a latency of about 4 hours (Huffman et al. 2020).

Recently, the GSMaP-ISRO (G-ISRO) has been developed by the ISRO-JAXA cooperation and the precipitation estimates are adjusted by the Indian Meteorological Department (IMD) daily gridded rainfall (Kumar et al. 2022). Improvements of the G-ISRO were significant in orographic regions with high rainfall amounts, mainly the western Ghats and northeastern parts of India.

In this study, we focused on India and evaluated the precipitation accuracy of NRT, GNRT, and IMERG-E, which are products with almost the same delivery time delay, compared to G-ISRO.

Table 1 : Precipitation average of NRT,GNRT,IMERG-E and G-ISRO in all of India and W-Ghats. Units are mm/day.

	NRT	GNRT	IMERG-E	G-ISRO
India	2.85	3.16	4.06	3.15
W-Ghats	4.13	5.25	5.96	8.70

Focusing on all of India, IMERG-E is overestimated especially Himalayan Range (80°E, 27°N) and Eastern Ghats(80°E,17°N). GNRT is slightly overestimated compared to G-ISRO, but it is underestimated in North-East India (e.g. 95°E,27°N). Focusing on W-Ghats, all of products are underestimated, especially NRT.

(2) RMSE and rank correlation coefficient

Figure 3 shows distribution of RMSE and Spearman's rank correlation coefficient (rank CC). Table 2 shows RMSE and CC average.

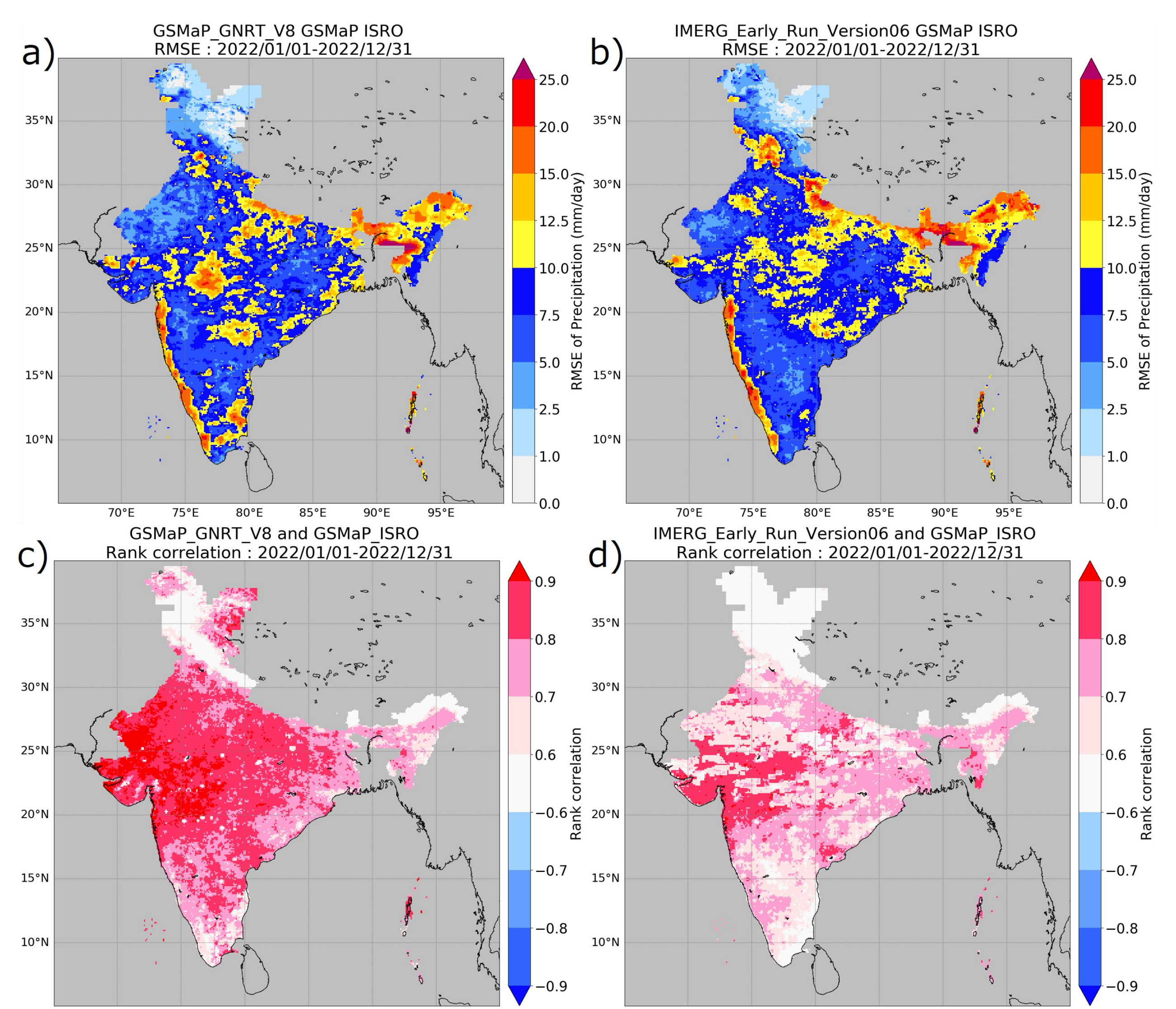


Figure 3 : Distributions of RMSE for a) GNRT, b) IMERG-E and rank-CC for c) GNRT and d) IMERG-E. Units of RMSE are mm/day.

Table 2 : RMSE and rank CC of NRT,GNRT,IMERG-E and G-ISRO in all of India and W-Ghats. Units of RMSE are mm/day.

	RMSE (mm/day)			Rank cc		
	NRT	GNRT	IMERG	NRT	GNRT	IMERG
India	8.72	8.58	9.01	0.73	0.77	0.64
W-Ghats	15.27	14.13	15.25	0.68	0.71	0.71

Focusing on all of India, RMSE for GNRT and NRT are smaller than IMERG-E, Rank CC of GNRT and NRT are larger than IMERG-E. This shows NRT and GNRT are more accurate than IMERG-E in all of India, especially GNRT. Focusing on W-Ghats, RMSE of GNRT is the smallest in the other product. On the other hand, rank cc of GNRT and IMERG-E shows same value.

4. Conclusion

We evaluated NRT, GNRT, and IMERG-E comparing to G-ISRO. This study shows that NRT, GNRT, and IMERG-E have same problems for estimation of orographic rainfall. Focusing on W-Ghats, rain average of IMERG-E is the closest to G-ISRO while RMSE of GNRT is the most accurate and cc of GNRT is the same value of IMERG-E. Focusing on all of India, GNRT is slightly more accurate than IMERG-E.

References

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2. Method

Evaluated period is over one year, from 1st January 2022 to 31st December 2022. We focused on all of India and Western Ghats (W-Ghats), which is known as a place of orographic rainfall. Figure 1 shows the area we focused on. Data detail is as follows:

Evaluated data

- NRT
- GNRT
- IMERG-E

True data

- G-ISRO

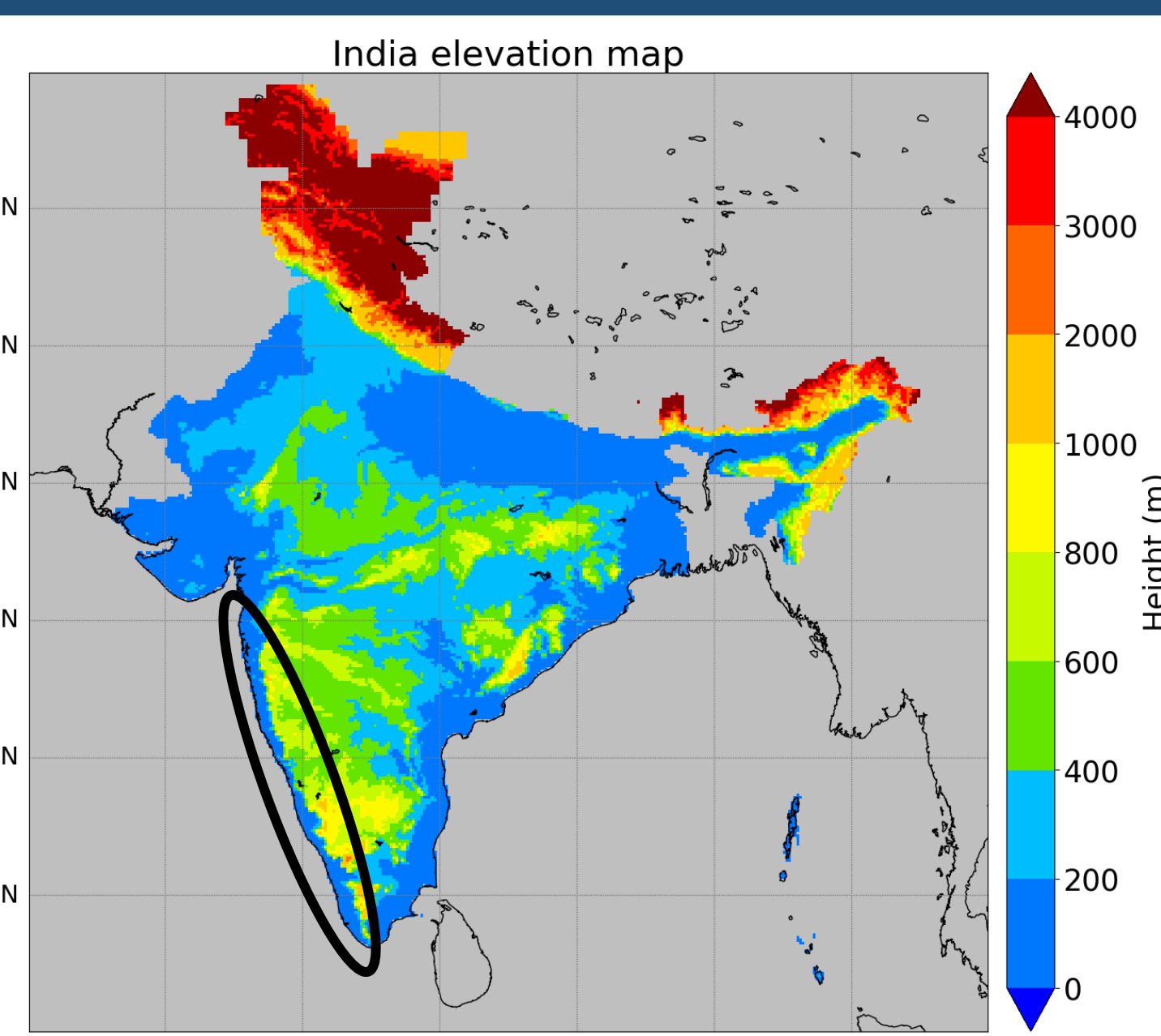


Figure 1: Areas of India in this study. Western Ghats is the enclosed area by black line.

3. Result

(1) Average

Figure 2 shows distribution of precipitation average from January to December 2022 and Table 1 shows precipitation average in each area.

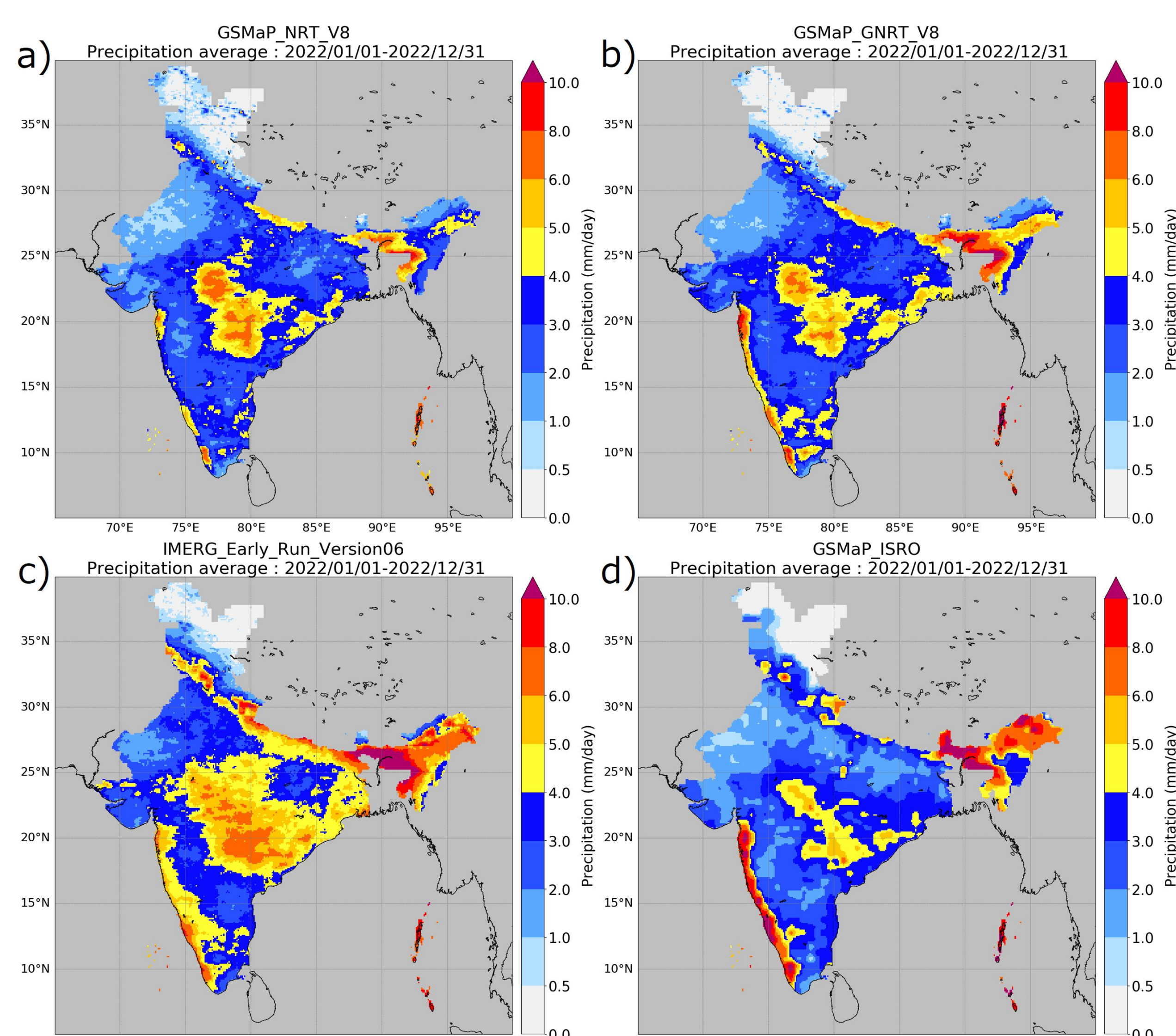


Figure 2 : Distributions of annual surface precipitation amounts for a) NRT, b) GNRT, c) IMERG-E, and d) G-ISRO. Units are mm/day.