

Assessment of Global Satellite Mapping of Precipitation Data for Rainfall Measurement in Bangladesh

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Abstract

Rainfall is one of the most challenging atmospheric parameters to measure because of its significant variations in space and time. This study aims to evaluate the Global Satellite Mapping of Precipitation (GSMaP) Version 8 (V8) and Version 7 (V7) data of spatial resolution $0.1^\circ \times 0.1^\circ$ with Bangladesh Meteorological Department (BMD) observed rainfall data during 2015-2022. Daily rainfall data of GSMaP V8 and V7 are extracted at 35 BMD station locations. This research compares the country's average daily, monthly, seasonal, and yearly GSMaP rainfall data with rain gauge measurements. The daily correlation coefficient between observed and GSMaP V8 (V7) rainfall was 0.50 (0.44), indicating moderate agreement. Notably, the monthly correlation coefficient for GSMaP V8 (V7) was a substantially higher value of 0.94 (0.87) compared to the daily. The root mean square error of V8 (V7) in daily scales was less, and the value was 11 (14) compared to that of the monthly value 100 (100). GSMaP V8 (V7) data was overestimated (underestimated) in both daily and monthly scales with values 2 (-1) and 52 (-17), respectively. BMD operationally uses the five types of threshold rainfall (in 24 hours) events: Very Heavy Rainfall (VHR > 88 mm), Heavy Rainfall ($88 \text{ mm} \geq \text{HR} > 43$ mm), Moderate Heavy Rainfall ($43 \text{ mm} \geq \text{MHR} > 22$ mm), Moderate Rainfall ($22 \text{ mm} \geq \text{MR} > 10$ mm) and Light Rainfall ($10 \text{ mm} > \text{LR} \geq 1$ mm). BMD (GSMaP V8) recorded 3 (5) VHR, 61 (35) HR, 166 (101) MHR, 397 (269) MR, and 961 (1009) LR events during the study period 2015-2022. Seasonal rainfall analysis reveals that GSMaP V8 provides more accurate estimates for winter, pre-monsoon, and post-monsoon seasons, while V7 performs better in measuring monsoonal rainfall than V8. Overall, the study contributes to our understanding of the performance of satellite-based rainfall datasets and their implications for meteorological and hydrological applications in Bangladesh.