Evaluation of rainfall datasets from CHIRPS and WorldClim in Meghalaya, India

Pratibha T. Das*, Dimpul Sonowal, Ranjit Das and S. P. Aggarwal
North Eastern Space Applications Centre, Department of Space, Govt of India, Umiam 793 103, India

Limited ground-based rainfall information has posed significant obstacles to hydrological, agricultural and related studies in Meghalaya, India. In this study, rainfall products were validated against ground-based rain gauge data from the India Meteorological Department, over three seasons. Both qualitative categorical metrics – probability of detection, false alarm rate, critical success index and frequency bias index, as well as quantitative statistical measures including Pearson correlation coefficient (*r*), Nash–Sutcliffe efficiency, relative bias, RMSE-observations standard deviation ratio, were computed to evaluate rainfall from CHIRPS and WorldClim. The quantitative statistics showed that the total rainfall estimated by CHIRPS provided better estimates than WorldClim during pre-monsoon (February–May) and post-monsoon (October–January). Neither dataset could provide good estimates of rainfall during the monsoon season (June–September). From this study, we found that CHIRPS is a reliable alternate source of rainfall data for Meghalaya with a limited rain gauge network.

Keywords: CHIRPS, IMD, Meghalaya, rainfall, WorldClim.

carefully evaluated, and site-specific evaluation should be done before utilisation.

To date, several studies have evaluated satellite-based rainfall products against rain gauge data[6–10]. However, these studies have primarily focused on either global scales or specific regions, which may not be directly applicable to the conditions in Meghalaya. Additionally, there has been no research specifically addressing this issue for Meghalaya. Hence, there is a significant gap in the literature regarding the evaluation of satellite-based rainfall products for various uses in Meghalaya.

This study aims to compare CHIRPS v2.0 and WorldClim rainfall estimates with rain gauge data by assessing error statistics. Rain gauge observations were collected for five districts in Meghalaya viz. West Khasi Hills, South West Khasi Hills, Ri-Bhoi, East Khasi Hills, and West Jaintia Hills. The analysis was based on monthly gauge data of 25 years covering the period from 1997 to 2021 for the study area. The study also examines how well the rainfall estimates from CHIRPS v2.0 and WorldClim datasets perform across different seasonal periods, such as October to January (ONDJ), February to May (FMAM), and June to September (JJAS). Based on the calculated statistics, the study assesses the suitability of these datasets for the studied region.

Study area