Seasonal intercomparison of observational rainfall datasets over India during the southwest monsoon season

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Abstract

The Indian monsoon is an important component of Earth's climate system, accurate forecasting of its mean rainfall being essential for regional food and water security. Accurate measurement of rainfall is essential for various water-related applications, the evaluation of numerical models and detection and attribution of trends, but a variety of different gridded rainfall datasets are available for these purposes. In this study, six gridded rainfall datasets are compared against the India Meteorological Department (IMD) gridded rainfall dataset, chosen as the most representative of the observed system due to its high gauge density. The datasets comprise those based solely on rain gauge observations and those merging rain gauge data with satellite-derived products. Various skill metrics and subjective comparisons are carried out for the Indian region during the southwest monsoon season (June–September). Relative biases and skill metrics are documented at all-India and sub-regional scales. In the gauge-based (land-only) category, Asian Precipitation – Highly-Resolved Observational Data Integration Towards Evaluation of water resources (APHRODITE) and Global Precipitation Climatology Center (GPCC) datasets perform better relative to the others in terms of a variety of skill metrics. In the merged category, the Global Precipitation Climatology Project (GPCP) dataset is shown to perform better than the Climate Prediction Center Merged Analysis of Precipitation (CMAP) for the Indian monsoon in terms of various metrics, when compared with the IMD gridded data. Most of the datasets have difficulties in representing rainfall over orographic regions including the Western Ghats mountains, in Northeast India and the Himalayan foothills. The wide range of skill metrics seen among the datasets and even the change of sign of bias found in some years are causes of concern. This uncertainty between datasets is largest in Northeast India. These results will help those studying the Indian monsoon region to select an appropriate dataset depending on their application and focus of research.