Comparing two high-resolution gauge-adjusted multisatellite rainfall products over India for the southwest monsoon period

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Abstract

Reliable high-resolution rainfall estimates are vital for hydrological and weather/climate related applications, and evaluation of high-resolution numerical model outputs. Multi-satellite rainfall products provide immense opportunities to analyze rainfall at regular spatial and temporal scales, but suffer from large region- and season-dependent biases. Direct calibration or merging of ground-based observations with multi-satellite rainfall estimates essentially provide more accurate rainfall estimates as it benefits from the relative merits of both the sources. In this paper, two popular gauge-adjusted multi-satellite rainfall products namely, the Tropical Rainfall Measuring Mission (TRMM) Multi-satellite Precipitation Analysis (TMPA) research monitoring 3B42 version 7 (3B42V7) and Climate Prediction Center (CPC) Rainfall Estimation Algorithm version 2 (RFE2.0) are compared with recently released and improved gridded India Meteorological Department (IMD) gauge-based rainfall estimates over India. The comparison is done for a 13-year southwest monsoon season ranging from 2001 to 2013 at 0.25° latitude/longitude resolution. A number of skill metrics such as mean, bias, coefficient of variation, correlation coefficient, anomaly correlation, pattern correlation, and root-mean-square error (RMSE) are computed to assess the accuracy of both the merged satellite-gauge rainfall products. The prominent Indian monsoon rainfall features are well captured by both 3B42V7 and RFE2.0 products, in general. However, they overestimate mean rainfall at all-India scale and the overestimation is comparatively larger for RFE2.0 than 3B42V7. Even though the inter-annual variability of the Indian monsoon rainfall from both the gauge-adjusted multi-satellite data sets is comparable with the gauge-based estimates for the study period, RFE2.0 overestimates light rainfall and underestimates heavy rainfall. Moreover, the comparison at sub-regional scales shows that 3B42V7 overestimates rainfall over the eastern India and the foothills of the Himalayas and underestimates along the west coast and over the northeast, whereas RFE2.0 underestimates monsoon rainfall over the three sub-regions except over the eastern India where it overestimates rainfall by about 25%. Both the gauge-adjusted multi-satellite rainfall products show larger RMSE of the order of 100% along the west coast of India, which is a reason of concern. Overall analysis suggests that 3B42V7 is superior to RFE2.0 at synoptic scale over the Indian monsoon region.