Error characterization of TRMM Multisatellite Precipitation Analysis (TMPA-3B42) products over India for different seasons.

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Abstract

A comprehensive error characterization of satellite-based precipitation products is vital for advancement of precipitation algorithms, evaluation of numerical model outputs, and their integration in various hydro-meteorological applications. The Tropical Rainfall Measuring Mission (TRMM) Multi-satellite Precipitation Analysis (TMPA) products are in high demand to users for numerous applications. The latest version 7 (V7) of TMPA products are assumed to be better than its previous versions due to substantial changes in input data sets and algorithm. The TMPA algorithm is also a benchmark algorithm for the Global Precipitation Measurement (GPM) mission multi-satellite precipitation products. In this study, both near-real-time (TMPA-RT) and research-quality (TMPA-V7) TMPA data sets are extensively evaluated against gridded gauge-based data over India for pre-monsoon, monsoon, and post-monsoon seasons at daily scale for a 13-year (2001–2013) period. The systematic and random error components in TMPA data sets are decomposed for their wider usage in agricultural and hydrological applications. Although TMPA-V7 and RT data sets represent the mean seasonal rainfall characteristics reasonably well, both the satellite-based data sets show an overestimation of rainfall over most parts of the country except over the orographic regions. However, TMPA-V7 is better than TMPA-RT when compared with the reference observations. Both the TMPA products show larger systematic error over the mountainous regions of northeast India. TMPA-RT has larger random error than TMPA-V7 possibly due to difference in calibration methods for the development of these data sets. Both the satellite-based data sets show significant difference from the reference observations for light to moderate rainfall ranges especially in the monsoon season. Larger error associated with systematic component in both the data sets is found during the pre-monsoon season. Furthermore, bias and error in satellite-derived rainfall data show a considerable inter-annual variation. Overall results suggest that a suitable region and season dependent bias correction is required in TMPA data sets before its integration in hydrological applications.