Validation of Satellite Rainfall Products over the Upper Blue Nile Basin

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Abstract

The accuracy of three widely-used, near-global, high-resolution satellite rainfall products (CMORPH, TMPA-RT v7, TMPA-RP v7) is assessed using relatively dense networks of rain gauges deployed at two experimental sites that represent extreme topographic features of the Blue Nile River Basin: (1) low-elevation grid located in the lowland plain of the basin, and (2) high-elevation grid located in the highland mountainous region of the basin. Results show that the accuracy of satellite rainfall estimates depends on rainfall rate, underlying topography, and retrieval algorithm. The satellite estimates produce a positive bias for light rainfall and negative bias for moderate and heavy rainfall, and are less capable of detecting rainfall at the high-elevation site. CMORPH and TMPA-RT overestimate mean rainfall at the low-elevation site but underestimate it at the high-elevation site. TMPA-RT and TMPA-RP underestimate frequency but overestimate intensity of rainfall in both regions. Of all the products, CMORPH shows superior performance in estimating the temporal fluctuation of rainfall, detecting rain, and capturing the diurnal cycle of rainfall. However, CMORPH is the most biased estimate. TMPA-RT and TMPA-RP provide lower bias, but this comes as the result of two substantially large errors that tend to cancel each other while computing the bias: substantial underestimation of rainfall occurrence and substantial overestimation of rain intensity. Although the TMPA-RP estimates are primarily developed to remove the bias and improve the overall accuracy of the TMPA-RT estimates, the TMPA-RP estimates show by far inferior performance than the TMPA-RT estimates by all accounts including bias. Of all three satellite rainfall products considered, TMPA-RP shows the worst and unacceptable performance by all accounts.

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