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Error analysis of satellite rainfall products over complex terrain basins

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Floods occurring in complex terrain basins are mainly triggered by heavy precipitation events. Therefore, accurate quantitative precipitation estimation (QPE) is of great importance since it provides the main forcing variable for flood modeling and prediction. Rainfall estimation over complex terrain poses a great challenge cause in-situ observations are scarce and weather radar suffer from beam blockage. Currently, there exist various satellite-retrieved precipitation products with high spatiotemporal resolutions and quasi-global coverage, which enables global scale hydrologic applications and may offer an alternative source of QPE over complex terrain. However, use of satellite rainfall data in hydrologic modeling requires understanding of the errors in satellite retrievals at the basin scale. In this study, three satellite-rainfall products (TRMM-3B42, CMORPH and PERSIANN) are evaluated with respect to their performance in capturing heavy precipitation events over a range of basin scales at the Alto-Adige region of northeast Italy. Basin-average rainfall data derived from a dense rain gauge network in the region are used as reference. Satellite error analyses are performed for cold (November to next year April) and warm (May to October) season months as well as for different quantile ranges of storm totals. Overall, no single precipitation product can be considered ideal for detecting extreme events. Results show better estimation during the warm season months especially for CMORPH algorithm. Satellite retrievals exhibit a dynamic bias ranging from significant overestimation to underestimation as rainfall thresholds increase. Moreover, in the condition of overestimation, smaller basin scales yield lower biases. In the underestimation of heavier rainfall events, more consistent results are obtained in larger basin scales.