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An algorithm for blending multiple satellite precipitation estimates with in situ precipitation measurements in Canada

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This study proposes an algorithm for blending multiple satellite precipitation estimates (SPEs) with in situ gauge precipitation measurements in Canada. Depending on the number of gauge stations in the target area, the algorithm employs gauge data alone or blends gauge data with the corresponding SPEs that have been corrected for biases using a novel bias removal procedure developed in this study. The performance of this algorithm is evaluated in terms of root-mean-square error (RMSE), frequency bias index, and Pierce skill score, using 10 year gauge data from southwestern Canada where there are enough valid gauge stations to be split into a training data set and an evaluation data set. Sensitivity of the algorithm to gauge density is assessed by using five training data sets representing sparse to moderate gauge densities. The results show that, in comparison with the SPEs and a kriging analysis of gauge data, the blended analysis has the smallest RMSE and is least biased and most skillful in all seasons, and that the lower the gauge density, the more superior the blended analysis is. When gauge density is low, kriging analysis of gauge data is worse than bias-corrected SPEs. The unadjusted SPEs are the worst by all measures considered, which indicate a need for a proper correction of biases in the SPEs. The blending algorithm is promising for producing a more realistic gridded precipitation, especially for gauge sparse regions, such as northern Canada. A blended analysis of monthly precipitation is produced and compared with several existing precipitation analyses.