An Improved Technique for Post-Processing Solid Precipitation Time Series from Automated Accumulation Gauges

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ABSTRACT

The unconditioned data retrieved from automated operational accumulating precipitation gauges is inherently noisy due to the sensitivity of the instruments to mechanical and electrical interference. This noise, combined with diurnal oscillations and signal drift from evaporation of the bucket contents, can make accurate precipitation estimates very challenging. Compared with rainfall, relative errors are exacerbated for the measurement of solid precipitation because of lower accumulation rates and the systematic undercatch of solid precipitation due to wind. We have explored three post-processing techniques to filter cumulative precipitation time series derived from high-frequency bucket weight measurements: Operational 15 Minute (O15), Neutral Aggregating Filter (NAF), and Supervised Neutral Aggregating Filter (NAF-S). Inherent biases in these post-processing techniques have uncovered the need for a robust automated method to derive a clean precipitation time series from high-frequency bucket weight measurements that have varying levels of noise, diurnal signals, and evaporation. This study looks at the issues with current post-processing techniques and introduces a new automated method called the Segmented Neutral Aggregating Filter (NAF-SEG). The automated NAF-SEG technique filters 1-minute cumulative precipitation time series in 24-hour segments within three overlapping moving windows per day. The evaluation utilizes simulated data as a control but also applies the technique to real-world data collected from several WMO Solid Precipitation Inter-Comparison Experiment (SPICE) sites. Performance metrics are characterized using total seasonal bias, RMSE, and Pearson's correlation coefficient. The NAF-SEG post-processing technique shows substantial improvement over current automated techniques, contributing to the overall accuracy of gauge measurements of solid precipitation.

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