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Quantitative precipitation estimation in the Nam Co Basin with X-band dual-polarization weather radar

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The Tibetan Plateau (TP) is home to the largest number of high-altitude lakes on Earth. Nam Co is the third largest lake on TP. Obtaining accurate precipitation data at the Nam Co basin scale is crucial for a deeper understanding of the water cycle and related atmospheric processes in cold high-altitude lake basins, and it also provides solid data support for the innovation of precipitation remote sensing inversion algorithms and the improvement of regional climate models. The Institute of Tibetan Plateau Research, Chinese Academy of Sciences, has established a multi-scale precipitation observation platform in the Nam Co basin, with the goal of accurately obtain precipitation data with high spatial and temporal resolution at the basin scale. The platform is equipped with an X-band dual-polarization weather radar, a micro-rain radar, a Double Fence Intercomparison Reference (DFIR) gauge, two raindrop spectrometers, and 24 rain gauges (including 5 T-200B weighing-type rain gauges and 19 Hobo tipping-bucket rain gauges) distributed around the lake area. The X-band dual-polarization weather radar is capable of monitoring the reflectivity and polarization characteristics of precipitation particles within the basin, while other instruments assist the radar in accurately estimating the amount of precipitation at the basin scale.

Uncertainty and bias in precipitation measurement significantly impact the accurate estimation of precipitation in cold high-altitude regions, making the correction of precipitation measurements from different rain gauges essential. The DFIR system, due to its high-precision observation capabilities, is used as the benchmark for precipitation measurement to correct the observations from T-200B and Hobo gauges. Quality control of radar data is crucial for achieving accurate quantitative precipitation estimation (QPE). Therefore, it is necessary to improve the quality of radar data through steps such as denoising, elimination of non-meteorological echoes, systematic error correction, bright band correction, and attenuation correction. Based on quality-controlled radar data, corrected rain gauge data, and raindrop spectrometer data, we have developed QPE methods to achieve accurate estimation of precipitation for the Nam Co basin.