Evaluation and Comparison of the GWR Merged Precipitation and Multi-Source Weighted-Ensemble Precipitation based on High-density Gauge Measurement.

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Abstract

Accurate estimation of precipitation in both space and time is essential for hydrological research. We compared multi-source weighted ensemble precipitation (MSWEP) with multi-source fused satellite precipitation (CHIRPS) based on high-density rain gauge precipitation observations in the Taihu Lake basin. We proposed a new merge precipitation algorithm GWRMP based on the geographically weighted regression (GWR) method. GWRMP corrects the bias of MSWEP by using high-density rain gauge precipitation to address the common problem of daily precipitation underestimation in MSWEP. The large-scale spatial coverage of the water surface in this region leads to the uneven distribution of rain gauges on the lake. There are differences in the descriptive ability of the three spatial precipitation types, MSWEP, GWRMP, and IDW, for spatial and temporal precipitation information in the Taihu Lake basin. A comparison shows that GWRMP has a significant advantage in obtaining the spatial and temporal variability of precipitation in areas with complex topographic conditions. GWRMP compensates the problem of underestimation of precipitation by MSWEP (10% to 25%), and avoids the risk of the high dependence of IDW on rain gauges, and improves the accuracy of spatial and temporal precipitation in large lake areas with sparse distribution of rain gauges (Pbias limited to 10%). GWRMP improved the estimation for different rainfall intensities in the Taihu Lake basin, especially in the mid-level rainfall and above precipitation frequencies. Compared with IDW and MSWEP, GWRMP is more suitable for intense precipitation monitoring and storm flood frequency study in the basin. Therefore, GWRMP is a better choice for spatial and temporal estimation of precipitation in the Taihu Lake basin. The GWRMP algorithm can be applied to other regions with unevenly spaced high-density rain gauges.

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