Site-Specific Error-Cross Correlation-Informed Quadruple Collocation Approach for Improved Global Precipitation Estimates

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Abstract

To improve global risk management, understanding the characteristics and distribution of precipitation is crucial. However, obtaining spatially and temporally resolved climatic data remains challenging due to sparse gauge observations and limited data availability, despite the use of satellite and reanalysis products. To address this challenge, merging available precipitation products has been introduced to generate spatially and temporally reliable data by taking advantage of the strength of the individual products. However, most of the existing studies utilize all the available products without considering the varying performances of each dataset in different regions. Comprehensively considering the relative contributions of each parent dataset is necessary since their contributions may vary significantly and utilizing all the available datasets for data merging may lead to significant data redundancy issues. Hence, for this study, we introduce a site-specific precipitation merging method that utilizes the Quadruple Collocation (QC) approach, which acknowledges the existence of error-cross correlation between the parent datasets, to create a high-resolution global daily precipitation data from 2001-2020. The performance of multiple gridded precipitation products are first evaluated per region to determine the best combination of quadruplets to be utilized in estimating the error variances through the QC approach and computation of merging weights. The merged precipitation is then computed by adding the precipitation from each dataset in the quadruplet multiplied by each respective merging weight. Our results show that our approach holds promise for generating reliable global precipitation data for data-scarce regions lacking spatially and temporally resolved precipitation data.

Keywords: Global Precipitation; Quadruple Collocation; Least Square Method; Satellite; Reanalysis data

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