A novel framework for correcting satellite-based precipitation products in Mekong river basin with discontinuous observed data

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Abstract

The Mekong River Basin (MRB) is a crucial watershed in Asia, impacting over 60 million people across six developing nations. Accurate satellite-based precipitation products (SPPs) are essential for effective hydrological and watershed management in this region. However, the performance of SPPs has been varied and limited. The APHRODITE product, a unique gauge-based dataset for MRB, is widely used but is only available until 2015. In this study, we present a novel framework for correcting SPPs in the MRB by employing a deep learning approach that combines convolutional neural networks and encoder-decoder architecture to address pixel-by-pixel bias and enhance accuracy. The DLF was applied to four widely used SPPs (TRMM, CMORPH, CHIRPS, and PERSIANN-CDR) in MRB. For the original SPPs, the TRMM product outperformed the other SPPs. Results revealed that the DLF effectively bridged the spatial-temporal gap between the SPPs and the gauge-based dataset (APHRODITE). Among the four corrected products, ADJ-TRMM demonstrated the best performance, followed by ADJ-CDR, ADJ-CHIRPS, and ADJ-CMORPH. The DLF offered a robust and adaptable solution for bias correction in the MRB and beyond, capable of detecting intricate patterns and learning from data to make appropriate adjustments. With the discontinuation of the APHRODITE product, DLF represents a promising solution for generating a more current and reliable dataset for MRB research. This research showcased the potential of deep learning-based methods for improving the accuracy of SPPs, particularly in regions like the MRB, where gauge-based datasets are limited or discontinued.

Keywords: APHRODITE, Bias correction, Deep learning, Mekong river basin, Satellite precipitation product, TRMM

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