Bias Correction of Satellite-Based Precipitation Using Convolutional Neural Network

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Abstract

Spatial precipitation data is one of the essential components in modeling hydrological problems. The estimation of these data has achieved significant achievements own to the recent advances in remote sensing technology. However, there are still gaps between the satellite-derived rainfall data and observed data due to the significant dependence of rainfall on spatial and temporal characteristics. An effective approach based on the Convolutional Neural Network (CNN) model to correct the satellite-derived rainfall data is proposed in this study. The Mekong River basin, one of the largest river system in the world, was selected as a case study. The two gridded precipitation data sets with a spatial resolution of 0.25 degrees used in the CNN model are APHRODITE (Asian Precipitation - Highly-Resolved Observational Data Integration Towards Evaluation) and PERSIANN-CDR (Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks). In particular, PERSIANN-CDR data is exploited as satellite-based precipitation data and APHRODITE data is considered as observed rainfall data. In addition to developing a CNN model to correct the satellite-based rain data, another statistical method based on standard deviations for precipitation bias correction was also mentioned in this study. Estimated results indicate that the CNN model illustrates better performance both in spatial and temporal correlation when compared to the standard deviation method. The finding of this study indicated that the CNN model could produce reliable estimates for the gridded precipitation bias correction problem.

Keywords : precipitation bias correction, APHRODITE, PERSIANN-CDR, Mekong river basin, Convolutional Neural Network(CNN)

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