Bias Correction of Daily Satellite-Based Precipitation Data Using the Convolutional Neural Network Model

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(a) Purpose of study or research hypothesis

Spatial rainfall distribution information plays a vital role in water resources simulation and management problems. Due to the low density of rain gauge network, the use of gridded precipitation datasets could improve the simulation of spatial precipitation distribution. With the advancement in remote sensing technology, satellite-based rainfall estimation has achieved remarkable achievements. However, there are gaps between satellite-based precipitation and observed data. Bias correction of satellite-based precipitation data is still a significant challenge due to the dependence of precipitation on the spatial, temporal distribution, as well as the specific characteristics of the area.

(b) Key issue(s) or problem(s) addressed

This study suggests an efficient approach based on a deep learning neural network model to correct the satellite-based precipitation data. The two gridded precipitation datasets mentioned in this study are APHRODITE (Asian Precipitation - Highly-Resolved Observational Data Integration Towards Evaluation) as the observed data and PERSIANN (Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks) as the satellite-based data. The Mekong River basin was chosen as a case study with a gridded resolution of 0.25 degrees

(c) Methodology or approach used

A deep learning neural network model has been constructed based on convolutional neural network (CNN) and autoencoder architecture, called convolutional autoencoder (ConvAE) neural network to reanalysis the satellite-based precipitation data. Model performance is evaluated by comparing corrected data based on the ConvAE neural network and estimated data based on the standard deviation method

(d) Results or conclusions derived from the project

In comparison with the observed data, the corrected precipitation data from the ConvAE model achieved superior performance compared to the standard deviation method in terms of both spatial and temporal correlations. The finding of this study indicated that the ConvAE model produces reliable estimates for the precipitation bias correction problem. As a result, the ConvAE model has great potential in applying in the field of hydrology, especially problems related to gridded data

(e) Implications of the project relevant to congress themes

The results of this study introduce an effective approach for precipitation bias correction problem. This will play an important role in water resources simulation and management problems

Keywords : Convolutional Neural Network (CNN), Precipitation Bias Correction, Aphrodite, Convolutionall Autoencoder (ConvAE)