Application of machine learning for merging multiple satellite precipitation products

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Abstract

Precipitation is a crucial component of water cycle and play a key role in hydrological processes. Traditionally, gauge-based precipitation is the main method to achieve high accuracy of rainfall estimation, but its distribution is sparsely in mountainous areas. Recently, satellite-based precipitation products (SPPs) provide grid-based precipitation with spatio-temporal variability, but SPPs contain a lot of uncertainty in estimated precipitation, and the spatial resolution quite coarse. To overcome these limitations, this study aims to generate new grid-based daily precipitation using Automatic weather system (AWS) in Korea and multiple SPPs(i.e. CHIRPSv2, CMORPH, GSMaP, TRMMv7) during the period of 2003-2017. And this study used a machine learning based Random Forest (RF) model for generating new merging precipitation. In addition, several statistical linear merging methods are used to compare with the results of the RF model. In order to investigate the efficiency of RF, observed data from 64 observed Automated Synoptic Observation System (ASOS) were collected to evaluate the accuracy of the products through Kling-Gupta efficiency (KGE), probability of detection (POD), false alarm rate (FAR), and critical success index (CSI). As a result, the new precipitation generated through the random forest model showed higher accuracy than each satellite rainfall product and spatio-temporal variability was better reflected than other statistical merging methods. Therefore, a random forest-based ensemble satellite precipitation product can be efficiently used for hydrological simulations in ungauged basins such as the Mekong River.

Keywords : Satellite Precipitation, Merging, Random Forest, Machine Learning

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