Machine Learning of GCM Atmospheric Variables for Spatial Downscaling of Precipitation Data

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Abstract

General circulation models (GCMs) are widely used in hydrological prediction, however their coarse grids make them unsuitable for regional analysis, therefore a downscaling method is required to utilize them in hydrological assessment. As one of the downscaling methods, convolutional neural network (CNN)-based downscaling has been proposed in recent years. The aim of this study is to generate the process of dynamic downscaling using CNNs by applying GCM output as input and RCM output as label data output. Prediction accuracy is compared between different input datasets, and model structures. Several input datasets with key atmospheric variables such as precipitation, temperature, and humidity were tested with two different formats; one is two-dimensional data and the other one is three-dimensional data. And in the model structure, the hyperparameters were tested to check the effect on model accuracy. The results of the experiments on the input dataset showed that the accuracy was higher for the input dataset without precipitation than with precipitation. The results of the experiments on the model structure showed that substantially increasing the number of convolutions resulted in higher accuracy, however increasing the size of the receptive field did not necessarily lead to higher accuracy. Though further investigation is required for the application, this paper can contribute to the development of efficient downscaling method with CNNs.