Effect of input variables on rainfall-runoff modeling using a deep learning method

Kazuki yokoo¹, Kei ishida², Takeyoshi nagasato³, and Ali Ercan⁴

¹Kumamoto University, Kumamoto-shi, Japan (207d2121@st.kumamoto-u.ac.jp)
²Kumamoto University, Kumamoto-shi, Japan(keiishida@kumamoto-u.ac.jp)
³Kumamoto University, Kumamoto-shi, Japan(171t4810@st.kumamoto-u.ac.jp)
⁴University of California Davis, Davis, CA, United States

In recent years, deep learning has been applied to various issues in natural science, including hydrology. These application results show its high applicability. There are some studies that performed rainfall-runoff modeling by means of a deep learning method, LSTM (Long Short-Term Memory). LSTM is a kind of RNN (Recurrent Neural Networks) that is suitable for modeling time series data with long-term dependence. These studies showed the capability of LSTM for rainfall-runoff modeling. However, there are few studies that investigate the effects of input variables on the estimation accuracy. Therefore, this study, investigated the effects of the selection of input variables on the accuracy of a rainfall-runoff model by means of LSTM. As the study watershed, this study selected a snow-dominated watershed, the Ishikari River basin, which is in the Hokkaido region of Japan. The flow discharge was obtained at a gauging station near the outlet of the river as the target data. For the input data to the model, Meteorological variables were obtained from an atmospheric reanalysis dataset, ERA5, in addition to the gridded precipitation dataset. The selected meteorological variables were air temperature, evaporation, longwave radiation, shortwave radiation, and mean sea level pressure. Then, the rainfall-runoff model was trained with several combinations of the input variables. After the training, the model accuracy was compared among the combinations. The use of meteorological variables in addition to precipitation and air temperature as input improved the model accuracy. In some cases, however, the model accuracy was worsened by using more variables as input. The results indicate the importance to select adequate variables as input for rainfall-runoff modeling by LSTM.