Utility of deep learning model for hydrologic forecasting over dam-affected river basin

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(a) Purpose of study or research hypothesis

Prediction skill of precipitation is limited in a changing climate, which raises a concern about dam operation in a timely manner. To make our water resources system sustainable throughout the year, proactive dam operation plans are necessary. This study aims to evaluate the utility of a deep learning model for dam operation using multiple Korean hourly hydrologic data at the Seonjin River Dam.

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

Hydrologic forecasting for dam operation has been barely used because of the current reactive rule of dam operation. Proactive dam operation is warrant for climate change adaptation. During the summer of 2020, the dam was collapsed due to extremely intense rainfall over Seomjin River. A sustainable dam discharge control function is also necessary even to mitigate the adverse effect of dams on environmental changes.

(c) Methodology or approach used

We computed the correlation coefficient of outflow with water level, water storage, water storage rate, rainfall, and inflow. We evaluated the performance of the trained deep learning model for dam operations from multiple error metrics, such as root mean squared error (RMSE) and Nash-Sutcliffe Efficiency index. We also conduct the sensitivity test of the model performance to the number of input variables.

(d) Results or conclusions derived from the project

The results show that the correlation coefficients of outflow with inflow, storage, storage rate, and rainfall are 0.31, 0.14, 0.14, 0.11, and 0.064, respectively. The prediction scores of deep learning models depend on input variables. We found that the deep learning model using inflow as the sole input has 68% of the prediction score. When the deep learning model was trained with the three or more input variables, the model prediction score reached over 70% of the prediction score.

(e) Implications of the project relevant to congress themes

The results of this study would help improve dam-operation rules for dam operation to adapt to climate change and mitigate water-related disasters, such as drought and flood, through optimized water resources management.

Keywords : **Deep learning model, Dam operation, Hydrologic forecasting, Climate change**