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Improvement of the Low Resolution of the Dataset and Prediction of the Water Quality Using the SWAT-LSTM Hybrid Model

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Extended Abstract

The river environment where people, animals, and plants exist together is a significant place to continue their own lives. Especially, since the river water quality directly impacts the survival of living things, it is crucial to effectively manage the quality of river water. To manage the river water quality effectively, it is important to make appropriate water quality management plans by accurately predicting the river water quality. Many researchers have utilized various tools for modelling the water quality of the river environment. Until now, river water quality has been modelled using the watershed model such as Soil and Water Assessment Tool (SWAT) [1], Hydrological Simulation Program-Fortran (HSPF) [2], and QUAL2E [3]. However, those models are developed in the US government (United States Department of Agriculture and United States Environmental Protection Agency), so it is challenging work to adapt those models to Korean watershed direct. And nowadays, the application of Artificial Intelligence (AI) is gradually increasing, because of its high prediction accuracy, adaptability for non-linearity, and high speed rather than other methodologies [4]. Despite the increasing use of AI in river water quality modelling, a challenge is that AI requires high-resolution dataset for effective modelling. However, in Korea, the resolution of the dataset for water quality of river environment is low because of lack of the number of conducted water quality monitoring stations.

The purpose of this research is to improve the low-resolution of datasets required for modelling the river water quality. This is achieved by combining the results of the semi-distributed watershed model, SWAT, with current weather and hydrological data, and using an AI model to predict the river water quality using the dataset with improved resolution. The SWAT is applied to the Yeongsan River (YS) watershed in Korea and the output data of SWAT is used as input data of Long-Short Term Memory (LSTM) model. The river water quality is then simulated by the LSTM using the combined dataset of SWAT output and already secured dataset. Evaluation of the modelling accuracy for predicting the TP and TN load of YS watershed shows that the SWAT-LSTM hybrid model has better performance compared to the SWAT alone. Therefore, this methodology, which secures high prediction accuracy with high-resolution datasets, could be a new methodology to effectively predict the river water quality.

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