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PREDICTION OF SUSPENDED SEDIMENT LOAD IN RIVERS USING RANDOM FOREST INTEGRATED WITH LONG SHORT-TERM MEMORY (RF-LSTM) – CASE STUDY: EGHLID, FARS PROVINCE

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Abstract

The accurate forecasting of rivers suspended sediment load (SSL) plays a key role in the designing of water and environmental projects. There are several methods for forecasting SSL of rivers with different performances. This paper introduces a new hybrid model called Random Forest integrated with Long Short-Term Memory (RF-LSTM) to forecast the daily SSL in the Shour River located in the Kharestan watershed, Fars province, Iran. In the first step, the partial mutual information (PMI) algorithm was used to select efficient input variables (EIVs) on daily SSL. Then, daily SSL values were forecasted using three standalone models: Random Forest (RF), Support Vector Regression (SVR) and Short Term Memory (LSTM). The results were assessed based on four evaluation criteria including root mean square error (RMSE), Nash-Sutcliffe efficiency (NSE), correlation coefficient (R), and relative error (RE). Finally, two models with the best performance in terms of the evaluation criteria were combined and daily SSL were forecasted based on the new hybrid model. The results of the PMI algorithm indicated that the streamflow at time t (Q_t) and streamflow with the delay of 1 day (Q_{t-1}) were considered as the EIVs on daily SSL. In addition, combining the RF-LSTM based on the PMI algorithm with MAE = 18.963 ton/day, RMSE =25.514 ton/day, NSE = 0.914, R = 0.960, and RE = 6.124% showed more accuracy in forecasting of daily SSL compared to standalone models.

Key words: long short-term memory, PMI algorithm, random forest, suspended sediment load, support vector regression

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