Open Channel Sluice Gate Scouring Parameters Prediction: Different Scenarios of Dimensional and Non-Dimensional Input Parameters

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Abstract

The determination of scour characteristics in the downstream of sluice gate is highly important for designing and protection of hydraulic structure. The applicability of modern data-intelligence technique known as extreme learning machine (ELM) to simulate scour characteristics has been examined in this study. Three major characteristics of scour hole in the downstream of a sluice gate, namely the length of scour hole (Ls), the maximum scour depth (Ds), and the position of maximum scour depth (Lsm), are modeled using different properties of the flow and bed material. The obtained results using ELM were compared with multivariate adaptive regression spline (MARS). The dimensional analysis technique was used to reduce the number of input variable to a smaller number of dimensionless groups and both the dimensional and non-dimensional variables were used to model the scour characteristics. The prediction performances of the developed models were examined using several statistical metrics. The results revealed that ELM can predict scour properties with much higher accuracy compared to MARS. The errors in prediction can be reduced in the range of 79%–81% using ELM models compared to MARS models. Better performance of the models was observed when dimensional variables were used as input. The result indicates that the use of ELM with non-dimensional data can provide high accuracy in modeling complex hydrological problems.