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Using Artificial Neural Network to Estimate Sediment Load in Ungauged Catchments of the Tonle Sap River Basin, Cambodia

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ABSTRACT

Concern on alteration of sediment natural flow caused by developments of water resources system, has been addressed in many river basins around the world especially in developing and remote regions where sediment data are poorly gauged or ungauged. Since suspended sediment load (SSL) is predominant, the objectives of this research are to: 1) simulate monthly average SSL (SSL_m) of four catchments using artificial neural network (ANN); 2) assess the application of the calibrated ANN (Cal-ANN) models in three ungauged catchment representatives (UCR) before using them to predict SSL_m of three actual ungauged catchments (AUC) in the Tonle Sap River Basin; and 3) estimate annual SSL (SSL_A) of each AUC for the case of with and without dam-reservoirs. The model performance for total load (SSL_T) prediction was also investigated because it is important for dam-reservoir management. For model simulation, ANN yielded very satisfactory results with determination coefficient (R^2) ranging from 0.81 to 0.94 in calibration stage and 0.63 to 0.87 in validation stage. The Cal-ANN models also performed well in UCRs with R^2 ranging from 0.59 to 0.64. From the result of this study, one can estimate SSL_m and SSL_T of ungauged catchments with an accuracy of 0.61 in term of R^2 and 34.06% in term of absolute percentage bias, respectively. SSL_A of the AUCs was found between 159,281 and 723,580 t/year. In combination with Brune's method, the impact of dam-reservoirs could reduce SSL_A between 47% and 68%. This result is key information for sustainable development of such infrastructures.

KEYWORDS

Artificial Neural Network; Suspended Sediment Load; Ungauged Catchment; Lower Mekong Basin; Tonle Sap River Basin

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