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Impact Factor 2.270   ISI indexed

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Multi-criteria validation of artificial neural network rainfall-runoff modeling

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Abstract. In this study we propose a comprehensive multi-criteria validation test for rainfall-runoff modeling by artificial neural networks. This study applies 17 global statistics and 3 additional non-parametric tests to evaluate the ANNs. The weakness of global statistics for validation of ANN is demonstrated by rainfall-runoff modeling of the Plasjan Basin in the western region of the Zayandehrud watershed, Iran. Although the global statistics showed that the multi layer perceptron with 4 hidden layers (MLP4) is the best ANN for the basin comparing with other MLP networks and empirical regression model, the non-parametric tests illustrate that neither the ANNs nor the regression model are able to reproduce the probability distribution of observed runoff in validation phase. However, the MLP4 network is the best network to reproduce the mean and variance of the observed runoff based on non-parametric tests. The performance of ANNs and empirical model was also demonstrated for low, medium and high flows. Although the MLP4 network gives the best performance among ANNs for low, medium and high flows based on different statistics, the empirical model shows better results. However, none of the models is able to simulate the frequency distribution of low, medium and high flows according to non-parametric tests. This study illustrates that the modelers should select appropriate and relevant evaluation measures from the set of existing metrics based on the particular requirements of each individual applications.

Final Revised Paper (PDF, 1514 KB)   Discussion Paper (HESSD)

Citation: Modarres, R.: Multi-criteria validation of artificial neural network rainfall-runoff modeling, Hydrol. Earth Syst. Sci., 13, 411-421, 2009.   Bibtex   EndNote   Reference Manager

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