Application of Data Driven Based Models as Early Warning Tools of High Stream Flow Events and Floods

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Abstract : The early warning of high stream flow events (HSF) and floods is an important aspect in the management of surface water and rivers systems. This process can be performed using either process-based models or data driven-based models such as artificial intelligence (AI) techniques. The main goal of this study is to develop efficient AI-based model for predicting the real-time hourly stream flow (Q) and apply it as early warning tool of HSF and floods in the downstream area of the Selangor River basin, taken here as a paradigm of humid tropical rivers in Southeast Asia. The performance of AI-based models has been improved through the integration of the lag time (Lt) estimation in the modelling process. A total of 8753 patterns of Q, water level, and rainfall hourly records representing one-year period (2011) were utilized in the modelling process. Six hydrological scenarios have been arranged through hypothetical cases of input variables to investigate how the changes in RF intensity in upstream stations can lead formation of floods. The initial SF was changed for each scenario in order to include wide range of hydrological situations in this study. The performance evaluation of the developed AI-based model shows that high correlation coefficient (R) between the observed and predicted Q is achieved. The AI-based model has been successfully employed in early warning throughout the advance detection of the hydrological conditions that could lead to formations of floods and HSF, where represented by three levels of severity (i.e., alert, warning, and danger). Based on the results of the scenarios, reaching the danger level in the downstream area required high RF intensity in at least two upstream areas. According to results of applications, it can be concluded that AI-based models are beneficial tools to the local authorities for flood control and awareness.

Keywords : floods, stream flow, hydrological modelling, hydrology, artificial intelligence
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