Flow Forecasting in Urbanized Catchments with Data Driven Models

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ABSTRACT

The motivation for this paper was to assess the suitability of data driven models, in this case the artificial neural network (ANN), in the light of forecasting applications in urban catchments. Results from two case studies are reported; the first is for an experimental catchment measuring 25 m x 1 m and comprises an impervious asphalt surface and the second, an urbanized catchment of area 5.6 km^2 in the Kranji reservoir catchment, Singapore. For the plane surface, the rainfall and runoff data collected for ten natural storm events were analyzed and the ANN model results compared with results obtained by a kinematic wave model (KW) and an autoregressive moving average (ARMA) time series model. The results show that ANN model forecasts compared favourably with KW and ARMA forecasts. Specifically, the ANN was found to be superior to the KW and ARMA models especially at longer lead times. This is due to the errors in the forecast rainfall and loss estimates that are required by the KW, and the recursive nature of the ARMA model especially for longer lead times. For the Kranji sub-catchment, the results of this study show that discharge inputs significantly influence short lead time forecasts while rainfall inputs help improve longer lead time forecasts. In order to study the upper bound for longer lead time predictions, an approach incorporating forecast rainfall as inputs to the ANN model was also investigated.

KEYWORDS

Data driven model, drainage, flow forecasting, urban catchment