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Stream Flow Data Predictions By Kalman Filtering Approach

- A Case Study

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Text of Abstract

One of the most powerful tools in the optimal filtering theory is Kalman filter (KF). It operates with two fundamental estimates: the first one is based on a prior knowledge of the system, the second one is a prediction based on new information (measure). By combining these two independent estimates, KF leads to an improved estimate and its great advantage is to provide accurately the prediction error covariance which is a measure of the estimation accuracy. For reasons of optimality, under such number of hypothesis, KF is used in identification and prediction.

To be applied, KF algorithm needs to be provided by certain initial conditions, which can be a prior estimation of initial parameters, based upon the available information, and the associated error covariance. This is required for Kalman gain calculations. The difference between the parameters estimation and the obtained observations is then determined and multiplied by Kalman gain in order to update the parameters estimation error. Finally, the updated error and parameters are returned as in puts to the model in order to obtain predicted parameters and associated errors at the next time step.

In the present study, the objective is to apply a KF approach to stream flow identification and prediction. The result aimed at is to obtain an online operation where the operator will not be bound to time or space but could adapt recursively itself to changes in climatic and any other condition relating to the studied process. The subject is one of the most important dams in northern Algeria: REMCHI, where records of annual stream flows are observed over a period of 40 years. Calculations are made according to the KF recursive algorithm and the obtained results are satisfactory. The model allows parameter changes in time, which is a manner to take into account the non linear response of the hydrologic system and his great advantage is that it gives accurately the prediction error covariance.