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# Data Driven Approaches to Real-Time Flood Forecasting

A. W. JAYAWARDENA
*Department of Civil Engineering, The University of Hong Kong*

Real-time flood forecasting involves arriving at an estimate of the magnitude of an impending flood in good time for an early warning to be effective. A forecast with a short lead time is generally more reliable than a forecast with a long lead time. However, a shorter lead time makes no sense if it is not long enough to issue early warnings and take preventive measures to avert a disaster. On the other hand a forecast with a longer lead time, which will inherently be less reliable, would provide sufficient time to issue early warnings and take preventive actions, although it may, at times, turn out to be a false alarm. In the latter case, disaster managers will need an indication of the degree of uncertainty associated with the forecast. Flood forecasting involves several hydrological and meteorological variables. The final forecast is issued as the stage in a river or the magnitude of flow in the river at a given time at a given location. Most hydrological variables are either stochastic, or have very strong stochastic components, thereby making the deterministic reductionist approach difficult to implement. The top-down holistic approach, which relies on data mining as well as data assimilation, is gaining popularity although some researchers argue that deterministic physics-based approaches should still be pursued. Any real time forecasting model depends heavily on data and therefore collection of reliable data is an integral part of the problem. The objective of this paper is to present what has been achieved and what can be achieved in future following the holistic approach, which is basically data driven. Experiences in the use and application of different data driven modeling techniques such as Kalman filtering, ANN's, phase-space reconstruction methods, Genetic Algorithms/Programming etc. would be discussed together with issues such as uncertainty, training and/or calibration of model parameters, non-linearity of model parameters, updating, measures of goodness of fit of models etc.