The Bayesian probabilistic flood forecasting model based on AM-MCMC and BP

ZHENG-XIANG XING\textsuperscript{1,2}, XIAO-FANG RUI\textsuperscript{3}, FANG-GUI LIU\textsuperscript{4} & JIE FENG\textsuperscript{3}

\textsuperscript{1}College of Water Conservancy and Civil Engineering, Northeast Agriculture University, Harbin 150030, China
xingzhenxiang01@163.com
\textsuperscript{2}Center for Postdoctoral Studies in Agricultural Engineering, Northeast Agriculture University, Harbin 150030, China
\textsuperscript{3}College of Hydrology and Water Resources, Hohai University, Nanjing 210098, China
\textsuperscript{4}College of Civil Engineering and Architecture, Guangxi University, Nanning 530004, China

\textbf{Abstract} Under the general theoretical framework of the Bayesian Forecasting System (BFS), models of the prior density and likelihood function based on the Back Propagation of error Artificial Neural Net (BP ANN) were built in the paper. The posterior density of flood discharge was obtained by the Markov Chain Monte Carlo simulation method based on the Adaptive Metropolis algorithm (AM-MCMC), and then probabilistic forecasting of flood discharge was made. A Genetic Algorithm (GA) was used to optimise the weights and bias of BP ANN and the initial samples in AM. The results of a case study show that the accuracy of BFS was higher than that of the Xin’anjiang model. Not only the mean of forecast discharge, but also the variance of forecast discharge was given by the BFS based on the AM-MCMC and BP ANN model. The variance of the predictand qualified the uncertainty of the predictand could be considered in the decision-making for prevention of floods.

\textbf{Key words} BFS; adaptive metropolis algorithm; MCMC; BP; probabilistic forecasting