7th International Conference on Hydroinformatics
HIC 2006, Nice, FRANCE

SNOWMELT FLOOD FREQUENCY ESTIMATION USING PHYSICALLY BASED MODEL COUPLED WITH WEATHER GENERATOR (WITH ESTIMATION'S UNCERTAINTY)

GELFAN A. N.
Water Problems Institute of the Russian Academy of Sciences, 3 Gubkina Str., 119991 Moscow, Russia

A dynamic-stochastic model, which combines a physically based model of snowmelt runoff formation with a stochastic weather generator, has been proposed to estimate frequencies of extreme snowmelt floods. The physically based model describes snow accumulation and melt, soil freezing and thawing, vertical soil moisture transfer and infiltration, detention of melt water by the depressions at the catchment surface, overland and channel flow. The weather generator includes stochastic models that produce daily values of precipitation, air temperature, and air humidity during a whole year. Daily weather variables have been generated by *Monte Carlo procedure and transposed to* snowmelt flood discharges by the physically based model. The suitability of the dynamic-stochastic model has been demonstrated through its ability to reproduce frequencies of snowmelt flood peak discharges measured at the Seim river (the catchment area is 7460 km^2). Uncertainty of the calculated peak discharges of low probabilities has been assessed on the basis of Latin hypercube sampling.

INTRODUCTION

For the design of large hydraulic structures, there is need for estimation of magnitude of very infrequent floods with return period of hundreds or even thousands years. The fundamental weaknesses of the flood frequency analysis (FFA), which is traditionally used for this estimation, are widely known (see, for example, discussions in Klemeŝ [9], Singh and Strupczewsky [15]). Opportunities for refinement of estimation of floods of low exceedance probabilities are associated with invoking new information in addition to statistical one extracted from the runoff measurements only. This additional information may be both an empirical one, containing in available measured variables other than runoff (weather variables, snow characteristics, soil moisture, etc.), and a priori information, reflecting accumulated knowledge of flood generation physics.

Attempts to develop a more physically based approach started with the derived distribution method of Eagleson [4]. This method is in estimating flood peak frequencies in relation to the physical characteristics of river basin and the probabilistic properties of rainfall. The derived distribution approach was used for the estimation of the rainfall flood frequency and extended by many authors within both the analytical and the numerical frameworks (the latter is based on Monte Carlo simulation of the input variables). Detailed review of these extensions is given in [1, 11]. However, there is