TECHNICAL SESSION - VI

MODELLING OF HYDROLOGICAL PROCESSES IN MOUNTAINOUS AREA II

General Report
by
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In this session 4 full length papers and 2 abstracts have been included :

1. Hydrological and Multiple Resources Simulation Models-Application in Mountain Areas, by Peter Ffolliott,

2. Accuracy of Hydrodynamic Models of Free Surface Flows, by, V.P. Singh,

3. Geomorphology of Kolar Subbasin, by R.D. Singh, and Vibha Jain,

4. Cisterns as Water Supply Alternative for Mountainous Areas, by N. Alpaslan, N.B. Harmancioglu, and V.P. Singh,

5. Mathematical Modelling of Mountainous River Basins - A Case Study in South India, by L.C. Kandasamy, E.J. James, H. Suresh Rao and E. Elango,

6. Application of Rainfall-Runoff Model in the Depressed Haor and Hilly North-Eastern of Bangladesh, by M.A. Bhuiyan & Md. M. Alam.

The above papers cover varied aspects of modelling of hydrological processes in mountainous areas. Paper number 1, 5 and 6 deal with application of mathematical models for mountainous areas, paper 2 deals with free surface flows, 3 deals with geomorphological analysis and 4 examines use of cisterns as a means of regulating water supply in mountainous areas.

The first paper deals with application of hydrological and multiple resources simulation models in the mountainous areas. These models can be used to evaluate the impacts of the changes in the use of hydrological and other resources for a catchment. A group of multiple-resource simulation models has been described in this paper. The models are contained in three main modules : WATER, related with rainfall runoff process with sedimentation and quality aspects, FLORA, related with vegetation growth and yield, and FAUNA, to evaluated animal habitats, carrying capacities and population dynamics. A case study has also been described. The issues related to impact of various development schemes on ecological balance of watersheds and their resources are attracting more and more attention and hence this type of models will be in increasing demand. As efforts are being made in India also to develop such models, this paper will prove to be very useful to those researchers who are engaged in development of such models in India. The author deserves appreciation for a timely and interesting paper.

The second paper is related to modeling of free-surface flows based on shallow water wave theory. The Saint Venant equations are the governing equations whose approximations, either in the form of the kinematic-wave (KW) or the diffusion-wave (DW) are used. A dimensionless parameter γ is defined which reflects the effects of initial flow depth, channel-bed slope, lateral

inflow and channel roughness. The author has presented a detailed and comprehensive analysis of the various scenarios for determination of error and has concluded that the KW and DW approximations are sufficiently accurate when the parameter $\gamma \geq 3$.

Singh and Jain in their paper on geomorphology have made an excellent attempt to use the geomorphological characteristics to simulate hydrologic response of a catchment. They have tried to identify some geomorphological parameters which describe three important, i.e. linear, areal and relief aspects of the catchment which can be used for flow simulation with appropriate inputs. The authors have carried out the analysis using the data of Kolar subbasin of river Narmada in India. The methodology uses the information which is time invariant and can be obtained from topographic maps. Therefore, it can be easily used for ungauged catchments. The authors have indicated that the methodology requires digitized data of drainage networks as input. They may please illustrate as to how they have been able to distinguish between various stream orders and estimate related parameters.

Alpaslan, Harmancioglu, and Singh recommend cisterns as a water supply alternative for mountainous areas. In the mountainous area, the pipeline network is not cost-effective in many circumstances because the establishments are sparse and population is small. Cisterns, which are nothing but artificial reservoirs, are attractive alternatives in such areas. The objective of this paper is to present a critical overview of the data collection practices in respect of simplification of design phase of the cisterns. The authors have discussed various aspects like selection of the variables to be monitored with frequency of observation, and selection and delineation of monitoring site. Since the cisterns can provide a viable alternative for mountainous areas in India, the paper should be of immense interest to the Indian audience.

The fifth paper is related to application of four different rainfall-runoff models to two types of basins. The models considered are Linear, Linear Perturbation. Constrained Linear System (CLS), and the Tank Model. The authors have concluded that in calibration, the Linear Perturbation model performs better than the others. However, in verification, Linear Perturbation model gives better overall performance for 50%, the Linear model for 30% and the Tank model for 20% of the station years of the data. It will be interesting to know the value of various performance indices for the various models. The authors have recommended that the Linear Perturbation model be preferred for application to small, mountainous catchments subject to monsoonic rainfall. It is, however, worthwhile to note that all the four models used do not make use of same information.

In their paper, Bhuiyan and Alam describe an application of the NAM model for rainfall-runoff modeling in a basin in North-Eastern Bangladesh. The NAM is a simple conceptual model, developed in Denmark. It has been successfully used in a number of studies in India also. The authors mention that the study area was subdivided in 50 subcatchments and there is a wide variation in the topography of the subbasins. Presuming that the response mechanisms of these subbasins differ considerably, it would be very interesting to know how the parameters for these subbasins vary. It is also not known how the response of the various subbasins was combined to get the response of the entire catchment. No results of the study have been provided in the abstract submitted by the authors. They may like to discuss the results of their study during the presentation. It would be interesting to know how the calibration was carried out, what criteria was used to determine goodness of fit. They have also emphasized the need to focus attention on the conservation and rational management of mountain resources through a better understanding of the system dynamics.

The papers included in this group provide interesting reading material and I congratulate all the authors for the same.