TECHNICAL SESSION - III

MODELLING OF SNOW AND GLACIER MELT

General Report
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Seven full length papers and two abstracts were received for this session. Though the papers deal with some aspects of snow and glaciers, all of them are not strictly on the theme of melt modelling.

In his paper 'Computation and Reconstruction of Mass balance runoff in Akshiyrak Glacier System, Tien Shan', Dr. Mikhalenko has presented 33 years' (1945-77) information on net mass balance of the glacier system containing a chain of 7 glaciers, having a total area of 125 km^2. Although there have been the years of +ve balance, the average net balance is -25.6 gm cm^{-2}.

He also concludes that maximum glacier volume is lost in its middle with altitude ranging from 4 to 4.6 km. These losses are more closely related to the change in altitude of glaciers surface than the changes in area of length of the glacier. The paper is informative. Some of its inferences can be generalised for the entire mountain system of Western Himalayas.

Dr. Mikhalenko has indicated that by correlating mass balance of a glacier with precipitation and temperature data the series could be extended without actual mass balance study. I would like the author to throw more light on this. Has any effort been made by him in this direction ? What type of correlation is expected between mass balance & meterological data ?

Sri M.R. Bhutiyani has brought out some observations regarding water balance of Chhota Shigri glacier basin during ablation (melt period) period. In multidisciplinary expeditions to this glacer 4 years' (1986-89) data were collected on different aspects and a detailed report published by Deptt. of Science & Technology. The author has presented some meteorological and hydrological data of 1988 expedition. He infers that ground water is the largest contributor to daily runoff in this basin during the ablation period. The author may like to elaborate on the following points mentioned in his paper :

(i) Based on only a few days' observation how lapse rates have been established. If the temperature observations are taken at two points on glacier's surface, the temperature changes refer to the lapse rate in surface temperature. How are they related to adiabatic or environmental lapse rate ?

(ii) How the formula given at page-4 is used to compute rain component of discharge ? It will be interesting to know whether the theoretical values of snowmelt, rain and groundwater components added together tally with observed discharge ?

Sri S.S. Iyer, Chief Engineer from CWC, in his paper 'Snow Hydrology Project (UNDP) in Yamuna Basin', has brought out in a general way, the need of such pilot projects for the development of water resources in Himalayas. He has indicated towards the ene of the paper about development of some model in CWC. The author may like to throw some more light on this model.

Authors of the paper 'Integration of Remotely Sensed Data, Meteorological Parameters & Topographical Details in Snowmelt-Runoff Modelling - A case study in Chamoli District of U.P., India, Drs. Tangri and Shukla should be congratulated for the clarify of their views and excellent presentation. They have discussed the possibility of a snow-runoff model by studying inter-relationship among satellite based snow cover area, meteorological parameters and topographical inputs. They illustrate their views with a case study of Alaknanda & Dhauliganga catchments. LANDSAT data on snow coverage and their variations with altitudes are particularly informative. Further work on this line should be continued aiming at evolving an operational model.

Dr. Peter F. Ffolliott has presented a review of work done in Southwestern USA during past 25 years in the area of snow hydrology and forest-snow relationship. Field and theoretical studies have been carried out to provide management guidelines to increase snowmelt water yield on high elevation. Low forest density corresponds to high storage of snowcover and slow melt. Hence forest management activities can alter the temporal distribution of melt water yield. The author has also highlighted the importance of studying runoff efficiency in relation to topographical features, catchment characteristics and antecedent moisture conditions. This knowledge is useful in predicting snowmelt amount.

The author has mentioned various studies on estimating snow pack depletion from satellite data and relating them to runoff volumes.

The paper contains information on US experience regarding snow-forest relation. We may like to know from the author how much is the time lag in peak melt rates in forested and open areas and what is the difference in melt rates ?

Dr. A.A. Isaev, in his paper, 'Large Scale Mathematical Simulation of Snow Life in Mountains', has described a digital relief model (DRM) which aims at deducing snow cover characteristics on the basis of geomorphological structure and feature of the relief. These features are to be taken from the contour map of the area. The author suggests that such a DRM can be derived manually, automatic or automatic-manually. Since such model can be worked out only for limited area, its utility is mainly for studying snow pack structures, weaknesses and avalanche phenomena.

The author has not presented any practical illustration on working of his model. Are such models being used anywhere for the purpose of avalanche forecasting ?

The abstract of the paper 'Conceptual Model of the Himalayan Snowcover Information System (HIMSIS)' by Dr. Ramana Rao et al. state that NRSA is monitoring snowcover area of Himalayan basins using satellite image data. They may like to further explain if these data have been used to develope any snowcover runoff relationship or hydrological modelling.

In the paper 'Characteristics of Himalayan Glaciers', Shri M.S. Dhanju indicates about some recent results of his study, which he may like to present in this session.

Although some valuable information have been brought out in these papers, in toto they do not fully meet the objectives of the theme. Understanding snowmelt processes and evolving operational prediction models is immediate need for better water management in mountains. The question of artificial augmentation of snow and glacier and their after effects have not been discussed by any author.