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Research and development for the management of surface water

C. M. PANDIT
Director, Subject Matter Division, Ministry of Water Resources, Government of India, New Delhi, India

There are twelve papers listed for this session. These twelve papers pertain to almost twelve different topics and no two papers address the same issue. These papers cover:

1. Surface drainage requirements in irrigated command of Central Gujarat by M.S. Zaman et al describes the rainfall, soil and drainage scenario in Mahi Right Bank Canal and recommends a method for design of drainage coefficient.

2. Water use and sustainable development of commercial forestry by Devi Tewari describes the principles of water management in South Africa and introduces the concept of user paying for the consumptive use of water for commercial purposes even when the use is by harvesting of rainfall on the land owned by the user.

3. Multilinear discrete cascade model for stage hydrograph routing by M. Perumal presents a method for routing of stage hydrograph in rigid bed channels using multilinear approach.

4. Effective and safe surface water management for reclamation and crop production in black alkali soils by S.K. Verma describes the experiences of the author with harvesting and recycling of surface water for crop production in the stated soil conditions over a period of three years.

5. Restoring hydrologic regime of overgrazed pastures and forest lands by Murari Lal Gaur describes the experience of the author in application of soil and water conservation engineering in lands degraded due to overgrazing and other adverse climatic factors.

6. Study of thermal structure of some stratified reservoirs in India by D.N. Deshmukh et al analyses the temperature stratification data of some reservoirs in India and reports an unexpected conclusion that heated discharges from thermal power projects and other industries may have very little effect on the thermal stratification.

7. In Neural computation technique for estimating components of hydrologic cycle, Sudheer K. P. et al have proposed an artificial neural network to estimate the ET and evaporation from daily values of air temperature.

8. In Modernizing the teaching of water resources management, K. Ponnambalam et al argue for modernization of the teaching for making the study more interesting in the hope of attracting better students to the field of water resources.

9. In Prediction of deposited sediment at the entrance of Toushka project, Abdel Aziz Tarik Mohamed presents application of a one dimensional mathematical model for sediment transport and consolidation in the approach canal to pumping station in Aswan High Dam project.

10. Role of storage characteristics of glaicers in regulation of stream flow by Pratap Singh et al describes experiments with round the clock measurements at the snout of a Himalayan glacier and reports some interesting facts about the storage characteristics of the glacier and its role in diurnal variation of discharge.

11. In An efficient solution algorithm for dendritic channel networks using FEM or FDM, D.J. Sen presents a new algorithm that can be used on parallel processing machines.

12. In Group based estimation methods for missing values in hydrological data sets, U.S. Panu et al present data infilling methods based on groups of data rather than single points of data. Internal structure of groups of data are described using artificial neural networks.

Apart from the results reported in each individual paper, some interesting and noteworthy features of some of the papers and issues for discussion are as below :-

1. Practising engineers who actually carry out project hydrology studies can not be expected to have the same level of familiarity as have academicians, with the intricate theoretical aspects in use of such advanced techniques. There is need for easy to use software packages for application of not only the newer but also the existing techniques where the practising engineer can get the results without having to understand the internal working of the model. Unless such packages are available there is danger that the newer techniques may remain confined to labs/universities.

   It is now generally accepted that parallel processing and not faster chips, is the path to super computing. While faster execution is one application for super computers, other more important application is bringing to the domain of numerical computing those problems which were hitherto considered unsuitable for numerical solution.

2. Space scientists routinely encounter flow conditions that can not be easily replicated in a lab, like flow at Mach 15. Therefore they had to go for numerical solutions for which they use super computing extensively. Comparatively, river engineers have

lagged behind in numerical analysis. Dr. Sen's paper should be noted for introducing parallel processing to river hydraulics.

3. Similar is the case with use of artificial neural networks. Has the community of water resources engineers lagged behind other disciplines in use of advanced computing techniques.

4. Glaciology is a neglected area of hydrology. Even the post graduate curricula includes very little about the hydrology of glaciers. The paper on role of glaciers by Pratap Singh is interesting as it brings to light some little known facts about the discharge and storage characteristics of glaciers.

5. Can better talent be attracted to a discipline by making the teaching more interesting?

6. Should advanced education in water resources engineering be imparted at under graduate level or at post graduate level - perhaps with a few years of field experience - a more appropriate stage ?

7. Charging the user of rainfall for the quantum of rainfall used consumptively. The paper by Devi Tewari is in the context of commercial forest. But the principle is equally applicable to other uses of rainfall. However, the legal and social implications of its application need to be discussed.

Possible recommendations are as below :-

a) Atleast one institutes of national repute, e.g. NIH, should acquire a parallel processing super computer. Initially this could be a 8 to 16 node transputer based machine. Training courses should be conducted in parallel programming and other advanced techniques like neural networks, artificial intelligence, fuzzy logic, expert systems etc. so that water resources engineers explore the world beyond FORTRAN IV.

b) More research needs to be taken up on hydrology of glaciers.

c) The appropriate stage for imparting education in water resources engineering is likely to be highly country specific. Each country needs to decide the correct stage, the eligibility criteria for the input material.

d) So far the modelling of sedimentation in reservoirs is based on a one dimensional model, restricted to prediction of new zero elevation and reduced capacity at different levels. With a large number of reservoirs having been surveyed in 3-D, attempts at mathematical modelling in 3-D needs to be made.