JALVIGYAN SAMACHAR

जल विज्ञान समाचार

Newsletter of National Institute of Hydrology

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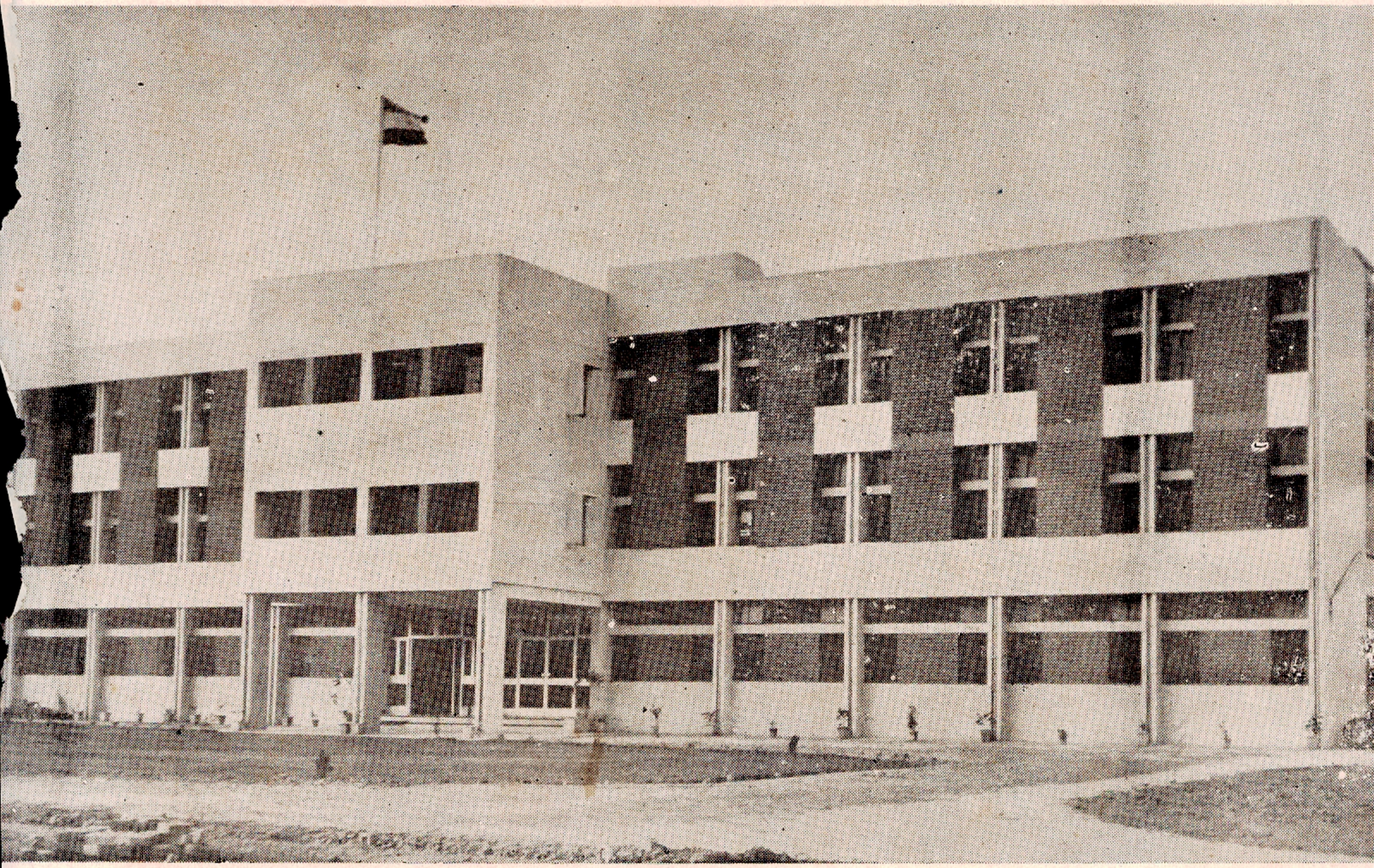


राष्ट्रीय जल विज्ञान संस्थान

MEETING OF AUTHORITIES

(a) Governing Body (GB)

The 24th meeting of the G.B was held in Shram Shakti Bhawan, New Delhi on 16th July, 1985.

(b) High Level Technical Committee on Hydrology (HILTECH)

The 6th meeting of the HILTECH was held in Andhra Pradesh Secretariat, Hydrabad on 19th August, 1985.

STUDIES AND RESEARCH ACTIVITIES

Reports under different categories viz. Tecnical Review Notes, User's Manuals, Manuals, and Case Studies have been prepared. Some selected abstracts of these reports are given as under.

(a) Review Notes

1. HYDROLOGIC FLOOD ROUTING INCLUDING DATA REQUIREMENTS

Flood routing is used to simulate flood wave movement through river reaches and reservoirs. There are two types of flood routing methods used in practice viz, hydraulic flood routing and hydrologic flood routing. Hydrologic flood routing uses the continuity equation in lumped form and some relationship between discharge and storage within the reach. This report reviews the various hydrologic flood routing methods available in literature including the two parameter models which incorporate the Muskingum method, lag and route method, Kalinin-Milyukov method, diffusion analogy method, modified Puls method and working R and D method; the three parameter models which incorporate diffusion added with lag model, multiple Muskingum method and three parameter Gamma distribution model etc. The linearized St. Venant's equation model applied to wide rectangular channels, the multiple linearization flood routing model and the simple non-linear model are also reviewed. A broad discussion on the relationship between some of the hydrologic flood routing methods and the basic St. Venants's equation describing the one dimensional flow in channel is made. The advantages of the hydrologic flood routing methods over the hydraulic flood routing methods are described. The limitations of the hydrologic flood routing methods for inability to take into account the back-water effects and discontinuities in the water surface such as jumps or bores are considered. The data requirements of the hydrologic flood routing methods are indicated.

2. COMPARATIVE STUDY OF COMPONENTS OF WATERSHED MODELS

The rainfall runoff process in a catchment is a complex and complicated phenomenon governed by large number of known and unkown physiographic factors that vary both in space and time. The rain or snow falling on a catchment undergoes number of transformations and abstractions through various component processes such as interception, detention, evapotranspiration, overland flow, infiltration, interflow, percolation, sub-base flow, baseflow etc. and emerges as runoff at catchment outlet. Application of mathematical medelling techniques to the constituent processes involved in the physical processes of runoff generation have led to better understanding of the processes and their interaction. Different types of watershed models have been developed depending on the purpose such as flood forecasting simulation of hourly or daily runoff or estimation of water yield.

Each watershed comprises of differnt types of soil cover, vegetation, land use, topography, drainage pattern, density, and slope etc. So the processes that take place are not uniform throughout the basin, moreover they are also not uniform in time: eg. interception loss depends on type of vegetation cover and its density and also on rainfall amount, its intensity and duration. Interception loss is high at the beginning of rainfall but reduces gradually to a constant value equal to potential evaporation rate till rainfall continues. Similariy infiltration rate also varies in space and time and also depends on initial soil moisture conditions. As such exact analysis of these complex component processes is very difficult.

To simplify analysis of these complex processes different watershed models have adopted different laid out approaches, methods or approximations for each process and the developed model as a whole is capable to simulate observed runoff. A comparative study of model structures for various processes considered in different watershed models has been done to ascertain suitable model structure for each component process for typical physiographic and hydrometeorological conditions of river basins in India.

The models that have been included in this review are Stanford Watershed Model (SWM IV) developed by Crawford and Linsley of USA, University of British Columbia Model (UBC) developed at the Civil Engineering Department of the University of Vancouver, Canada, Stream flow Synthesis and Reservoir Regulation (SSARR) model of the US Army Engineers, Sacramento model of the Sacramento River Forecast Centre, California, USA, TVA daily streamflow model of Tennessee Valley Authority, USDAHL-74 hydrologic model of U.S. Deparment of Agriculture, HBV-model of the Swedish Meteorological Hydrological Institute, USGS Peak flow Synthesis model of U.S. Geological Survey, RORB (Version-3) model of Monash University, Australia and Leavesley model of George H Leavesley of Colorado State University USA. The component processes that have been considered in the review are interception, evapotranspiration, overland flow, infiltration, percolation, interflow and base flow.

This review has indicated different simplified techniques and structures for component processes that may be considered for developing rainfall-runoff models suited to Indian conditions.

3. STUDY OF HYDROGEOLOGICAL PARAMETERS

Frequently, the groundwater modeller faces with the problem of input parameters to the model. Hydrogeological paramers like hydraulic conductivity, transmissivity, strorage coefficient, specific yield and porosity form part of the model input. Estimation of these hydrogeological parameters through conventional pumping test methods is too expensive and time consuming. Therefore, faster and cheaper techniques involving empirical formulae and graph analytical methods shall have to be adopted. In the present report it has been attempted to put togther all the available graphical and empirical techniques for estimating transmissivity, storage coefficient, specific yield, and hydraulic conductivity.

4. RAINFALL RECHARGE

Part of the rain that falls on the ground is infiltrated into the soil. The infiltrated water is partly utilished in filling the soil moisture deficiency and the remaining part is percolated down reaching the water table. This part of the total rain reaching the water-table is known as the recharge from the rainfall to the aquifer. So far, no conclusive estimates of the quantity of recharge are available. Empirical relations are generally used for estimation of recharge in north Indian doabs. Chaturvedi formula was developed for the Ganga-Yamuna doab, in 1936. Amritsar formula was developed with recharge as a function of annual rainfall only. The other method of working out recharge from annual rainfall is indirect one i.e. by estimating the fluctuations of water table in the area during the period just before and after the rainy season. In this report the review of the procedures for estimation of rainfall recharge has been presented.

5. DATA COLLECTION AND TRANSMISSION SYSTEM

The report reviews the various system of data-collection and transmission in hydrology and hydrometeorology. Data on precipitation, evaporation, temperature, humidity, wind velocity, sunshine hours, water level, discharge measurement, soil moisture etc. is required for use in weather and flood forecasting and efficient water management. Significant technological developments in the fields of tele-communication, computers and satellites are responsible for the automation of hydro-meteorological observation techniques.

Various systems for collection of hydrometeorological data can be classified into three basic groups i.e. manual, semi-automatic (man/machine mix) and automatic (computer controlled) observing station. In modern technology, point-to-point wireless communication manually operated systems are being replaced by modern systems like telemetry through VHF/UHF/microwave or satellite.

During recent years, the need for data has extended to inaccessible areas where up to now no information has been available. Insistence on high quality information as well as rapid receipt of data (for real-time analysis) has resulted in drastic changes both in the methods of collection as well as transmission of data. Data collection systems are of basically two types-analog system and digital system. Analog systems encompass a wide band-width of signal but have lower accuracy. Whereas digital systems are more accurate and are especially useful for multichannel recording systems. A variety of preliminary signal processing can also be performed on digital systems as the data is available in computer-compatible form. Some of the more commonly used hydrometeorological data transmitting systems are-direct wire telephone line, line-of-sight ratio telemetry, radio relay, meteor-burst and satellite based system. The type of data transmission link to be used depends on the distances involved between measuring stations and the receiving centre, and on the nature of the terrain. Depending upon the above requirements, various systems of data transmission have been recommended and their relative merits are outlined.

With the advent of microprocessors and micro-computers. data-collection and transmission systems have undergone a remarkable improvement in terms of versatility and flexibility. Microprocessor-based systems are especially suitable for remote-field application which requires low-power, compact and flexible instrumentation. Flexibility is achieved by controlling the operations of the system through software.

(b) Technical Notes

1. WATER REQUIREMENTS OF CROPS

It has become essential to make effective use of the available water resources allocated for agricultural purposes. Besides better methods of land preparation, proper management of Irrigation water and improved cultural practices, it is necessary to improve the estimates of crop water requirements based on climatic data. Procedures for estimating crop water requirements should provide consistent land reliable results, and require minimum of data and computation. A reliable estimation of crop water requirements will help planning design and execution of an irrigation project.

The present technical note describes various methods of estimating crop water requirements. A review of various empirical relations for determining evapotranspiration has been presented. Application of various empirical relations has also been discussed giving details of data requirements. The various instruments required to collect the necessary data have also been mentioned. The F. A. O. in its Irrigation and Drainage paper No. 24 described four methods viz., Blaney Criddle, Radiation, Modified Penman, and Pan evaporation for estimating reference crop evapotranspiration and listed a computer programme using these methods for computing reference evapotransprration. The programme has been implemented on VAX-11/780 computer system of the institute and the results for a set of data are given. An exhaustive bibliography is given at the end of the note.

(c) User's Manuals

1. MODEL PARAMETER EVALUATION USING CATCHMENT CHARACTERISTICS

In view of growing development of water resources in many projects, it becomes necessary to estimate discharge values for ungauged watersheds or sites within a region. The simplest way is to transfer the information from catchments for which data are available to nearby ungauged catchments within a given region having similar hydrological characteristics. If loss rate parameters and unit hydrograph parameters of a rainfall-runoff model such as Nash Model are related to the catchment charcteristics, then the relationships thus obtained can be used to estimate discharges for ungauged catchments.

In this user's manual the following form of non-linear equations have been adopted between Nash Model parameters and catchment characeristics.

$$NK = a \left\{ \frac{LL_c}{\sqrt{S}} \right\} \qquad \text{.........(1)}$$

$$K = C\,(L)^d$$

Where N & K are the average parameters of the Nash Model for each gauged catchment, L is the length of the main channel, L_c is the length from the outflow point on the main stream nearest to the centroid of the watershed, S is the average slope of the stream, a, b, c and d are the unknown coefficients.

The unknown coefficients a, b, c and d in the above equations are obtained using multiple-linear regression programme MULTI • FOR after transforming the above equations into the linear form through logarithmic transformation. Knowing the coefficients a, b, c and the parameters af Nash Model for ungauged catchments can be obtained after solving the above two equations. The computer programme MULTI • FOR takes the values of NK as a dependent variable and $\left(\frac{LL_c}{\sqrt{S}}\right)$ as an independent variable for first equation and the values of K as dependent variable and L as an idependent variable for second equation. The programme gives the regression coefficients, the standard error of estimate, standard of regression coefficients, correlation coefficients, t-statistics and F-statistics etc. as the output. The computer programme MULTI • FOR has been implemented and tested on VAX-11/780 system. Input and output specifications for the programme have been described. The programme could be run on other computer system, having FORTRAN compiler, after making suitable modifications in the programme.

2. PREPARATION OF ROUTING CURVE/ WORKING TABLE

The tools such as computer models and data management systems, provide means to analyse the complex problems of alternate management strategies of multireservoir operations. A computer model synthesised from the existing models to analyse the impact of alternate multireservoir working rules to arrive at the suitable working rule under Indian conditions has been presented in the manual. The model described here is capable of analysing the systems of any configuration on ten daily basis using Kilter algorithm. Operation policies are given in terms of relative priority ranks between meeting the demand and storage levels.

A ratio called reservoir factor is introduced here to decide about the amount of releases. Reservoir factor is defined as ratio between the sum of storage presently available in the reservoir and the inflow during the remaining period of the year to the indent on the reservoir during the remaining period of the year. The model is capable of using 3 sets of operation rules depending upon the state i.e. whether the system is in dry or wet or average state. The manual also describes power computation capability both by conventional method and calibrated power table interpolation technique. The report identifies the data requirements. It ends with an exhaustive bibliography.

(d) Manuals

1. RESERVOIR CAPACITY COMPUTATION

A reservoir created behind a dam is best means of regulating surface water. It can change both temporal and spatial availability of water. One important parameter to be decided is the storage capacity of the reservoir to be constructed. From the physical point of view the minimum storage capacity can be zero and maximum can be the approximately the average annual flow of the stream. Thus the problem is to decide the capacity of reservoir between these two bounds. However, from economic point of view, one should choose, among the alternatives, that gives least cost, or in other words, the one having minimum storage capacity.

Two main techniques have been proposed in this report. The first technique is mass curve technique. Although this can be easily

Visit of Honourable Shri B. Shankaranand

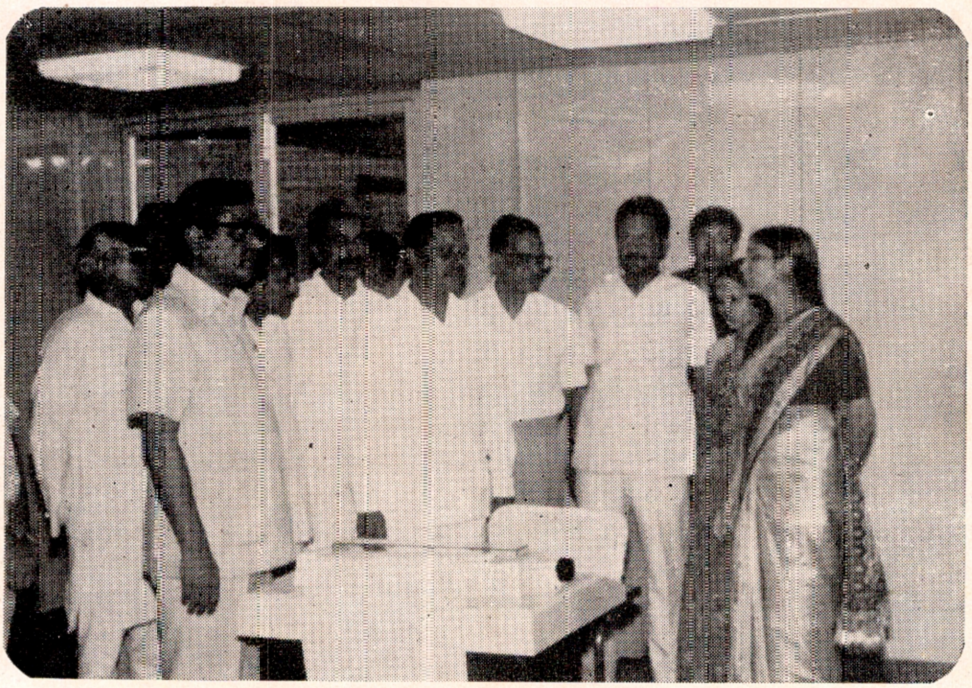
President of NIH Society to the Institute

on

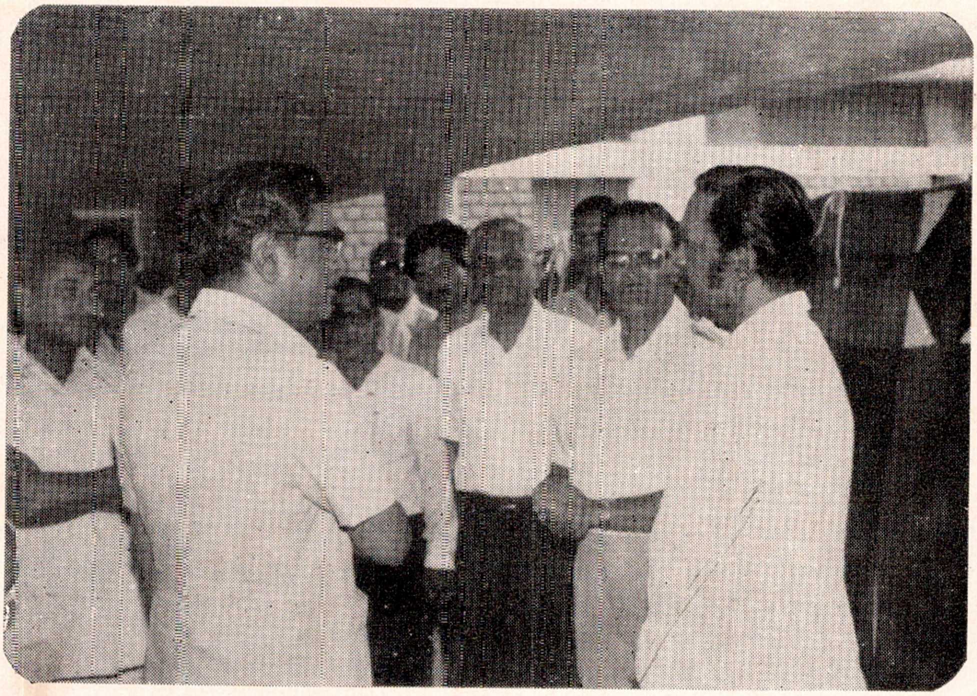
July 15, 1985

Few Glimpses

Inaugurated Experts' Hostel



Visiting Computer Centre



Discussing with the Scientists and staff members

Excerpts from the Address by Hon'ble Shri B. Shankaranand, President, NIH Society and Union Minister of Irrigation and Power to the Scientists of the Institute during his visit to the Institute on July 15, 1985

* I am very happy to be with you here in this Institute today. You all know, the development of our water resources is going to be a back-bone of further economic growth. Hence we must have a very thorough understanding of the science dealing with the occurrence of water on this globe. In the absence of a proper apprecia-tion of the various hydrological processes, it has not yet been possible for us to deal effectively with some of our vexed problems like floods and the droughts-both of which represent the nature's extremes.

* I would strongly urge that NIH should immediately set up programmes for the measure-ment of hydrological processes in the different regions of the country and throw better light on the impact of the different factors involved therein. Our country has got varied climatic pat errs in its different parts and a variety of physiographic features. Hence it would not be correct to generalise any phenomenon. NIH would have to develop strong regional centres for studying the specific hydrologic characteris-tics of the different regions of the country.

* I am not sure how accurately the phenomenon of drought or floods is predictable. However, there is an urgent need for developing appro-priate methodologies for predicting such calamities before they can cause catastrophe. I understand that some work has already been done in the area of flood forecasting but very little prediction has been possible in the case of droughts. I would. therefore, suggest that NIH should address itself to this area of work and see if they are able to develop some scienti-fic techniques by which the drought situations can be reasonably forecasted. More than one third of our agricultural area is drought prone. Agricultural operations are carried out under precarious conditions. Hence the management of water in the drought area will have to be done in a very scientific manner. It would be advantageous if the NIH sets up special studies on the evaporation processes, moisture-losses from the soil and the ground water movements in the drought areas. NIH may, in fact, assign these problems specifically to some identified groups of its scientists.

* We will have to develop scientific methodo-logy for water accounting of our projects by undertaking extensive measurements on the various loss-phenomena. It w'll be interesting to know how far you have addressed yourself to this problem. You may adopt a few projects from the different regions of the country and try to develop their annual water accounts in a scientific manner. For such efforts, you may not wait for the project authorities to approach you, but you may at your own initiative approach the different project authorities and get yourself involved in the problems being faced by them in respect of annual water accounts.

* I would like to sound a word of caution in this context. The sophisticated technology developed by the advanced countries may not fit in exactly in the Indian context. Particularly in the field of hydrology, we may have to remember that our data base is not as extensive as could be developed by the advanced countries over centuries.

programmed, it is basically a graphical technique. Solving the problem graphically gives the insight into it which may be missed if using a computer programme.

The second approach is based upon an optimization technique called Linear Programming. One framework in which it can be used is known as Linear Decision Rule which recognizes that linear rules are equally good or better than quadratic or power rule. Both aspects of Linear Decision Rule, namely deterministic and stochastic have been discussed in the report. The methodology of computing reservoir capacity has been presented in linear programming formulation. Its solution could be obtained using available linear programming packages.

2. HYDROLOGIC WATER BALANCE

The term 'Water Balance' means the systematic presentation of data on the supply and use of water within a geographic region for a specific period of time. The impact of storage reservoir, diversion works, well production, deforestation and other type of resource development can be assessed through a water balance. On the basis of water balance approach it is possible to make a quantitative evaluation of water resources and their change under influence of man's activities. An understanding of water balance is also extremely important for studies of the hydrologic cycle, to identify deficiencies in the distribution of observational stations and to discover systematic errors of measurements and also for indirect evaluation of unknown water balance component. The study of the water balance involves the principle of conservation of mass often referred to as the continuity equation.

Water balance method may be applied to any area, river basin, water bodies etc. and may be computed for any time interval. In this manual, procedure for hydrologic water balance of a river basin has been described. A river basin is the only natural area for which large-scale water balance computations can be simplified. The accuracy of computation increases with an increase in river basin area.

Manual for hydrologic water balance for a watershed is intended to assist water resources engineers and planners in estimating the availability of water for existing requirements as well as for future development.

Main water balance components considered are precipitation, runoff, evaporation and water storage in various forms. The general water balance equation for a river basin is given by following simple form,

$$P - E - Q - \Delta S - \eta + I - O' = 0$$

where, P = Precipitation as rainfall or snow,

E = Evaporation and evaportranspiration,

Q = River discharge from the basin,

ΔS = Change in storage of water,

η = Errors of measurement of estimation,

I = All inflows to the basin from adjoining basins, and

O' = All outflows from the basin to the adjoining basins.

Water balance may be computed for any time interval, but distinction is made between mean water balances and balances for specific periods (such as season, month or days). Mean water balances are usually computed for an annual cycle and for that positive and negative water storage variations tend to balance i.e. $\Delta S = 0$. For short time interval change in total water storage may be given as;

$$\Delta S = \Delta M + \Delta S_l + S_c + S_g + \Delta S_s + \Delta G$$

where,

ΔM = Change in moisture storage,

ΔG = Change in aquifer storage,

ΔS_l Change in lakes and reservoirs,

ΔS_c = Change in river channels,

ΔS_g = Change in glaciers, and

ΔS_s = Change in snow cover.

All the components of water balance are to be computed by independent methods. The manual provides the independent procedure for computing mean basin precipitation, observed discharge at basin outlet, mean basin evaporation and change in moisture storage, change in aquifer storage and change in lakes and reservoir storage. The other two components ΔS_g and ΔS_s are not considered under purview of this manual.

The discrepency of water balance (η) is given as the residual term of the water balance equation and includes the errors in determination of the componenrs considered and the values of components not taken into account by the particular form of equation used.

SPONSORED PROJECTS

1. The final report of the project 'Narmada Design Flood Studies' has been submitted to Narmada Cell, Mininstry of Irrigation, Govt. of India, on July 15, 1985.
2. Work on the NWDA sponsored project 'Water Availability at three sites in Mahanadi Basin' is under progress and is expected to be completed by October 1985.

INTERACTION WITH OTHER ORGANISATIONS

Director visited dfferent Organisations during the quarter with a view to making intractive discussions with concerned officers regarding problems in the areas of Hydrology and Water Resources Planning so that Institute could contribute its expertise for solving these problems.

1 (a) Secretary, and chief Engineer (D & R), Department of Irrigation and waterways, Government of West Bengal. Discussions were held regarding possible interaction and involvement of the Govt. of West Bengal in setting up a Regional Centre in West Bengal. Preparation of a representative hydrological year book for Kaliya Ghai river studies and analysis of sedimentation data for small reservoirs were also discused. Government of West Bengal requested the Institute to organise a workshop of Flood Frequency Analysis in December.

b) Director, State Water Investigation Directorate, Dept. of Agriculture, Govt. of West Bengal. Discussions were held to undertake joint work for water balance studies of Darakeshwar river basin and groundwater modelling studies. Demarcation of recharge areas using isotopes had been indicated as a possible field of collaboration.

2. Secretary, Irrigation and Chief Engineer, Planning and Research, Govt. of Punjab. Discussions were held to study flash floods and to evolve a design flood for the region. Modelling of surface and ground water in this region to control water logging and brackish ground water was also discussed.

3. Engineer - in - chief, Haryana Irrigation Deptt. Department indicated keen interest in utilising the expertise of the Institute for solving its pressing hydrological problems.

4. a) Engineer-in-Chief, orissa Irrigation Department. The department expressed their eagerness for a comprehensive study for evolving a criteria for design flood. Assistance has been sought for finalising the computer configuration of the proposed computer to be procured by the Department and to train the manpower in the area of Hydrology and Computer Applications. Department requested the Institute to organise a workshop on Flood Frequency Analysis in April, 1986.

b) Director (Technical), Orissa Lift Irrigation Corporation. The corporation wanted the Institute to organise training of their officers in Computer Programming and Ground Water Modelling. Further, it has been indicated that the Corporation will be needing the support of the Institute to finalise the configuration of a mini/micro computer which is likely to be procured in future.

5. Chief Engineer, Subarnarekha Multipurpose Project. Discussed about the Project with Chief Engineer and officers of Central Ground Water Board of Subarnarekha UNDP Project.

6. Visited Experimental Watersheds of the Central Soil and Water Conservation Research and Training Institute and Forest Research Institute in and around Ooty and held discussions with the senior scientists.

7. Director, National Remote Sensing Agency, Hyderabad. Discussed about the works that are being carried out in this organisation.

ORGANISATION OF SEMINARS/WORKSHOPS

*A one-day seminar on 'Flood Frequency Analysis' sponsored jointly by National Institute of Hydrology and Central Board of Irrigation and Power has been held on September 30, 1985 at CBIP, New Delhi.

* The workshop on 'Ground Water Modelling–Tyson Weber Model' which was postponed earlier, is now scheduled to be held from November 18 to 22, 1985 at Roorkee. The workshop is intended to impart the training for the use of Tyson-Weber Model for the field engineers who are associated with the problem of regional aquifer simulation and who have basic knowledge in Computer programming. Interested persons may please contact:

Dr. P.V. Seethapathi
Scientist 'E' and Head
Ground Water Synthesis Division
National Institute of Hydrology
Jal Vigyan Bhawan
Roorkee-247 667,

* A four day regional workshop on 'Flood Frequecy Analysis was held at Assam Engineering collige, Guwahati from Oct. 7-10, 1985. The workshop is being organized in collaboration with Brahmaputra Board. The aim of the workshop is to impart training to field engineers of the region for carrying out flood frequency analysis.

ACTIVITIES OF HILTECH SECRETARIAT

The High Level Technical Committee on Hydrology (HILTECH) Secretariat which is attached to National Institute of Hydrology was very active during the period. The following meetings took place :

1. The Sixth Meeting of HILTECH was held at Hyderabad on August 19, 1985. The meeting was chaired by Chairman, Brahmaputra Board and was attended by a number of members, state coordinators and invitees. The committee took important decisions regarding collection and dissemination of hydrological research in India, encourage national institutes to take up hydrological research and effective participation of India in International Hydrological Programme (IHP). The committee also discussed the active participation of state governments in HILTECH activities.

2. The meetings of the following HILTECH panels took place :

a) The meeting of the Water Resources Panel took place on August 2, 1985 at Roorkee. The panel discussed the action plan for bringing out state-of-art reports and status papers on Water Resources Systems.

b) The meeting of the Hydrometeorology panel took place on Sept. 9, 1985 at Delhi. The panel reviewed the status of research in hydrometeorology in India and suggested areas of research.

3. The meetings of the following HILTECH sub-committees took place :

a) The meeting of the Expert Review Group for IHP-Phase III took place on June 25, 1985 at Delhi. The Group decided about the actions to be taken for active participation of India in IHP-Phase III.

b) The meeting of the 'Sub-committee for Incentive to Post Graduate Courses' took place on June 25, 1985 wherein important decisions were taken to promote hydrology education in India.

c) The meeting of the 'Sub-committee for Man Power Assessment' in Hydrology took place on June 25, 1985 at Delhi. The committee discussed the methods to assess man-power requirement in hydrology.

d) The meeting of the HILTECH Steering Committee took place on July 30, 1985 at Delhi. The proposals received for funding were considered. The research proposal submitted by Prof. Subhash Chander entitled "Development of Generalised Software on HP-1000 Computer System for Unit Hydrograph based forecast model and its application on the real time Data collected on Yamuna and other catchments", was recommended for HILTECH support to Chairman, HILTECH. Subsequently, the proposal has been approved by Chairman, HILTECH and was placed before the Sixth meeting of HILTECH for information and noting.

The printing of "Hydrology Review" for 1984 is under progress and is expected to be published soon.

ARCCOH SECRETRIAT

Progress of Compilation of Directory of Hydrologists

The secretariat has given final shape to the Experts' directory and it has been sent to press for publication. About seven hundred completed questionnaires have been received fom various ARCCOH Counties including India, Srilanka, Nepal, Pakistan, Malaysia, Afghanistan and Bangladesh. Other ARCCOH countries have been requested to send the questionnaires soon to the secretariat.

Third ARCCOH Steering Committee Meeting

The High Level Technical Committee on Hydrology (HILTECH) hosted the third meeting of ARCCOH Steering committee which was held at the conference hall of world Bank, New Delhi from 18-20 September, 1985. The meeting was attended by members/observers from India, Nepal, Malaysia, Iran and representatives of UNESCO, Paris and its regional offices in Jakarta and New Delhi. The committee discussed in details the formulation of a Major Regional Project in Water resources for South-Central Asia and preparation of hydrogeological map of Asia. Discussions were also held on organisation of seminars, symposia, workshops, conferences etc in various Asian countries as part of IHP-III activities. The committee expressed satisfaction over the functioning of ARCCOH in past and suggested measures to further boost its activities in the region.

Lab News

Soil moisture measurements using Soil Moisture Neutron Probe are in progress and a microprocessor based soil moisture monitoring system is being developed.

Computer News

The capabillities of the VAX-11/780 computer System have been enhanced by adding few more peripherals like Card Reader (CR-II), Line Printer (B 600), additional memory, and nine more terminals. The memory of the System is now enhanced to 1.5 Megabytes. One personal computer having word processing facilities, has been installed in the computer centre.

News

* Independence Day was celebrated in the Institute with great enthusiasm this year too. The Director hoisted the National flag and emphasised the role of scientists in the arduous task of building a strong nation.

* **Building and Related Activity**

The construction of extension of Jal Vigyan Bhawan has commenced. The laying of Water supply distributory line is near completion. The uninterupted Power Supply System is being installed to maintain power supply to the computer during changeover from A.C. to D.C. supply in case of A.C. failure.

* **NIH Recreation Club.**

The club organised an interesting Quiz competition on July 29, '85.

* **Appointments, Resignations, Interviews etc.**

Nine number of supporting and ministerial staff have joined the institute during the quarter.

Sh. Bhaskar Datta, Scientist 'C' has reverted back to Flood Control Department, Assam, in August, 1985.

Sh. A.T. Jeyaseelan, Sr. Research Asstt. has resigned and has been relieved.

Following posts have been advertised

(i) Scientist-E, (ii) Scientist-C, (iii) Scientist-B (iv) Jr. Engineer (v) Sr. Research Asstt.

(vi) Lower Division Clerk (vii) Attendant/ Peon.

Interviews were held for posts of Scientist-B, Research Supervisor, Research Asstt, Hindi Translator, Tracer and Driver.

DISTINGUISHED VISITORS

1. Mr. Brain Albinson,
   World Bank,
   Washington D.C.

2. Mr. M.A. Chitale,
   Jt Secretary (Ganga Basin)
   Ministry of Irrigation,
   New Delhi.

3. Dr. Bharat Singh,
   Vice Chancellor,
   University of Roorkee,
   Roorkee.

4. Dr. Audrei Filotti,
   Chief Technical Advisor,
   Deptt. of Technical Cooperation for Development, United Nations.

5. Mr. W. H. Gilbrich,
   UNESCO Head Quarters,
   Paris.

6. Mr. Javaslov Urban,
   UNESCO Regional Office,
   Jakarta.

7. Mr. D. Hauet,
   Acting Director,
   Science Operation Division,
   UNESCO, Paris.

8. Mr. B. Dev,
   Chief Engineer (Retired), Irrgation Deptt.,
   Govt. of West Bengal.

9. Mr. A. K. Ummat,
   Chief Engineer (Drainage),
   Irrigation Deptt., Punjab.

RECENT ACQUISITIONS IN LIBRARY

1. Remote Sensing in Civil Engineering, edited by T.J M. Kennie and M C. Matthews, Halsted Press, 1985, 357 pages

2. Chemical Hydrogeology, edited by W. Back and R.A. Freeze, Hutchinson Press, 1983, 419 pages.

3. Proceedings of the Fourth Congress of Asian and Pacific Regional Division of the International Association of Hydraulic Research, Sept. 11-13, 1984, Thailand Asian Institute of Technology, 1984, 2 Volumes, 1886 pages,

4. Frontiers in Hydrology, edited by W H.C. Maxwell and L. R. Beard Water Resources Publications, 1984, 325 pages

5. Recursive Estimation and Time Series Analysis, by P. Young, Springer - Verlag, 1984, 300 pages.

6. Using Computers to Solve Reservoir Engineering Problems. by M.A. Nobles, Gulf Publications, 1984, 2nd edition, 561 pages

7. Streamflow Characteristics, by H.C. Riggs, Elsevier Publishers, 1985, 249 pages.

8. Urban Hydrology, by M. J. Hall, Elsevier Applied Science Publishers, 1984, 299 pages.

9. Guide book on Nuclear Techniques in Hydrology, International Atomic Energy Agency, 1983, 439 pages.

Anubhav Printers & Packers, Anaj Mandi, Mathura Bhawan, Roorkee Phones : 2007 2654