SESSION-8 :

WEB GIS, HYDROLOGICAL ANALYSIS

14th National Symposium on Hydrology with focal theme on "Management of Water Resources under Drought Situation", 21-22 December, 2010, Organized by National Institute of Hydrology, Roorkee and Malaviya National Institute of Technology, Jaipur at Jaipur, Rajasthan

WEB BASED INFORMATION SYSTEM FOR MAJOR AND IMPORTANT LAKES IN INDIA

Deepa Chalisgaonkar, Suhas Khobragade
National Institute of Hydrology, Roorkee – 247 667

ABSTRACT

There are tens of hundreds of lakes of varying socio-economic significance in India, both natural and artificial. Natural lakes are mostly concentrated in Himalayas and the manmade lakes in the arid and semi-arid regions. However, no systematic data about the total lake water resources of India are reported so far. A national inventory of wetlands of India, initiated by the Govt. of India in the 1960's, could only give a broad assessment of the wetland areas in 1984.

The progress and quality of research depends upon the availability as well as quality of data. Systematic storage and management of data and creations of data banks for lakes are also needed for proper planning and management. Although India has a history of lake research of well over a century now, unfortunately the data availability, storage and management is not very encouraging. Long term data are not available, except for a few lakes which have been systematically studied. In general natural lakes of high latitude Himalayas, particularly the lakes of Kashmir and Kumaun, have received more attention by researchers than other lakes. Of the low altitude tropical lakes, studies have concentrated on some specific regions for example lakes of Udaipur, Hyderabad, Bhopal, etc. As far as other lakes are concerned, only sporadic and preliminary studies have been reported. In many cases, these studies are scattered at different sources, often not easily accessible. As such there is a need to bring the various findings and data together. An attempt is now being made by the National Institute of Hydrology, Roorkee to develop a digital information system for lakes in India. Information related to as many lakes as possible is being added to the system. It is also proposed to update the system frequently.

The present paper gives an overview of the web based information system for the lakes of India being developed at the National Institute of Hydrology, Roorkee. It is hoped that the system will be helpful for the users working in the area of research related to conservation and management of lakes in India.

14th National Symposium on Hydrology with focal theme on "Management of Water Resources under Drought Situation", 21-22 December, 2010, Organized by National Institute of Hydrology, Roorkee and Malaviya National Institute of Technology, Jaipur at Jaipur, Rajasthan

WEB GIS FOR DAMS AND DIVERSIONS IN INDIA

D.S. Rathore, Deepa Chalisgaonkar, Tanvear Ahmad
National Institute of Hydrology, Roorkee

ABSTRACT

In India, the large and growing population combined with highly seasonal rainfall and need for economic development is driving the construction of dams. Dams mainly store water for irrigation purposes, for generating hydro-electricity and for preventing floods. In the year 1947, there were around 300 large dams throughout the country and number gradually increased by 2000 when it reached to almost 4000. India holds a strong position in the list of dam building countries, after US and China. Dam construction is considered as one of the greatest investments in the field of irrigation. Owing to the construction of dams, the country`s food grain production increased rapidly over the past few decades.

For decision making in water resources planning and management, country wide information on water resources development in India covering existing water resources projects is needed. The information could be in form of location and salient features of major dams and diversions in India. Geographical Information System (GIS) has emerged as a very important tool for effective planning in the various stages of the decision making. GIS provides a tool for effective and efficient storage and manipulation of spatial and non-spatial data types of dams and diversions. Traditional GIS are complex systems that require sophisticated hardware and infrastructure. They are capital intensive and most organizations cannot afford the resources needed to institutionalize such systems. The systems are highly centralized. Even in a client-server configuration, they use a thick client that requires high-end workstations and an intricate user-interface. These limitations of traditional GIS hindered the wide spread adoption of this technologies.

A new category of GIS called Web GIS has emerged which uses a spatial representation for displaying spatial information in web environment which has much wider reach. Web GIS are increasingly becoming popular since these facilitate to work / analyse data from a remote place and make holistic decisions. Application of a high end, powerful and open source Web GIS software Mapserver for managing information of dams and diversion structures of India, is presented in the paper.

14th National Symposium on Hydrology with focal theme on "Management of Water Resources under Drought Situation", 21-22 December, 2010, Organized by National Institute of Hydrology, Roorkee and Malaviya National Institute of Technology, Jaipur at Jaipur, Rajasthan

ECOHYDROLOGICAL ANALYSIS USING SOIL HYDROLOGICAL PARAMETERS –A CASE STUDY

B. K. Purandara, S. Chandrakumar

National Institute of Hydrology, Hard Rock Regional Center,
Hanuman nagar, Belgaum

V. K. Choubey
National Institute of Hydrology, Roorkee

ABSTRACT

In water scarce ecosystems, soil moisture and vegetation have a coupled relationship that is basic to ecosystem dynamics. The dynamics of the interactions is crucially influenced by the scale at which the phenomena are studied as well as by the physiological characteristics of vegetation, the pedology of the soil, and the type of climate. Through transpiration, plants have an active role in soil water use that heavily conditions the water balance. A substantial amount of information exists on the energy and water balance of various types of vegetation, however, there are only limited literatures available on soil moisture characteristics and soil hydraulic measurements under different land cover conditions spread over various climatic conditions. In general, the energy and water balance of an area can be greatly influenced by slope, aspect and altitude which combine with and in fact modify the local climate and even the vegetation. For instance, upland forests respond to precipitation and energy inputs in a very different way from low land arable crops. Therefore, in the present study an attempt has been made to understand the relation between soil hydraulic properties and climatic conditions. Belgaum district represent a unique climatic condition in the State of Karnataka where the climate varies from humid climate to a semi-arid climate over a distance of about 90 km stretch. In this regard, soil samples under different land covers were collected from different climatic regions and soil hydraulic parameters such as soil moisture, soil retention characteristics, infiltration and saturated hydraulic conductivity were estimated. The preliminary results of the study showed that the climatic variability has a significant control on the fundamental soil properties such as soil moisture availability (quantity and duration), saturated hydraulic conductivity and retention characteristics showed the influence of climatic condition on the above measured parameters. However, in order to arrive at a more precise conclusion detailed investigations are required.

14th National Symposium on Hydrology with focal theme on "Management of Water Resources under Drought Situation", 21-22 December, 2010, Organized by National Institute of Hydrology, Roorkee and Malaviya National Institute of Technology, Jaipur at Jaipur, Rajasthan

VARIATIONS OF SNOW MELT CONTRIBUTION IN THE UPPER PART OF BEAS BASIN LOCATED IN WESTERN HIMALAYA

S. P. Rai, Rajeev S. Ahluwalia, S. K. Jain, Bhishm Kumar
National Institute of Hydrology, Roorkee

ABSTRACT

The proper estimation of snow and glacier contribution in annual flow of a snowfed river is very important for planning and development of water resources. Snow and glacial melt contribution in Beas basin located in Western Himalayan region has been carried out. Beas river originates from Beas Kund and Rohtag pass at the altitude of 3505 meters and 3977 meters respectively and major tributaries the river are: Parvati River near Bhuntar, Tirthan and Sainj rivers near Larji, Sabari nala near Kulu and Bakhli khad near Pandoh dam. All these rivers are perennial and the flow varies considerably during different months of the year. In spite of the significance of Beas River for a large population of the Northern region of India, only a few systematic studies on the snowmelt and glacier runoff assessment have been made so far.

River discharge and rainfall data from 1996 to 2008 were collected from Bhakara Beas Management Board (BBMB), Pandoh and have been analysed. River lean flow period is during the month of October to the month of January. River Discharge gradually increases from February with increase in air temperature. It was observed from the discharge that there are two peaks at Manali which are in the month of June and August of each year. The highest peaks are found in the month of August due to contribution from rainfall-runoff and snowmelt from higher altitude. The first peak is due to melting of seasonal snow mainly in lower part of the basin. The seasonal analysis of runoff of the River at Manali reveals that out of total river runoff 65% occurs during monsoon period and remaining 35% during pre-monsoon (18%), post monsoon (8%) and winter (9%).

The discharge data at Manali site of the years 2002-2008 have been used to estimate the snowmelt contribution using the baseflow separation techniques. In these years, rainfall is less than 25 mm in a day except two events. It is assumed that there is no significant contribution from the rainfall-runoff due to the initial losses from rainfall. The results show that river receives snow melt contribution from March to August in significant amount and in other months it is sustained by subsurface/groundwater contribution. The snow melt contribution varied from minimum 35% (2004) to maximum 52 % (2008) in a year. The annual average contribution of snow and glacier in river runoff is approximately 47% of total runoff.

14th National Symposium on Hydrology with focal theme on "Management of Water Resources under Drought Situation", 21-22 December, 2010, Organized by National Institute of Hydrology, Roorkee and Malaviya National Institute of Technology, Jaipur at Jaipur, Rajasthan

HYDROLOGICAL MODELLING OF CATCHMENTS IN MAHANADI RIVER BASIN USING ARC-SWAT

P. Sagar Narhar, C. Chatterjee, A. Mishra and R. Singh
Department of Agricultural and Food Engineering,
Indian Institute of Technology, Kharagpur, West Bengal 721302, India

ABSTRACT

A distributed parameter model, ArcSWAT (ArcGIS Soil and Water Assessment Tool) was calibrated and validated on daily basis in order to predict runoff for the Kesinga and Salebhata catchments in Mahanadi river basin, India. Kesinga and Salebhata catchments comprise an area of 11794 km^2 and 4515 km^2, respectively. The required input data for model were collected from different sources.

Model set up for the two catchments were prepared. For calibration and validation of ArcSWAT model, the data collected for the monsoon period of 2004 to 2006 (1^{st} June - 30^{th} September) were used. Model was calibrated using parameters like Curve number (CN_2), Base flow recession constant (ALPHA_BF), Soil available water capacity (SOL_AWC), Surface runoff lag coefficient (SURLAG), Manning's n for channel (CH_N_1) and Soil evaporation compensation factor (ESCO). Calibration and validation results revealed that model predicted daily runoff of Kesinga and Salebhata catchments satisfactorily.

Sensitivity analysis was performed on six different parameters used in model calibration by changing the calibrated value of each parameter by a fixed percentage (10%) and results show that parameter CN_2 is most sensitive and parameter ESCO is less sensitive as compared to other parameters for both the catchments. SRTM (90×90 m resolution) and ASTER (30×30 m resolution) DEMs were considered for studying the effect of DEM resolutions on runoff and it was found that both DEMs provide similar results during calibration and validation of ArcSWAT model and hence, either of SRTM and ASTER DEM may be used.

14th National Symposium on Hydrology with focal theme on "Management of Water Resources under Drought Situation", 21-22 December, 2010, Organized by National Institute of Hydrology, Roorkee and Malaviya National Institute of Technology, Jaipur at Jaipur, Rajasthan

HYDROLOGY PROJECT (SW) MAHARASHTRA A TOOL FOR SUSTAINABLE DEVELOPMENT OF SURFACE WATER HYDROLOGY

M. K. Pokale, S. K. Kshirsagar
Hydrology Project Circle (Collection), Nashik, Maharashtra

ABSTRACT

God has bestowed Earth Mother nature in various forms of resources to the universe. Now-a-days water is a burning issue. Third WAR will be for the Water. God has gifted it to us as green environment. But increase in civilization, urbanization and industrialization has made man to go against nature. These all aspects have really destroyed our nature. While going ahead towards development and production, we have forgotten that simultaneously we using our natural non-renewable sources to large extent. These all are on the verge of extinction. We are developing without thinking of our future generation. So we should develop considering the term "sustainable development." Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

National Hydrology Project was started in 1995 under the Ministry of Water Resources, Govt. of India. The project was implemented in 9 Southern States with 6 central agencies. The aim of the Hydrology Project was to develop comprehensive, easily accessible and user friendly databases covering all aspects of Hydrological Cycle, including surface water and ground water in terms of quantity and quality and climatic measurements, particularly of rainfall involving complex web of inter-state and intra-governmental relationship. The development of the databases would support major aspects of India's Water Policy, particularly with regards to water allocation and planning and management of water resources development at the National, State, Basin and Project level.

The paper includes some findings in the sector of quantity as well as quality also followed by remedial measures wherever necessary. It also includes achievements of Hydrology Project (SW), along with recommendations for maintaining the wholesomeness of surface water.

This paper will play a vital role and guideline to the users, individual, farmers, researchers, academic personals, NGO's in this sector for sustainable development of Surface Water Hydrology with advance tools and computerized software. Sustainable development of Surface Water Hydrology needs data of various variables in Hydrology & this paper will be the step towards Success of Story, which is available in the DATA BANK of Hydrology Project.

14th National Symposium on Hydrology with focal theme on "Management of Water Resources under Drought Situation", 21-22 December, 2010, Organized by National Institute of Hydrology, Roorkee and Malaviya National Institute of Technology, Jaipur at Jaipur, Rajasthan

HYDROLOGICAL EVALUATION OF A POND IN THE KANDI-BELT

M. K. Goel
NIH, Roorkee

Santosh S. Mali
ICAR, Ranchi

Naresh Kumar
NIH, Roorkee

ABSTRACT

Kandi-belt is the steeply sloping submontane belt of the Himalayas fringing the Siwalik hills and extending discontinuously from Jammu and Kashmir to Assam. Major land and water management problems being faced in the Kandi-belt include excessive runoff, soil erosion, land degradation and erratic water distribution in space and time. Population in the entire belt suffers from water scarcity. Almost all villages in the Kandi-belt have one big pond which has played a crucial role for conserving water for domestic and irrigation purposes. However, by the middle of the 20th century, piped drinking water supply has led to the neglect of these ponds. A long-term solution to the water scarcity problem in the Kandi belt lies in the rejuvenation of these village ponds. However, any rejuvenation effort first requires the hydrological evaluation of the present system.

In this study, an attempt has been made to demonstrate the hydrological analysis for a pond, the results of which can be utilized for rejuvenation purposes. Water balance analysis has been carried out for Sohal pond and different components of water balance (say inflow, evaporation losses, seepage losses, outflow etc.) have been estimated. Inflow to the pond has been estimated by using the Soil Conservation Service (SCS) Curve Number method. Water balance of the pond has been carried out at daily time step. Generalized computer programs have been written for inflow estimation and water balance analysis. The inputs to the models include daily rainfall, normal evaporation depths, elevation-area-capacity table, and seepage rate from the bottom surface. The outputs from the models include generated inflow to the pond, evaporation loss, seepage loss, water storage depth, spread area, and volume on any day. Spills (if any) from the pond are also estimated.

From the SCS analysis, the runoff coefficient for the catchment of Sohal pond has been found to be 0.225. From the water balance analysis, it was observed that the pond remains perennial throughout the year. Seepage loss is the major water loss factor from the pond though it may contribute to groundwater recharge and subsequent usage. In the monsoon season, the spill from the pond is also appreciable. If the water of the pond is diverted for irrigation or other domestic use during such surplus periods, the storage of the pond can be optimally utilised. There is a strong need to conserve the quality and quantity of the water of the pond which can benefit the society in the long run. The developed

programs can be used for the hydrological analysis of any other pond in the Kandi-belt.

This study has the limitations of hydrological observations in the area. If only a simple staff gauge is installed in each pond and daily observations of pond water level are recorded, significant improvements in the hydrological analysis can be made.

14th National Symposium on Hydrology with focal theme on "Management of Water Resources under Drought Situation", 21-22 December, 2010, Organized by National Institute of Hydrology, Roorkee and Malaviya National Institute of Technology, Jaipur at Jaipur, Rajasthan

APPLICATION OF RS AND GIS FOR THE ASSESSMENT OF PHYSICAL CHARCTERISTICS OF WATERSHED

Dilip G. Durbude and V. K. Choubey
Environmental Hydrology Division
National Institute of Hydrology, Roorkee- 247 667

ABSTRACT

Remote Sensing is a powerful spin-off from space exploration and it has emerged as a useful tool for watershed characterization, planning and management in recent times. The integrated approach of Remote Sensing and GIS have a capabilities of data exploration, storage, retrieval and manipulation, plays an important role for systematic analysis of various lithological, geo-morphological, soil, hydrological and land use characterization following the synoptic and multi-spectral coverage of terrain. In the present study, efforts have been made to assess the physical characteristics of the Ralegaon Sidhi watershed in Ahmednagar district of Maharashtra State, India. The integrated approach of the remote sensing and GIS techniques has been used to identify the land use/cover pattern and morphological characteristics of the watershed. IRS 1C LISS III satellite data have been analyzed in conjunction with topographical data of Ralegaon Sidhi watershed for land use and morphological characterization of a watershed under the GIS environment. Five major land use/cover classes were identified. Agriculture is identified as the major land use/cover unit in the study area.