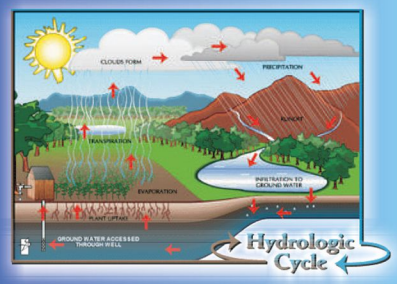
Issue 16 December 2019

Hydrology for People™

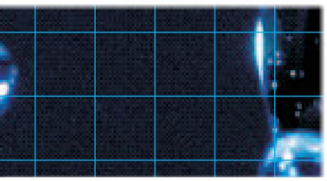
आपो हिष्टा मयोभुवः

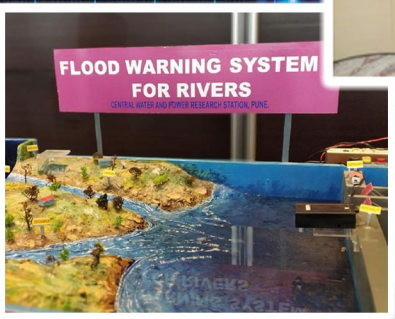
जन साधारण के लिए जलविज्ञान अंक:16

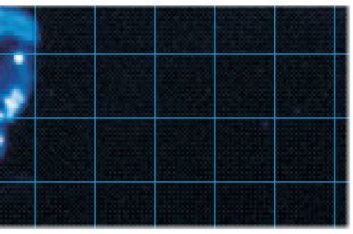


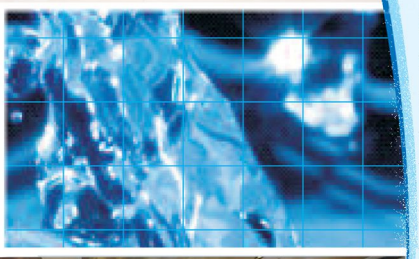
Newsletter of National Institute of Hydrology, Roorkee (India)

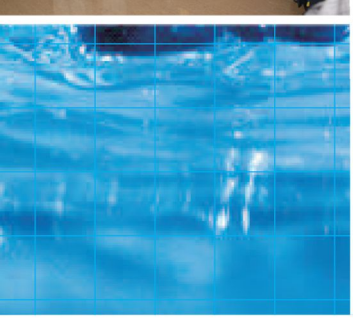
राष्ट्रीय जलविज्ञान संस्थान रूड़की द्वारा प्रकाशित समाचार पत्र



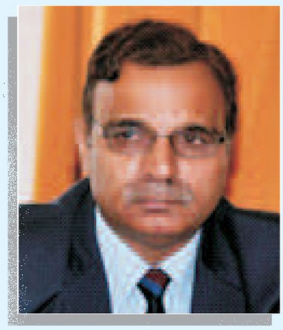








From Director's Desk



Pre-monsoonseason in current year (2019) was one of the most difficult times concerning management of water resources In India.

The progress of monsoon had been slow so far and the month of June has been one of the driest months in the recent times. Consequently, residents of many urban and rural areas found it difficult to get enough water, even for drinking water needs. many reservoirs were close to their minimum level or had dried up; many small tanks and ponds were almost dry To manage the situation, Ministry of Jal Shakti has launched a massive Jal Sanrakshan Abhiyan covering 254 most water stressed districts of the country.

The first phase of the program will run from 01 July 2019 to 15 Sept. 2019.

In order to find a sustainable solution to water scarcity problem in India, several steps would be essential.

First, we will have to prepare schemes to conserve flood flows by employing a range of tools such as surface storage reservoirs, minor irrigation tanks, ponds and sub-surface storage. Small structures need to be constructed for inducing recharge to ground water at village level. Second, there is a need to make and implement schemes for transfer of water from surplus to deficit region, at local, regional as well as at national level.

Unchecked withdrawal from ground water is causing a number of problems as water tables are rapidly falling in many parts of India and we have to regulate ground water use. Besides, due attention has to be given for rejuvenation of rivers and environment. To overcome the ill effects of poor quality of water in rivers, shallow aquifers, and ponds, it would be necessary to strictly enforce the water quality norms.

Sharad K. Jain

About National Institute of Hydrology

The National Institute of Hydrology (NIH), established in 1978 as an autonomous organization under Ministry of Water Resources (Government of India), is a premier R&D institute in the country to undertake, aid, promote and coordinate basic, applied and strategic research on all aspects of hydrology and water resources development.

The Institute has its headquarters at Roorkee (Uttarakhand). To carry out field related research covering different regions of the country, the Institute has four Regional Centres located at Belagavi, Jammu, Kakinada and Bhopal, and two Centres for Flood Management Studies at Guwahati and Patna. The Institute has established state-of-art laboratory facilities in the areas of Nuclear Hydrology, Water Quality, Soil Water and Remote Sensing & GIS Applications.

The Institute acts as a centre of excellence for the transfer of technology, human resources development and institutional development in specialized areas of hydrology, and conducts user defined, demand-driven research through collaboration with relevant national and international organizations.

The Institute vigorously pursues capacity development activities by organizing training programmes for field engineers, scientists, researchers and NGOs. The Institute has undertaken a number of internationally funded projects, including those from UNDP, USAID, UNESCO, The World Bank, The Netherlands, Sweden and European Union. The Institute is presently participating in the World Bank funded National Hydrology Project and National Mission for Sustaining the Himalayan Ecosystem (NMSHE) (GoI funded).

The Institute is actively pursuing the IEC and mass awareness activities and is contributing in 'Jal Shakti Abhiyan' of the Ministry of Jal Shakti (GoI). NIH hosts the Secretariats of Indian National Committee on Climate Change (INC-CC) and Indian National Committee for International Hydrological Programme of UNESCO (INC-IHP).

Thrust Areas

- Water Resources Planning and Management
- Ground Water Modeling and Management
- Flood and Drought Prediction and Management
- Snow and Glacier Melt Runoff Estimation
- Prediction of Discharge in Ungauged Basins
- Water Quality Assessment in specific areas
- Hydrology of Arid, Semi-arid, Coastal & Deltaic Zones
- Reservoir / Lake Sedimentation
- Impact of Climate Change on Water Resources
- Application of modern techniques to solve hydrological problems

Projects Solving Real Life Problems:

1. Improving our Understanding of the Aquifer Systems inSunderbans

Deltaic coastal areas face challenges in dry season water availability, with brackish rivers and limited reservoir constructing opportunities. Water supplies and irrigation may depend on groundwater. In aquifers where confined saline layers are present aquifer storage and recovery can be developed to provide extra water resources during drought.

The Sundarbans area of West Bengal is an example of a deltaic system with islands where the population rely on groundwater for public supply and irrigation. Groundwater resources are supplemented by farm ponds, but the low relief means that reservoirs can't be constructed without excessive sacrifice of productive agricultural land. A multi-layered aquifer is present; the upper unconfined and confined layers normally saline. Deeper freshwater aquifers are heavily exploited, suffering from deteriorating yields and water quality. The potential of aquifer storage and recovery (ASR), where water is injected into the saline aquifers during the monsoon season, and recovered during dry months will be explored through a combination of participatory survey by local villagers and mathematical simulation. The project's conclusions will help guide pilot implementations of ASR as an approach to water management and to help increase community resilience to drought and cyclone induced flooding that periodically contaminates the farm ponds.

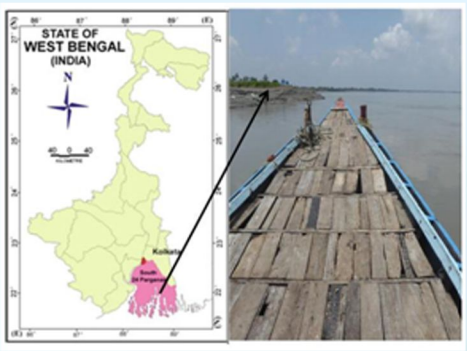


Fig. 1. Study area, Sunderbans, West Bengal

A participatory groundwater management approach was adopted for data collection, using the skills of village self-help groups to collect field data on aquifer properties using a range of simple field measurements and interviews with farmers and borewell drillers, with a particular focus on the saline aquifers. The collection of aquifer properties data for the saline aquifers has complemented existing data on the properties of the freshwater aquifers. The data have informed a simple 2d groundwater model that has been used to explore the sensitivity of operation to a range of aquifer parameters. Water level and quality parameters in the saline and fresh water aquifers were determined based on information derived from Focused Group Discussion, Rapid Rural Survey and field experiments conducted with barefoot-hydrogeologists in two blocks; Gosaba and Sandeshkhali II of Sunderbans West Bengal, India. Measurements were made on existing and in-progress wells to quantify aquifer properties and water quality within the saline systems. The data on the saline aquifers has been integrated with available data for the deeper fresh water aquifers; data that has demonstrated deterioration in both yield and water quality as a result of over abstraction. The focused group discussions highlighted the principal water resource challenges facing farmers; including limited access (because of cost) to the deeper freshwater aquifers, uncertainty over long term recharge to deeper aquifer units and the impact of cyclone flooding with saline water on the usability of surface water ponds. The modelling shows that an ASR approach can be used in this area to store water as a reserve supply in the driest season, or post cyclone but the practicality of this intervention is sensitive to the exact aquifer geometry and to the costs of drilling and injecting fresh water.

2. Development of Habitat Suitability Curves for the Aquatic Species of Western Himalayan Streams and Assessment of Environmental Flows

Attempts for assessing E-Flows in western Himalayan region have been mostly based on hydrological or hydraulic approaches with application of limited habitat preferences due to limited knowledge base hydrology-ecology relationships for the aquatic species of this region. In this connection, the present study has been carried out to develop habitat suitability curves for the aquatic species of western Himalayan streams using the available literature for the assessment of environmental flows using habitat simulation modelling In the present study, the data/information on biotic parameters (abundance of aquatic species) and

Influencing abiotic parameters (water depth & velocity and water quality parameters: water temperature, pH, DO, BOD, turbidity etc.) for the concurrent period have been compiled for 48 sites in the western Himalayan region. It was found from the literature that the keystone species for upper (>1500m), middle (500-1500m) and lower (< 500m) zones are Brown Trout, Snow Trout and Golden Mahseer respectively. Hence, the habitat suitability curves for these species have been developed through the specific module in the 'System for Environmental Flow Analysis (SEFA)' software utilizing the data/information available in the compiled literature.

Fig. 1: Habitat suitability curves for Snow Trout

For habitat simulation modelling through SEFA, four sites have been selected viz. Joshimath (upper zone), Rudraprayag (middle zone) and Devprayag&Rishikesh (lower zone). Further, the developed habitat suitability curves alongwith discharge and cross-section data at these four sites have been used for the simulations through habitat simulation modelling exercise. The final modelling output is the Area Weighted Suitability (m2 of river bed/ m of reach length) which indicates the suitability of a particular discharge for the habitat sustenance. Further, AWS Duration analysis was also performed on monthly basis at these sites for the keystone species which provides the median, 90%, 75%, 25%, 10% and mean of AWS for the historical flow series (Fig. 2). Assuming that the environmental flows may be kept for maintaining the median or higher values of AWS for sustenance of keystone aquatic species, it was found that the recommended e-flows are falling in the range from 26.32 to 41.81 % of average monthly flows at Joshimath site, from 20.94 to 38.64% of average monthly flows at Rudraprayag site, from 23.67 to 33.81% of average monthly flows at Devprayag site (after confluence) and from 24.66 to 37.17% of average monthly flows at Rishikesh site.

The habitat suitability varies significantly with respect to the species and location. The curves developed for this habitat simulation modelling exercise are based on the secondary literature available. The results may be different if we derive the site-specific habitat suitability curves. Habitat simulation modelling provides additional information in comparison to hydrodynamic modelling in terms of a number of optional management scenarios for the maintenance of different levels of habitat sustenance.

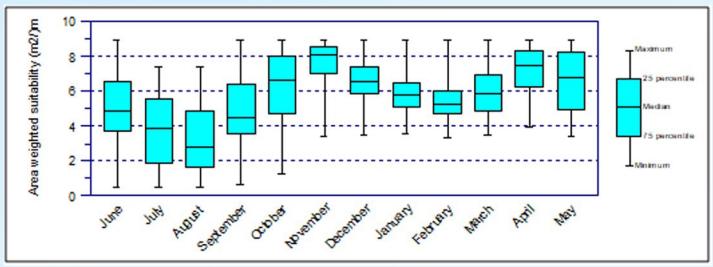


Fig. 2: AWS duration analysis for Snow Trout at Rudraprayag (before confluence) site

3. Study on effect of climate change on sediment yield to Pong reservoir

The developmental activities in the catchment area contribute high sediment load which affects the expected performance of the reservoir. Increase of anthropogenic emissions of green house gases will aggravate climate change and thus average temperature of atmosphere, no of extreme events of rainfall and intensity will increase. In Himalayan region, the increase in high intensity rainfall will contribute more sediment to the reservoir. It is important to estimate the change in sediment yield under the projected different climatic scenarios to assess the performance of the Pong reservoir.

The SWAT model is setup with the required input data to simulate the sediment yield from Beas Catchment up to Nadaunbridge (Pong reservoir). The input data such as DEM, LULC and soil type have been generated from different sources such as National Aeronautics and Space Administration (NASA), USA, Landsat 8 OLI, USGS and National Bureau of Soil Survey and Land Use Planning (NBSSLUP), India. Grid based meteorological data such as daily rainfall, minimum and maximum temperatures have been obtained from Indian Meteorological Department (IMD). The model

is calibrated using the data of stream flow and sediment yield for the period from 1987 to 1995 and validated with data for the period from 1996 to 2005. The sensitive parameters for streamflow and sediment yield are optimized by SUFI2 algorithm (Sequential Uncertainty Fitting version 2). The simulated values of sediment yield are found to be in good agreement with the observed values. The performance of the model is evaluated on the basis of statistical parameters. The values of coefficient of determination (R2) for streamflow and sediment yield are found to be 0.82 and 0.64 for calibration period and 0.76 and 0.61 for validation period.

The statistical downscaling model (SDSM) is used to downscale the daily rainfall, minimum and maximum temperature from General Circulation Model (GCM) Coupled Model Intercomparison Project Phase 5 (CMIP5): Canadian Earth System Model, CanESM2. In SDSM, the multiple linear regression (MLR) technique is used to derive the statistical relationships between observed small-scale variables and larger GCM scale. The daily rainfall,minimum temperature and maximum temperature data of Indian Meteorological Department (IMD) (1961-2005) of the Nadaun Bridge, Himachal Pradesh is considered as input to the model. The MLR model has been calibrated and validated with the daily rainfall, minimum and maximum temperature for the period of 1961 to1995 and 1996 to 2005 respectively. National Centre for Environmental Prediction (NCEP) reanalysis data (historical) have been used as a predictor, which consists of 26 parameters. Significant predictors of rainfall, maximum and minimum temperature have been determined using the averaged IMD gridded data of rainfall, maximum and minimum temperature and the rainfall, maximum and minimum temperature from NCEP-NCAR reanalysis data for the period from 1961-2005 by SDSM tool. The significant predictors for rainfall, maximum and minimum temperature are given as follows:

Variable	Significant predictors
Rainfall	Mean sea level pressure (pa), total precipitation (mm), surface airflow strength (m/s), specific humidity at 500 hpa (%), surface specific humidity (%)
Maximum temperature	Mean sea level pressure (pa), wind direction at 500 hPa, airflow strength at 500 hPa (m/s), vorticity at 500 hPa, geopotential height at 500 hPa (m), mean temp (°C)
Minimum temperature	Mean sea level pressure (pa), wind direction at 500 hPa, vorticity at 500 hPa, geopotential height at 500 hPa, surface specific humidity (%)

Table 1 Significant predictors for rainfall, maximum and minimum temperature

The calibration and validation of significant predictors of NCEP-NCAR data have been carried out by SDSM with averaged IMD gridded data. The coefficient of determination for the calibration and validation of significant predictors for rainfall are 0.98 and 0.97 respectively. The coefficient of determination for the calibration and validation of significant predictors for maximum temperature are 1.00 and 1.00 respectively. The coefficient of determination for the calibration and validation of significant predictors for minimum temperature are 1.00 and 1.00 respectively.

Monthly rainfall, maximum and minimum temperature have been downscaled on the basis of future daily rainfall, maximum and minimum temperature by MLR model with the predictors from CanESM2 for the period from 2006 to 2100 under the RCP 2.6, RCP 4.5and RCP 8.5 emission scenarios. The downscaled rainfall, maximum and minimum temperature from CanESM2 for climate scenarios RCP 2.6, RCP 4.5 and RCP 8.5 with the significant predictors have been bias corrected by the method of probability of exceedence. The bias corrected rainfall for the climate scenarios RCP 2.6, RCP 4.5 and RCP 8.5.

The monthly streamflow and sediment yield for the period from 2006 to 2100 have been projected using the monthly projected rainfall, minimum and maximum temperature under the RCP 2.6, RCP 4.5 and RCP 8.5 emission scenarios and the other meteorological data from SWAT website with the optimized parameters for streamflow and sediment yield obtained from SWAT-CUP using the hydrometeorological data for the period from 1987 to 2005. The projected streamflow and sediment yield for the period from 2006 to 2100 for the climate scenarios RCP2.6, RCP4.5 and RCP 8.5 are given in figs 1 and 2 respectively. The unit weight of deposited sediment in the reservoir is computed from particle size distribution of suspended sediment concentration and the method of reservoir operation by the procedure suggested by USBR, from the sediment volume observed by hydrographic survey and assuming porosity of uniformly distributed sediment in the reservoir. The consolidated unit weights of the sediment are computed by the equation proposed by Miller of USBR and frequency analysis of unit weights derived from particle size distribution. The consolidated unit weights computed by different methods are used to

project the sediment volume and the life of the reservoir for the climate scenarios RCP 2.6, RCP 4.5 and RCP 8.5 for 2025, 2050, 2075 and 2100.

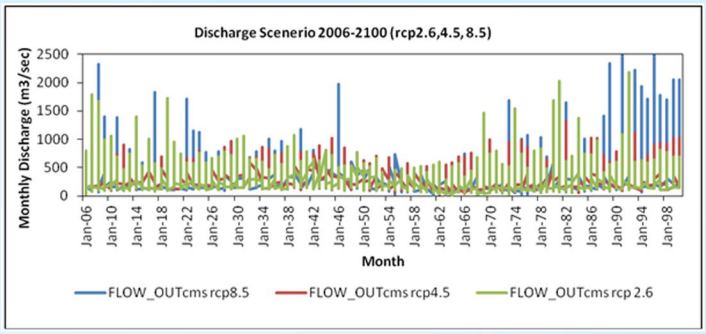


Fig. 1 Projected streamflow for the climate scenario RCP 2.6, RCP 4.5, RCP 8.5 for the period 2006-2100

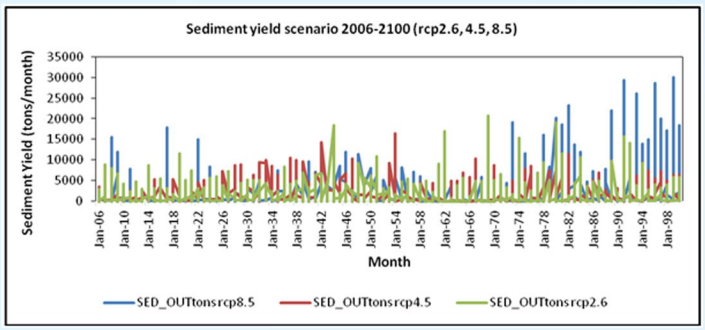


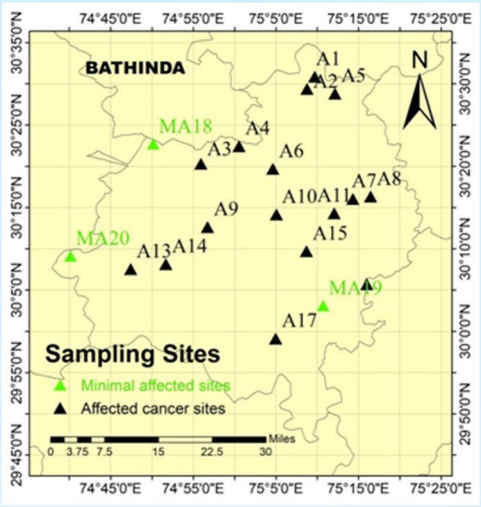
Fig. 2 Projected sediment yield for the climate scenario RCP 2.6, RCP 4.5, RCP 8.5 for the period 2006-2100

4.Water Quality Assessment of Southwest Punjab Emphasizing Carcinogenic Contaminants and their Possible Remedial Measures

Punjab has been the subject of much skepticism in the last decade. It has previously been called the "grain bowl of the country", but has recently adopted a new nickname, "the cancer bowl of the country". The pride of holding the title "a state with maximum per capita income" came with the price of cancer due to unrestricted use of chemicals (pesticides, fertilizers, metals, polycyclic aromatic hydrocarbons, pharmaceutically active hydrocarbons, etc.) in the agricultural fields and industries. A train which connects the affected region with the nearby Bikaner city, which contains a cancer hospital, has been nicknamed Cancer Express. Thakur et a. (2015) analyzed trace metals, pesticides, and other relevant parameters in some major drains, water samples (surface as well as groundwater), fodder, vegetable, and blood samples, and concluded that these samples contained harmful contaminants in excess of desired levels. Intake of these contaminants through the water as well as food is leading to deleterious health effects such as gastrointestinal disorders, reproductive toxicity, neurotoxicity, renal toxicity, and carcinogenic manifestations (WHO, 2011). Another study conducted by Thakur et al. (2008) observed a higher prevalence of cancer cases and cancer-related deaths in the area. A year-long study entitled "An epidemiological study of cancer cases reported from villages of Talwandi Sabo block, district Bathinda, Punjab", conducted by School of Public Health (SPH) at the Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh, compared cancer incidents in the villages producing cotton with those producing rice and wheat, and found high cancer rates in the villages where pesticide usage was high. A recent hospital-based study for Punjab shows that out of the 1328 cancer cases in the state, 1230 cases were from the seven districts of Southern Punjab comprising Muktsar, Ferozepur, Bathinda, Faridkot, Fazilka, Moga& Mansa districts (Aggarwal et al., 2015). Considering the high cancer numbers and poor water quality described above, a comprehensive study of groundwater contaminants, especially carcinogens, is urgently required for the state of Punjab. The objectives of this study is to analyze the water quality of the area with an emphasis on carcinogenic chemicals, identifying their sources, and suggesting appropriate remedial measures.

The village-wise number of cases for year 2016, 2017, & 2018 were collected from the district hospitals and Dept. of Health & Family Welfare, Govt. of Punjab, and was used for selecting the sampling sites. The village wise population data was downloaded from the MHA Web-http://censusindia.gov.in/2011census/Listofvillagesandtowns.aspx). Each district was divided into grid of 10x10 km, and the cancer prone grids were identified and selected based on number of cancer cases, per capita cancer cases, and number of villages. Further, the village for sampling in a cancer prone grid was selected based on highest per capita cancer cases. Twenty sampling locations were finalized for each district, 17 from cancer prone grids, and 03 from minimal affected

grids as shown in below figure for Bathinda district.



Sampling Sites of Bathinda District

Drinking water samples from the identified villages were collected after discussion with the villagers based on the usage. The handpump were continuously pumped for at least 15 minutes prior to the sampling, to ensure the groundwater to be sampled was representative of groundwater aquifer. All the groundwater samples were collected from the sources, which are being used extensively. The samples from Bathinda and Mansa for pre-monsoon period were collected in Feb. 2019, Mauktsar and Fardikot in May 2019, and Fazilka and Firozepur in June 2019. From each district, 20 samples were collected, 17 from cancer prone villages and 3 from villages with negligible cancer incidences.The water samples are collected in appropriate sampling bottles as given in using grab sampling method and preserved as per standard methods (APHA, 2017).

N.I.H. History & Milestone

National Institute of Hydrology (NIH) is a premier Research and Development organization under the Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India. It was established as an autonomous society in 1978 with its headquarters at Roorkee. The main objectives of NIH are to undertake, aid, promote and coordinate systematic and scientific work in all aspects of hydrology. The Institute was declared as an S&T organization in 1987.

Our research findings are published in the form of reports and research papers in reputed international and national journals, international and national seminars and conferences.

Publications brought out by the Institute in the form of technical reports, brochures, leaflets, state-of-art reports etc. are widely circulated to various user agencies in India as well as abroad, enriching hydrologic literature and knowledge.

The Institute has completed a number of consultancy and sponsored research projects to solve real-life problems.

The Institute has developed software for hydrological analysis and design which are being used to solve various practical problems.

NIH has established Water Quality, Remote Sensing & GIS, Nuclear Hydrology, and Soil & Water Laboratories with state-of-art equipment and software.

Under technology transfer programme, the Institute has organized a large number of short-duration training courses all over the country on different topics in the domain of hydrology and water resources. The participants to these course come from Central and State government organization, academic and R&D institutes, private sector, and NGOs.

NIH has also organized number of International and National seminars and conferences.

A number of the scientists of the Institute have received awards for publishing their research works in the reputed journals and for their significant contributions in different areas of hydrology and water resources.

Under the mass awareness programme, the Institute has organized a number of activities for women and students. Campaigns for water conservation and management have been launched through electronic and print media.

The Institute is providing secretariat to the Indian National Committee on Climate Change (INCCC), an R&D program of MoWR.

The Institute is providing Secretariat to the Indian Association of Hydrologists.

Under the currently on-going National Hydrology Project, NIH is the lead agency for Training and Capacity building, Purpose Driven Studies (PDSs) for R&D and is setting up a Center for Excellence in Hydrologic Modeling.

Training courses attended by Scientist/ Scientific Staff during July-Dec. 2019

S.No.	Name of the Training Course	Place	Date & Month
1	Training on 'Water Budgeting tool for rivers basins using Google earth Engine applications'	NIH, Roorkee	Aug. 19-23, 2019
2	Training Course on "Spatial analysis with ArcGIS PRO"	NIH Roorkee	Sept. 11-12, 2019
3	Training on "ISO 9001:2015 Internal Auditor training course"	NIH, Roorkee	Oct. 15, 2019
4	e-Procurement	ISTM, New Delhi	Oct. 28-29, 2019
5	Training on "Tools and Techniques for Hydrological Investigation'	NIH, Roorkee	Nov. 4-8, 2019
6	Training on 'Hydrologic modelling for decision making'	NIH, Roorkee	Nov. 18-29, 2019

Training Course/ Workshop organised during July-Dec., 2019

S.No.	Name of Course	Period	Venue
1.	National Level Training Programme on "Flood Risk Management and Water Sector DRR" Jointly organized by NIDM & NIH	July 8-12, 2019	NIH, Roorkee
2.	Workshops on "Water resource systems modelling for global change impacts assessment and adaptation" jointly with Cranfield Water Science Institute, Cranfield University, UK.	July 12, 2019	NIH, Roorkee
3.	Training Course on "Groundwater issues of Punjab with special emphasis on GW Salinity" under NHP	July 16-18, 2019	Forest Complex, Mohali
4.	Geospatial technology for decision maker. (Theme: water resources)" sponsored by DST	July 19-21, 2019	NIH, Roorkee
5.	Workshops on "Water resource systems modelling for global change impacts assessment and adaptation" jointly with Cranfield Water Science Institute,Cranfield University, UK	July 25, 2019	Forest Complex, Chandigarh
6.	Training course on 'Water Security Assessment for Nation Building' under INC-IHP	July 23-27, 2019	NIH, Roorkee
7.	"Inception cum-Need Assessment" Workshop under DST funded project "IC-EcoWS"	Aug. 8-9, 2019	NIH, Roorkee
8.	Training of Trainers Course on 'Water Budgeting Tool for River Basins using Google Earth Engine Applications'	Aug. 19-23, 2019	NIH, Roorkee
9.	National Workshop on 'Integrated Water Resources Management (IWRM' under NHP jointly organised by CWC and NIH	Sept. 4-5, 2019	NIH Roorkee
10.	Training course on "Spatial Analysis with ArcGIS Pro"	Sept. 11-12, 2019	NIH Roorkee
11.	Special session in Future Earth Conference	Sept. 24-27, 2019	Bangalore
12.	Inception Workshop on SSAP (water) for Andaman	Sept. 27, 2019	Portblair
13.	Brainstorming Session on "Ecologically Sustainable Water Management: Challenges in Water Scarce Regions" under INC-IHP during Waterfuture Conference	Sept. 29, 2019	IISc. Bengaluru

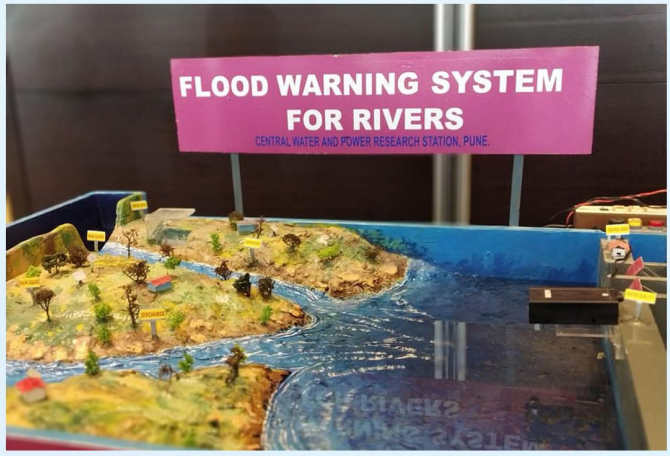
14.	Organisation of Hindi Workshop	Sept. 26-27, 2019	NIH Roorkee
15.	Training on "ISO 9001:2015 Internal Auditor"	Sept. 15, 2019	NIH Roorkee
16.	Training on "Spatial Analysis with ArcGIS PRO"	Sept. 11-12, 2019	NIH, Rookee
17.	National Workshop on Integrated Water Resources Management (IWRM) under National Hydrology Project (NHP) jointly organized by NIH, Roorkee and CWC, New Delhi	Sept. 4-5, 2019	NIH, Roorkee
18.	Training course on 'Hydrologic Modeling Using HEC-RAS and HEC-HMS'	Oct. 9-11, 2019	WALMI Campus Bhopal
19.	National Training Program on "Flood Risk Management and Water Sector DRR" in collaboration with NIDM, New Delhi	Oct. 14-18, 2019	NIH Roorkee
20.	Training course on "Tools & Techniques for Hydrological Investigations"	Nov. 4-8, 2019	NIH, Roorkee
21.	4th Management Board Meeting & Workshop of Indo-UK FAR-GANGA Project on Arsenic	Nov. 14-15, 2019	NIH, Roorkee
22.	Training Course on "Hydrologic Modeling for Decision Making"	Nov. 18-29, 2019	NIH, Roorkee
23.	Training Program on "Climate Change and Hydrological Impact Assessment"	Dec. 2-13, 2019	NIH, Roorkee
24.	Training Course on Geospatial Applications in Hydrology: Theory & Practice	Dec. 9-13, 2019	WHRC, Jammu
25.	**जल संसाधन एवं पर्यावरण विषय पर राष्ट्रीय जल संगोष्ठी-2019**	Dec. 16-17, 2019	NIH, Roorkee

Mass Awareness Program

S.No.	Name of Program	Period	Venue
1	Outreach activity under Swachhta Pakhwada-2019	Sept. 6, 2019	Methodist Girls P.G. College, Roorkee
2	Organisation of Swachhta-Hi-Sewa (SHS) – Plastic free Campaign	Sept. 11 – Oct., 2019	NIH Roorkee
3	Hindi Pakhwada	Sept. 16, 2019	NIH, Roorkee
4	Participation of NIH in "Regional Science Exhibition – JalvigyanPradarshani"	Sept. 20, 2019	KV-1 Roorkee
5	Participation and Exhibition in India Water Week (IWW)-2019	Sept. 25-28, 2019	New Delhi
6	Vigilance Awareness Week	Oct. 28 – Nov. 2, 2019	NIH Roorkee
7	Cleanliness programme at Campion School Road, near Shahpura lake, Bhopal and Drawing Competition and awareness programme on Plastic free campaign and water conservation at Govt Naveen Hs School Chunabhatti under Swachh Bharat Mission- Say No to Plastic campaign	Oct. 1, 2019	Bhopal
8	Swachh hi SevaCampaign under 'celebration of 150th birth ceremony of Mahatma Gandhi'. Taken Swachhta pledge, Clealiness drive at office campus of CFMS	Oct. 2, 2019	CFMS, Patna
9	VAW - 2019 Brainstorming session cum mass awareness under theme *"Integrity-A way of life'.*	Oct. 28 – Nov. 2, 2019	CFMS, Patna

Important Facts

-By alleviating 60% of the world's share of people defecating in the open, India has significantly contributed to the global achievement of SDG 6.
-The 6th India Water Week-2019 was observed from September 24, 2019. The theme of the India Water Week-2019 was 'Water Cooperation – Coping with 21st Century Challenges.'
-The Ministry of Jal Shakti has been organizing India Water Week since 2012 as an international event to focus on water related issues.
-First HAM project in sewerage sector: Sewage Treatment Plant (STP) at Sarai in Haridwar has become the first Hybrid Annuity (HAM) Based Public Private Partnership Model STP.
-Under Hybrid Annuity Model (HAM), the central government bears 40% of the project cost and the remaining amount is arranged by the developer. As per the design, the government contributes 40% of the project cost in the first five years through annual payments (annuity). The remaining payment is made on the basis of the assets created and the performance of the developer.
-Ganga Aamantran Abhiyan' is an open-water rafting and kayaking expedition on the Ganga River held in October-November 2019.
-Starting at Devprayag and culminating at Ganga Sagar, the expedition covered the entire stretch of over 2500 kms of the Ganga River.
-This is the longest ever social campaign undertaken through an adventure sporting activity to spread the message of River Rejuvenation and Water Conservation on a massive scale.



Important Meetings

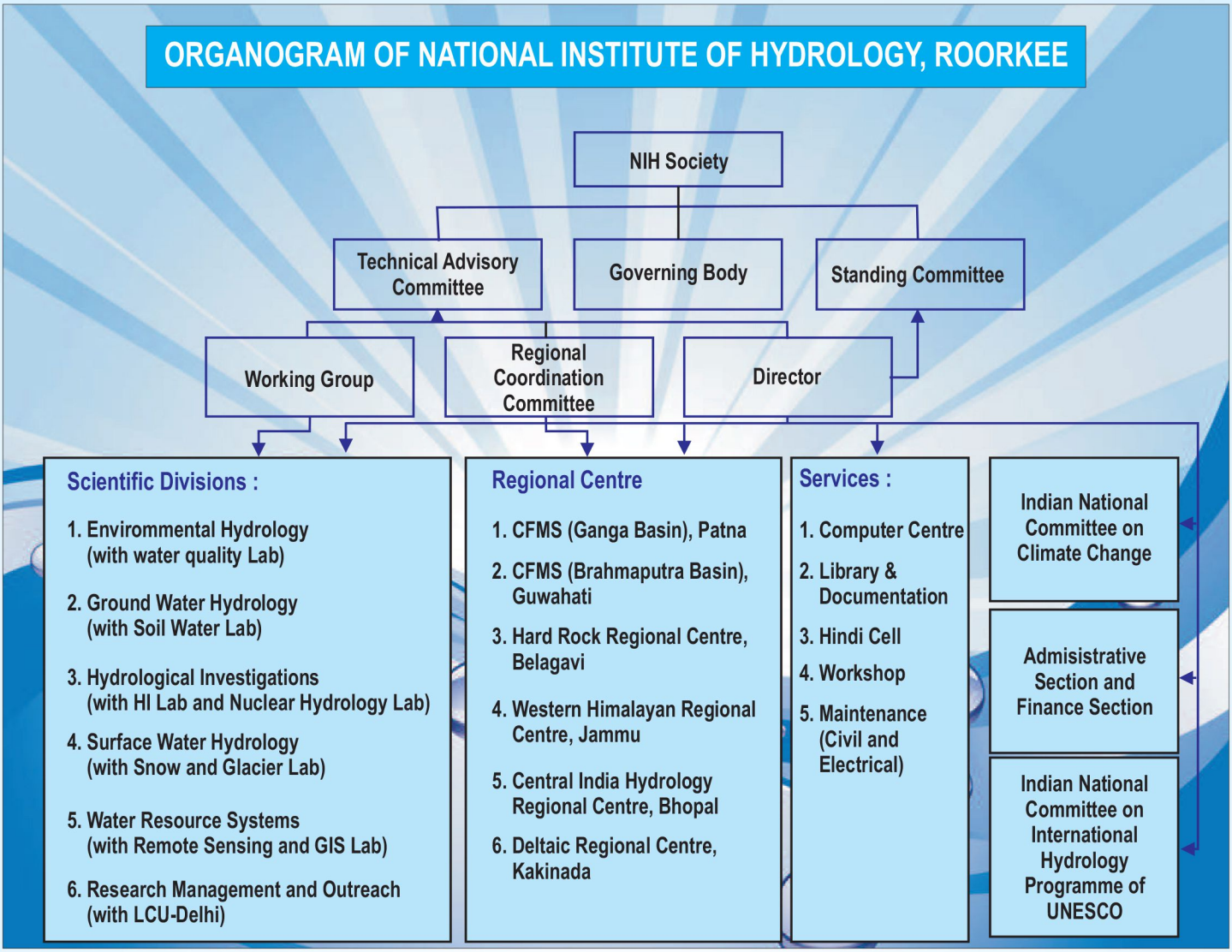
1. 38th Meeting of Annual General Meeting Nov. 1, 2019 at Ministry of Jal Shakti, New Delhi.
2. 49th Working Group Meeting Nov. 4-5, 2019 at NIH, Roorkee.
3. 73rd TAC Meeting Dec. 17, 2019 at NIH, Roorkee.

Well said about water

The fall of dropping water wears away the Stone.	Lucretius
When the well's dry, we know the worth of water.	Benjamin Franklin
Water is soft and humble, but it is the most powerful and is the most endurable.	DebasishMridha
Water is the lifeblood of our bodies, our economy, our nation and our well-being.	Stephen Johnson
No water, no life. No blue, no green.	Sylvia Earle

Hindi Glossary for Hydrological terms

Streamflow	धारा प्रवाह	Storage coefficient	संचयन गुणांक	Infiltration capacity	अःत स्यन्दन क्षमता
Current meter	धारा वेग मापी	Aquifer	जलदायी स्तर	Discharge	निस्सरण
Ablation of snow	हिम अपक्षरण	Artificial recharge	कृत्रिम पुनः पूरन	Conjunctive use	संयोजी उपयोग
Arid climate	शुष्क जलवायु	Channel	वाहिका	Drizzle	फुहार



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We Will Appreciate Your Guest Articles!
You can share your knowledge with others on topics highlighting 'water resources for community benefits' by contributing an article to the Guest Article Column. For more information, please contact:

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