Report of the International Conference

on

Sustainable Technologies for Intelligent Water Management

February 16-19, 2018

Organised by:

IWRS and Department of Water Resources Development & Management, IIT Roorkee
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• Prof. S. Bala Prasad, Deptt. of Civil Engineering, Andhra University, Visakhapatnam
• Prof. T.I. Eldho, IIT Bombay
• Dr. Praveen K Gupta, Space Applications, Centre, ISRO, Ahmedabad
• Prof. D.G. Regulwar, GCOE, Aurangabad
• Dr. Ambrish Kumar, IISWC, Dehradun
• Dr. V.M. Chowdary, Head, RRSSC, Kolkata
• Er. N.N. Pande, Chief Engineer (Ret.), NHPC
• Dr. Ashok Mishra, IIT Kharagpur
• Dr. R. P. Pandey, NIH, Roorkee
International Conference
“Sustainable Technologies for Intelligent Water Management”
(16-19 Feb. 2018)
Organisers
Indian Water Resources Society, Roorkee
Dept. of Water Resources Development & Management, IIT Roorkee

1. INTRODUCTION & REGISTRATION

Indian Water Resources Society (IWRS), Roorkee in association with the Department of Water Resources Development & Management (WRDM), IIT Roorkee organised a 4-day 'International Conference on Sustainable Technologies for Intelligent Water Management' during 16th – 19th February 2018. Eminent experts from well-known foreign universities such as Texas Agricultural and Mechanical University (TAMU), Purdue University, Consiglio Nazionale delle Ricerche Via Madonna Alta PERUGIA (ITALY), University of Florida, and University of Nebraska-Lincoln of USA and reputed Indian institutions including IITs, AIIMS, NRSC, NITS, ICAR etc. and several other prestigious Indian universities participated in the conference. The delegates from Ministry of Water Resources, RD &GR; NWM; NMCG; SJVN Limited; CWC; THDCIL; NTPC; and other Central and State government as well as Non-Government organisations also participated in the conference. Total three hundred fifty nine delegates registered for the conference. Total 359 delegates registered for the conference.

2. INAUGURAL FUNCTION

All the guests were honoured by Prof. S.K. Mishra, Professor and Head Department of Water Resources Development and Management & Executive Vice President IWRS and Prof. Ashish Pandey, Associate Professor, Department of Water Resources Development and Management & Secretary, IWRS during the inaugural function.

Plate 1: Lighting of the Lamp by Chief Guest during the Inaugural function
The conference was inaugurated by Shri. Satpal Ji Maharaj, Hon'ble Cabinet Minister of Govt. of Uttarakhand and the Chief Guest of the function. He highlighted the problems of the Himalayan region in general and Uttarkhand in particular including the problems of flash floods, erosion, landslides, glacier outburst floods avalanches etc. besides those of erosion and sedimentation, affecting the life of reservoirs and operation of hydropower plants. Dr. Y. V. N. Krishna Murthy, Director, NRSC, Hyderabad mentioned that the use of satellite technology may bring a lot of changes in the water management practices and has large scope of employment through start-up programs. Er. A.B. Pandya, President, IWRS, and Secretary General, ICID, Er. H.L. Arora, Director (T), THDCIL, Rishikesh, Prof. N.S. Raghuvanshi, Director, MANIT, Bhopal, Prof. Ravi Kant, Director, AIIMS, Rishikesh and Prof. Ajit Kumar Chaturvedi, Director, IIT Roorkee also addressed the gathering during the inaugural session.

The Chief Guest also released the abstract Proceeding of the Conference, IWRS Theme Paper on “Inter-Basin Water Transfer” (Author: Er. Shri M. Gopalakrishnan, Former Secretary General, ICID) and a text Book on “Introductory Soil and Water Conservation Engineering (Authors B.C. Mal and Ashish Pandey)”.

Plate 2: Release of Book on “Introductory Soil and Water Conservation Engineering” during Inaugural Function

The Chief Guest also presented awards instituted by the IWRS for the years 2016 and 2017, as follow.

For the year 2016, Dr. Mahesh Verma, Former Professor (Dept. WRD&M, IIT Roorkee) was conferred up on the Life Time Achievement Award. Er. Ramesh N. Misra, Ex-CMD, SJVN Limited; Prof. K.N. Tiwari, Professor, IIT Kharagpur and Dr. Surendra Kumar Chandniha Post-Doctoral Fellow, NIH Roorkee were been conferred up on Eminent Water Resources Engineer Award, Eminent Water Resources Scientist Award and the Best Water Resources Student award respectively.

For the year 2017, Shri M. Gopalakrishnan, Former Secretary General, ICID was conferred up on the Life Time Achievement Award. Er. R.C. Jha, Former Chairman, CWC, New Delhi; Prof. T.I. Eldho, Professor and Head, Civil Engg. Department, IIT Bombay and Dr. Pravin R. Patil, Research Associate, NIH Roorkee were conferred up on Eminent Water Resources Engineer Award, Eminent Water Resources Scientist Award and the Best Water Resources Student award respectively.
Plate 3: Chief Guest Conferring Life Time Achievement Award of IWRS-2017 on Shri M. Gopalakrishnan during the Inaugural function.

Plate 4: Prof. S.K. Mishra, Executive Vice President, IWRS addressing the gathering during Inaugural function.
Plate 5: Shri A.B. Pandya, President, IWRS addressing the gathering during Inaugural function

Plate 6: Presidential address by Prof. Ajit K. Chaturvedi, Director, IIT Roorkee during Inaugural function
Plate 7: Address by Dr. Y.V.N. Krishna Murthy, Director, NRSC during the Inaugural function

Plate 8: Address by Chief Guest of the Inaugural function
3. PRELIMINARY SESSIONS

Total 34 Keynote addresses on various conference themes were delivered by eminent scientists/professors/water professionals from India and abroad in 5 Plenary Sessions as detailed below:

PLENARY SESSION –I (Feb. 16, 2018)
CHAIRMAN- Er. M. Gopalakrishnan, Former President IWRS and Ex- Secretary General ICID, New Delhi
Co-Chairman-Prof. S.K. Shukla, Adjunct Professor, IIT Roorke

A. Technologies to Address Water Resources Management Challenges in India.
   Dr. Sharad K. Jain, Director National Institute of Hydrology, Roorkee

B. Space Technology Based Operational Hydrological Services in India.
   Dr. V.V. Rao, Group Director-Water Resources Group, NRSC, ISRO, Hyderabad

C. Water pollution and health.
   Prof. S. Kishore, Dean (Academics) & Prof. & Head Dept. of Community & Family Medicine, AIIMS, Rishikesh

D. Sustainable Coastal Management through Modeling and Monitoring –Scope of Numerical Simulation.
   Prof. T.I. Eldho, Professor, Department of Civil Engineering, IIT Bombay

E. Rubber Check Dams for Flood and Drought Management
   Dr. Susanta Kumar Jena, Principal Scientist, ICAR-IIWM, Bhubaneshwar

PLENARY SESSION –II (Feb. 16, 2018)
CHAIRMAN- Prof. S. Kishore, Dean (Academics) & Prof. & Head Dept. of Community & Family Medicine, AIIMS, Rishikesh
Co-Chairman- Dr. R.P. Pandey, Scientist G NIH, Roorkee

A. We all live downstream – watershed activities affect water quality and ecosystem services.
   Prof. Indrajeet Chaubey, Associate Dean and Director of International Programs in Agriculture Professor – Agricultural and Biological Engineering Professor – Earth, Atmospheric, and Planetary Sciences Purdue University, West Lafayette, IN 47907, (USA)

B. Using Climate Information for Reducing Drought and Water Quality Impacts.
   Prof. Puneet Srivastava, Director, Water Resources Center, Butler-Cunningham Eminent Scholar, Professor, Biosystem Engineering, 203 Hubbard CASIC Building, 559 Devall Drive, Auburn University, (USA)

C. Sustainable irrigation water management.
   Shri. K Vohra, Commissioner (SPR), MoWR

D. Ground & satellite observations for hydrological applications.
   Dr. Tommaso Moramarco, D. WRE via Madonna Alta Perugia (Italy)
E. Groundwater trends and availability under current and future groundwater withdrawals and climate scenarios in semi-arid South India.
Prof. Sanjay Shukla, Professor, Agricultural and Biological Engineering, University Term Professor and Distinguished Water Institute Fellow, SWFREC, University of Florida (USA)

F. Impact of Climate Change on Precipitation Regimes and its role on Hydrologic Extremes.
Dr. Venkataramana Rao Sridhar, Biological System Engg. Dept., Seitz Hall, RM 212, Virginia Tech., 155 Ag Quad Lane, Alacksburg, Virginia Tech Uni. (USA)

PLENARY SESSION –III (Feb. 16, 2018)
CHAIRMAN- Prof. N.S. Raghuwanshi, Director, MANIT, Bhopal-M.P.
Co-Chairman- Prof. S. Bala Prasad, Department of Civil Engineering, Andhra University, Visakhapatnam

A. Theory of Frequency Distributions in Water Engineering.
Dr. V. P. Singh, Department of Biological & Agricultural Engineering & Zachry, Department of Civil Engineering, Texas A&M University College Station, Texas-USA

B. An Approach to Sustainable Watershed Management.
Dr. Ramesh P. Rudra, Water Resource Engineering, School of Engineering, University of Guelph, Guelph, Ontario, (Canada) N1G 2W1

C. Local Controls for Effective Management of Water Supplies for Agriculture.
Prof. Chittaranjan Ray, Prof. and Director, Nebraska Water Center, Daugherty Water for Food Global Institute, University of Nebraska, Lincoln, NE, (USA)

D. Water Advanced Research and Innovation (WARI) Fellowship Program
Mr. Jesse Starita, Education Outreach Coordinator, Daugherty Water for Food Global Institute, University of Nebraska, Lincoln, NE, (USA)

Dr. N.K. Tyagi, Former member ASRB and Former Director CSSRI, Karnal

PLENARY SESSION –IV (Feb. 17, 2018)
CHAIRMAN- Prof. V. P. Singh, Department of Biological & Agricultural Engineering & Zachry, Department of Civil Engineering, Texas A&M University College Station, Texas, USA
Co-Chairman - Prof. T.I. Eldho, Prof. & Head, Civil Engg, Dept.IIT Bombay and Dr. V. M. Chowdary, Scientist/Engg "SG”.

A. Water Resources Management under Climate Change in a Semi-Arid Basin: Challenges and Opportunities.
Dr. Tushar Sinha, Texas A&M University, Kingsville, TX, United States

B. Water Resources Management Embracing the Data Deluge.
Dr. Saurav Kumar, Research Assistant Professor, UTEP, USA

C. Integrated Flood Management under Climatic variability.
Dr. Rakesh Kumar, Scientist-G & Head NIH Roorkee
D. Misunderstood Notions of Hydropower in India.
Shri R.N. Mishra, Former-CMD, SJVN Limited

E. Holistic Capacity-Building for the 21st Century in Agricultural Water Management.
Dr. V.K. Labsetwar, Director, ICID, New Delhi

F. Scientific Water Management for Higher Fish Production.
Prof. B.C. Mal, Vice Chancellor, JIS University, Agarpara, Kolkata

Prof. K. N. Tiwari, Professor, Department of Agricultural and Food Engineering, Indian Institute of Technology Kharagpur, India

H. Efficient Irrigation Water Management is Key for Sustainable Development.
Dr. K Yella Reddy Vice President, ICID, Director, WALAMTARI, Hyderabad

I. Sustainable Irrigation Water Management.
Dr. N.K. Gontia, Dean Junagadh Agricultural University, Junagadh

J. History and Development of Water Laws and Governance in India.
Dr. Avdhesh Pratap, Water Law, Management and Constitution Law Expert

PLENARY SESSION –V (Feb. 18, 2018)

CHAIRMAN- Er. R.N. Mishra, Former CMD, SJVN Limited
Co-Chairman - Prof. R.D. Singh, Adjunct Professor, IIT Roorkee

Dr. Ariz Ahammed, Mission Director, National Water Mission, MoWR, India

B. Precision Irrigation Techniques for Enhancing Water Productivity.
Dr. Ramadhar Singh, PS & Former Head

C. Sustainable Hydraulic Measurements for Intelligent Water Management.
Prof. Pranab Kumar Mohapatra, Civil Engineering, IIT Gandhinagar

Dr. V. M. Chowdary, Scientist/Engg "SG', RRSC-N, NRSC, ISRO, New Delhi

E. Relevance of climate change on characteristics of regional droughts and irrigation requirement.
Dr. R.P. Pandey, Scientist G, NIH, Roorkee

F. Inter-basin Water Transfer Through Link Canals -Some Problems and Solutions.
Prof. Somendra Kumar Mazumder, Former AICTE, Em. Professor, DCE/DTU.

G. Coastal Disasters Threats to Marine Ecosystem.
Shri. R. D. Singh, Adjunct faculty, Department of Water Resources Development and Management, IIT Roorkee

H. Issues and Challenges for Development of Decision Support System for large river basin in India for management of water resource of the basin – A Case Study.
Prof. Vijay Kumar Dwivedi, Professor, NIT Durgapur, West Bengal
Plate 9: Presentation of Keynote paper by Dr. S.K. Jain, Director, NIH Roorkee during a plenary session.

Plate 10: Presentation of Keynote paper by Dr. S. Kishore, Dean (Academics), AIIMS Rishikesh during a plenary session.
Plate 11: Presentation of Keynote paper by Prof. T.I. Eldho, IIT Bombay during a plenary session.

Plate 12: Presentation of Keynote paper by Prof. Indrajeet Chaube, Purdue University, USA during a plenary session.
Plate 13: Presentation of Keynote paper by K. Vohra, (State Projects) MoWR, RD & GR during a plenary session.

Plate 14: Presentation of Keynote paper by Prof. Puneet Srivastava, Director, Water Resources Center, Auburn University, (USA) during a plenary session.
Plate 15: Presentation of Keynote paper by Prof. Tommaso Moramarco, IRPI-Consiglio Nazionale delle Ricerche Via Madonna Alta PERUGIA (ITALY) during a plenary session.

4. TECHNICAL SESSIONS

Total 160 technical papers on various conference themes were presented by the eminent scientists/professors/water professionals/students in twenty 25 technical sessions as per the detailed below:

TECHNICAL SESSION – I (Feb. 17, 2018)

HALL-1

CHAIRMAN- Prof. Chittaranjan Ray, Director of Nebraska Water Center Nebraska University of Nebraska

Co-Chairman - Dr. Tushar Sinha, Texas A&M University, Kingsville, TX, USA

1. Upflow hydroponic constructed wetland microbial fuel cell (UHCW-MFC) for wastewater treatment and recovery of bioelectricity.
   Chabungbam Niranjit Khuman, Gourav Dhar Bhowmick, Bikash Ranjan Tiwari, Dibyojyoty Nath, Makarand Madhao Ghangrekar and Arunabha Mitra

   Deepak Kumar, Vinay Kumar and Sangeeta Kumari

3. Effect of Operating Parameters on Removal of Iron from Drinking Water by Electrocoagulation (Ec).
   Daisy Das and Barun Kumar Nandi

   Faizul Haque Quraishi, Jawed Rafiq and Akash Kumar Srivastava
5. Voltammetric behavior of 3-chloro 2-methylaniline in aqueous medium.
Richa Paliwal, Rajdeep Malik, Ravi Kant and Yogendra Nailwal

B Neethu, Pankaj Kumar Goutam, Dipak Ashok Jadhav and Makarand Madhao Ghangrekar

Sakshi Gupta and Deepak Khare

Swati Sirsant and M Janga Reddy

Abhijith G R and S Mohan

10. Application of carbon supported Silver-Tin oxide composite (Ag-SnO2) cathode for enhancing desalination performance in microbial desalination cell.
Ganta Anusha, Md. Tabish Noori, Pritha Chatterjee and Makarand Madhao Ghangrekar.

HALL-II

CHAIRMAN- Dr. Rakesh Kumar, Scientist-G & Head NIH Roorkee

Co-Chairman – Er. Sher Singh, Director, CWC, New Delhi

Co-Chairman – Dr. Susheel Kumar Himanshu, Research Scientist, NRSC, ISRO, Hyderabad

11. An Analytical Investigation to Select a Suitable Path for Canal using ANN to Meet the Challenges of Water Scarcity in Gomati District of Tripura.
Saumyadeep Bhowmik, Bishnu Kant Shukla and Dolonchapa Prabhakar

12. Assimilation and Analysis of Microwave Radiance observations with Atmospheric Radiative Transfer Simulator (ARTS) using Megha Tropiques SAPHIR data.
Catherin Sebastian, Shashi M and Jugdambe Sharma

13. Evapotranspiration Model Using Artificial Neural Network
Shreenivas Londhe and Madhura Kulkarni

Shreenivas Londhe and Kirti Sonawane

Saswata Nandi and M Janga Reddy

Kanak Moharir and Chaitanya Pande

17. Investigating the effect of objective functions on ANN model calibration for flood forecasting.
Cicily Kurian, K P Sudheer and Debabrata Sahoo
HALL-III

CHAIRMAN- Prof. S. Bala Prasad, Professor of Environmental Engineering, Department of Civil Engineering, Andhra University, Visakhapatnam-530003

Co-Chairman – Dr. Sushil K. Himanshu, Research Scientist, NRSC, ISRO, Hyderabad

18 Study of Groundwater Contamination due to Landfill Leachate in Mangaluru, India. Divya Anand and Shrihari S

19. Settling velocity of fine suspended sediments in Muthupet estuary, India and Bouregreg estuary, Morocco. Priya K L, Haddout S and Adarsh S


21 Rationalization of Krishna River Water Quality Monitoring Locations using Multivariate Statistical Techniques and Water Quality Index. Dr. Vikas Varekar, Aditya Nanekar and Hasan Rameez

22. Modelling Dissolution of Light Non-Aqueous Phase Liquid (LNAPL) Under Varying Subsurface Flow Conditions. Pankaj Gupta and Brijesh Kumar Yadav

23. Investigations on infiltration characteristics of soils in Hamirpur (Himachal Pradesh). Nitish Mahant and Vijay Shankar

HALL-IV

CHAIRMAN- Prof. Indrajeet Chaubey, Associate Dean & Director of International Programs in Agriculture Head, Department of Earth, Atmospheric, and Planetary Purdue University, West Lafayette IN 47907-2093

Co-Chairman – Prof. Ajay Kalra, Department of Civil and Environmental Engineering Southern Illinois Univ. Illinois

24. Grey Water Treatment by Two Stage Bioreactor. Naresh Kumar, Chiranjivi Eshwar, Manu D S and Arun Kumar Thalla


26. Recent Advances and Challenges in NF-RO Hybrid Water Desalination Technology. Alka Srivastava and Manoj Garg

27. Removal of Fluoride from Drinking Water Supplies. Stephano Alphayo and Mahendra Sharma

28. “Aeration”- An Essential Practice for Successful Aquaculture Water Treatment. Subha M. Roy and Bimal Chandra Mal

29. Sustainable Water Management of Water Bodies in Urban Area – A case of Indore. Dinesh Singh and Harsimran Kaur

30. Reductive removal of Cr(VI) from drinking water. Neha Bisht, Renuka Verma and Sudipta Sarkar
HALL-V

CHAIRMANT- Prof. Puneet Srivastava, Director, Water Resources Center, Butler-Cunningham Eminent Scholar, Professor, Biosystem Engineering, Auburn University, Auburn.

Co-Chairman – Prof. Sumit Sen, Department of Hydrology, IIT Roorkee

31. Efficacy of Surface Drainage System of Bhubaneswar City (Odisha), the Smart City No 1 – A Case Study.
   Joygopal Jena, Bandana Jethy and Swapnaranee Mohanta

32. Urban Flooding Solution: A Case Study of Bhubaneswar.
   Siddharth Purohit and Anil Kumar Kar

33. Groundwater conditions in northwest India: Few case studies for its sustainable management.
   Gopal Krishan, Nc Ghosh, Dj Lapworth, Alan Macdonald, Helen Bonsor, Cornelius Sandhu and Brijesh Yadav

   Manish Kumar Mishra and Kailash Jha

35. The influence of slope profile on rain garden hydrological performance.
   Osheen and Krishna Kumar Singh

   Mrunmayi Wadwekar and Dr. Rama Pandey

37. Improvement of Ground Water Quality Index using Citrus limetta.
   Rupas Kumar, Saravana Kumar, Amarendra Kumar, Likhita Komal and Sreedeepthi Molleti

TECHNICAL SESSION –II

HALL-I

CHAIRMANT- Dr. Ambrish Kumar, Principal Scientist, IISWC Dehradun

Co-Chairman – Dr. Rajesh Singh, Scientist, NIH Roorkee

38. 10 Challenges of water supply management in Harbour City of Freetown in Western Sierra Leone.
   Augustine Amara and Mitthan Lal Kansal

39. Development of Bio-filters for the Treatment of Grey Water
   Sujata Kulkarni, Basavaraj Hungund, Raghavendraprasad Suryavanshi, Geeta Bellad and M R Patil

40. Production and characterization of Bio-Surfactants from various lactobacillus species: a bioremediation technique.
   Ashwin T, Surinder Deswal and Baljeet Singh Saharan

   Rajesh Singh, Daniel Kanbienaa and Ashish Pandey
42. Development of a new approach for Scatterometer based river monitoring.
   Rohit Pradhan, P K Gupta and R P Singh

43. Monitoring of Soil moisture variability and establishing the correlation with topography by remotely sensed GLDAS Data.
   Kaushlendra Verma and Yashwant Bhaskar Katpatal

44. Analysis & GIS Mapping of the Groundwater Quality in the vicinity of Kala Sanghian Drain.
   Kirti Goyal and Bhanu Magotra

45. Effect of monthly variation of near surface lapse rate on snowmelt runoff simulation in Eastern Himalayas.
   Minotshing Maza, Liza Kiba, Arnab Bandyopadhyay and Aditi Bhadra

   Sabita Madhvi Singh, Pabitra Maiti and Neetu Singh

47. Land Use Classification of Sone River Basin-Bihar
   Zeenat Ara

48. Groundwater Modeling in a Semi-Confined Aquifer using Gis and Modflow
   Priyanka Thakare and Yashwant Katpatal

49. A Framework for High Resolution Downscaling for Large Regions.
   Maharana Pratap Singh and Varun Singh

50. Hydrological Modelling of River Basin using SimHyd Model.
   Ankit Balvanshi and H. L. Tiwari

   Amrita Preetam Barick, Mahendra Kumar Bhuyan, Anil Kumar Kar and Harihar Mohanty

52. Development of saturated rain-gauge network for runoff computation.
   Biswajit Choudhury, Anil Kumar Kar and Anil Kumar Lohani

53. Rain Response Releases in Krishna basin.
   Venugopal Kurnool and Srinivasu Nalluri

54. Experimental study and calibration of hydraulic coefficient using vertical orifice.
   Tejaswini R and Surendra H J

55. A simple and efficient numerical model for flow simulation around groyne.
   Kaushik Bora and Hriday Mani Kalita
56. Comparison of FAO56 and NDVI-derived Kc Curves for Major Crops in Pare Basin of Arunachal Pradesh.
Waikhom Rahul Singh, Khyoda Meema, Tana Matthew, A. Bhadra and A. Bandyopadhyay

Gaurav Saini and Rp Saini

58. Flash flood mapping using HEC-RAS.
Birju Pal, Sovan Sankalp and Sanat Nalini Sahoo

HALL-IV

CHAIRMAN- Prof. Devdutta Das, Former Head, Department of WRD&M, IIT Roorkee
Co-Chairman- Prof. Manoj K. Jain, Department of Hydrology, IIT Roorkee

59. Fate and Transport of Nano-Plant Nutrients in Lateritic Soils
Maheshwar Durgam and Damodhara Rao Mailapalli

60. Brahma Dravya: A liquid sample to render wastewater pathogens-free.
Monika Negi, Ayushi Maithani and Sakshi Gupta

61. Improvement in efficiency of activated carbon by doping through Zr: Sorption affinity towards anionic reactive dye.
Sonalika Sonal and Brijesh Kumar Mishra

Asthya Singh and Brijesh Kumar Mishra

63. Wastewater Treatment Modelling Using floating aquatic macrophyts (FAM) System and Management Strategies.
Dr. Satya Narain, Dr S. K. Mishra, Prof. C.S.P. Ojha and Mr. Tufa Feyissa

HALL-V

CHAIRMAN- Dr. P.K. Singh, Professor, Dept. of Irrigation & Drainage Engg., GBPUAT, Uttarakhand
Co-Chairman- Dr. Omkar Singh, Scientist, NIH Roorkee

64. Scaling up of microbial fuel cell for treatment of human waste to develop bioelectric toilet.
Indrasis Das, Dipak A. Jadhav and Makaranand M. Ghangrekar

65. Improved wastewater treatment by using integrated microbial fuel cell-membrane bioreactor system along with ruthenium/activated carbon cathode composite to enhance bio-energy recovery.
G. D. Bhowmick, S. Ghosh Ray, M. M. Ghangrekar and A. Mitra

Madhulika Bhati and Radhika Rai

67. Defluoridation of Industrial Waste Water using Eichornia Crassipes
Shreyank Goel, Tushar Srivastava and Dr Tej Pratap Singh

68. Enviro - economic analysis of active single slope solar still with cooling condensing cover.
Poonam Joshi and Gopal Nath Tiwari
69. Cost effective economic model for performance up-gradation of centralized potable water system of STEM, India.
Dr. Vikas Varekar, Vivek Chowdhary and Shashikant Salunke

TECHNICAL SESSION –III

HALL-I

CHAIRMAN- Prof. B. C. Mal, Vice Chancellor, JIS University, Agarpara, Kolkata, Former Vice Chancellor, Chhattisgarh Swami Vivekananda Technical University, Bhilai

Co-Chairman- Dr. Ambrish Kumar, Principal Scientist, IISWC Dehradun

70. A study on usage of treated waste water in agriculture.
Lavanya M B., Surendra H J and Teenu N

71. Performance Study on Treatment of Slaughterhouse Wastewater using Hybrid UASB Reactor.
R. Loganath and Debabrata Mazumder

Kiran Kumar Kurilla, Dr. Pankaj Kumar and Dr. Ramakrishna Kotha

73. Performance optimization of funnel and gate type of permeable reactive barrier.
Shashi Ranjan and Brijesh K. Yadav

74. Textile dyebath decolourization using pressure driven membranes: an integrated sustainable approach.
Harpreet Singh and Akepati S. Reddy

HALL-II

CHAIRMAN- Dr. V. M. Chowdary, Scientist/Engg "SG”, RRSC-N, NRSC, New Delhi

Co-Chairman- Rohit Pradhan, Scientist, SAC, Ahmadabad

75. Accuracy Assessment of Land use/Land cover Using Remote Sensing and GIS: Case Study of Kaushalya Watershed, Haryana.
Khushbu Choudhary and Baldev Setia

76. GIS based Rainfall runoff model A case study of Gurugram district.
Jawale Madhuri Vasudev and Abhilash Rawat

77. Evaluation of Sentinel 2 red edge channel for enhancing land use classification.
Sucharita Pradhan, Kamlesh Narayan Tiwari and Anirban Dhar

78. Meteorological Drought Assessment in Tripura of Humid Northeast India using EDI.
Annu Taggu and Salil K. Shrivastava

79. Glaciers and glacial lake outburst flood risk mapping using geospatial techniques.
Nity Tirkey, Dr. Anil Kumar Lohani and Dr. P K Parhi

HALL-III

CHAIRMAN- Prof. K. N. Tiwari, Professor, Department of Agricultural and Food Engineering, IIT Kharagpur

Co-Chairman- Dr. D.R. Sena, Principal Scientist, IISWC Dehradun

80. A multi-model ensemble based drought characterization over India for 21st century
Vivek Gupta and Manoj Kumar Jain
81. **Optimization of Human Effort and Time by Modified Foot Pump.**
    Shalini Tripathi, Shivam Mishra, Shubham Mishra, Anish Kumar and Jitendra Tivari

82. **Temporal and Spatial Variability of Daily Rainfall Extremes in Assam of humid northeast India.**
    Maisnam Luwangleima and Salil K. Shrivastava

83. **Discharge Prediction Approaches in Compound Meandering Channel.**
    Piyush Pritam Sahu, Kanhu Charan Patra and Abinash Mohanta

84. **Application of GIS in Flood Risk Zonation of a Catchment.**
    Subimal Nandi and Sujata Biswas

85. **A case study on flood and drought management in Jammu and Kashmir as well as Rajasthan with solutions.**
    Pakeeza Jhan, Mumtaz Mohammed Jahangir and Saumyadeep Bhowmik

86. **An Analytical S-Curve Approach for SUH Derivation.**

**HALL-IV**

**CHAIRMAN- Prof. Gopal Chauhan, Former Head WRD&M, IIT Roorkee**

**Co-Chairman- Dr. Surajit Singh, Scientist, NIH Roorkee**

87. **Impact of Land Use and Land Cover Change on Groundwater Resources in Sardar Sarovar Command Area of Region-V Using GIS and Modelling Approach.**
    Nitin Mishra, Murari Kumar, Shahid Shafai and Dolonchapa Prabhakar

88. **Solar radiation forecasting using ANN for smart grid energy management.**
    Divyakshi Aeron, R.P. Saini and N.P. Padhy

**HALL-V**

**CHAIRMAN- Prof. N. K. Gontia, Dean, Agricultural Engineering Faculty, Junagadh Agricultural University, Junagadh 362 001, India**

**Co-Chairman- Prof. P.K. Jha, Department of MIED, IIT Roorkee**

89. **New strategy of green water resources management for enhancing productivity, use efficiency and protection of environment.**
    Ram Yadav

90. **Challenges of Food Security in Tanzania: Need for Precise Irrigation.**
    Deogratius Nyamsha and Mitthan Lal Kansal

91. **Sustainable water use mechanisms for integrated irrigation and agriculture plan in Odisha.**
    Devipriya Paikaroy

92. **Indigenous Irrigation Management system in the Bhutan Himalayan Foothill Zone of Assam: Challenges and Sustainability.**
    Sourav Saha, Dr. Nityananda Deka and Dr. Abani Kumar Bhagabati

93. **Factor analysis of various reference evapotranspiration models for sub-humid sub-tropical climate.**
    Akshika Guleria and Vijay Shankar
94. Command Area Development and Management Strategies.  

95. Command Area Development Through Micro Irrigation.  
Vishnu Arya

96. Yield Maximization through Sustainable Water Conservation in Dryland Agriculture  
Mahendra Nagdeve and Rajesh Patode

**TECHNICAL SESSION –IV**

**HALL-I**

CHAIRMAN- Prof. Venkataramana Rao Sridhar, Biological System Engg. Dept., Seitz Hall, RM 212, Virginia Tech., 155 Ag Quad Lane, Alacomburgh, VA 24061, Virginia Tech Uni. USA  
Co-Chairman- Dr. Manohar Arora, Scientist, NIH Roorkee

97. Waste Water Management In Super thermal Power Stations-NTPC perspective.  
Mr. Sudarsan Chakrabarti, Ms. S. Padmapriya, Mr. Anirudh Sood

98. Paper mill effluents: identification of emerging pollutants in Taranga Beel of Assam, India.  
Khanindra Sharma, Neelotpal Sen Sarma and Arundhati Devi

99. Evaluation of Water Quality in Rivers Ganga and Yamuna using water quality index (WQI) and Streeter-Phelps Model.  
Sudha Goel and Aman Sharma

100. Contamination in drinking water supply: A case study of Shimla city, Himachal Pradesh.  
Mukesh Sharma, Chakresh Jain, Rajesh Singh and Omkar Singh

**HALL-II**

CHAIRMAN- Prof. Tushar Sinha, Texas A&M University, Kingsville, TX, USA  
Co-Chairman- Prof. P.K. Jha, Department of MIED, IIT Roorkee

Aparna Das, Raunak Prusty and Kanhu Charan Patra

102. Analysis of Agricultural Drought Frequency using the Geo spatial Technology in Marathwada, Maharashtra.  
Mohammadssanaulla K. Huddar, N.R. Patel, Abhishek Danodia and Avyakt Kumar Pathak

103. Geospatial Analysis coupled with Logarithmic method for Groundwater Quality assessment in part of Pindrawan tank in Raipur district of Chhattisgarh, India.  
Purushottam Agrawal, Alok Sinha, Srinivas Pasupuleti, Rajesh Nune and Sarbani Saha

104. Agricultural crop mapping using MODIS time-series data in DVC command area.  
Dibyendu Roy, Sneha Murmu and Sujata Biswas.

105. Assessment of surface urban heat island growth over Ahmedabad city using geospatial techniques.  
Aneesh Mathew, Shivam Chauhan, Sumit Khandelwal and Nivedita Kaul

Rashmirekha Hembram, Anil Kumar Kar and Harihar Mohanty

Bilal, Millie Pant and Deepti Rani
Moumita Palchaudhuri and Sujata Biswas

109. Analyzing the translation from Metrological to Hydrological Drought for Wainganga River of Central India.
Amit Kumar, Lalit Pal and Manish Nema

110. Rationalization of Water Quality Parameters for Krishna River Basin.
Dr. Vikas Varekar, Hasan Rameez and Aditya Nanekar

111. Vulnerability Assessment of Manipur to Floods Using Unequal Weights.
Sanayanbi Hodam, Dr Arnab Bandyopadhyay and Dr. Aditi Bhadra

112. Rainfall-runoff modeling using numerical model.
Shreenivas Londhe and Digvijay Saruk

113. Experimental drought monitoring.
Anantha Krishnan S, Saksham Joshi, Annie Maria Isaac, Raju Pv and Venkateswar Rao V

114. Agricultural drought management in Rajasthan.
Dr. Raj Vir Singh

115. Dam Break Flood Inundation Modelling for a Hydroelectric Dam.
Pankaj Mani, Rakesh Kumar and Jagadish Prasad Patra

Salahu M. Hamza, Amimul Ahsan, Abubakar A. Musa, Sarki A. Salisu and Mohammed B. Ibrahim

Chanchala

118. Assessment of Groundwater Potential and Sustainability in an Aquifer System of Mahanadi Delta, Odisha, India.
Aruna Kumar Nayak, Madan Kumar Jha and Sasmita Sahoo

119. Rainfall Variability Assessment Over Rokel-Seli River Basin In Sierra Leone.
Saramadie Thorlu-Bangura, Surendra Kumar Chandniha and Mitthan Lal Kansal

120. SCADA based Rainfall simulation and precision Lysimeters with open top climate chambers for Assessing the climate change impacts on Resource losses in Semi-Arid Regions.
K S Reddy, Vanaja Maddi, M Kumar and T Saikrishna

Pooja Agarwal, Mohd. Afaq Alam and Lalit Pal

122. Climatic Change due to Global Warming with Respect to Various Parameters.
Mumtaz Mohammad Jahangir and Irfan Yousuf Wani
Jyoti Tripathi and Rekha Gupta

125. Model to Generate Alternatives (MGA) of cropping pattern for tribal farmers.
Aniket Deo, Prof. Amit Arora and Prof. Upendra Bhandarkar

126. Modelling of Groundwater Development Using Arc-SWAT and MODFLOW
Satavisha Ghosh, Sunny Gupta and Susmita Ghosh

Jahangeer and Brijesh Kumar Yadav

128. Soil moisture depletion based irrigation technology for summer finger millet under midland situation of Chhattisgarh plains.
Dr. M. P. Tripathi, Yatnesh Bisen, Priti Tiwari, Prafull Katre, Karnika Dwivedi and Gaurav Kant Nigam

**TECHNICAL SESSION – V**

**HALL - I**

CHAIRMAN- Dr. Ariz Ahammed, IAS, Mission Director, National Water Mission, MoWR, Rd&GR, Govt. of India

Co-Chairman- Er. Anuj Kanwal, Director-INCSW, CWC-New Delhi

129. Humic acid removal from water using hydrophilic polysulfone membrane.
Bharti Saini, Manish Sinha and Sukanta Dash

Devika S L, Nimitha P, Shrihari Surathkal and Venkatesh Munganur

131. Challenges and Opportunities for Optimizing Water Consumption in Painting Process.
Veer Shivajee, Sanjay Rastogi and Rajesh Singh

Shweta Gupta and Arinjay Kumar

Tesfamariam Abreha Bahita, Ambrish Maurya, Pradeep Kumar Jha and Ashish Pandey

**HALL - II**

CHAIRMAN- Dr. C.V. Dharma Rao, Joint Secretary and Advisor (C&M), National Water Mission, MoWR, Rd&GR, Govt. of India

Co-Chairman- Dr. V. M. Chowdary, Scientist/Engg "SG", RRSC-N, NRSC, New Delhi

134. Flood forecasting of the Himalayan River Kosi at Baltara (India) by a wavelet-GA-ANN conjunction models.
Mani Kumar and Rajeev Sahay

135. Bringing science in community planning under changing climate.
Ajay Kalra, Ranjan Parajuli, Narayan Nyaupane, Lorenzo Mastino, Marco Velotta and Sajjad Ahmad

136. Streamflow Response to Land Use-Land Cover Change over the Subarnarekha River Basin, India.
Pratik Deb, Ashok Mishra, Igor Musikhin and Soukhin Tarafdar

137. A Study on Variability and Trends Towards Climate Instability.
Abhinav Anand Sinha, Nishant Kumar Singh and Avinash Kumar

138. Multifractal Description of Droughts in Western India using Detrended Fluctuation Analysis.
Adarsh S and Priya K.L.

139. Impacts of Climatic Variability and Extremes on Agriculture and Water in Odisha Coasts.
Devipriya Paikaroy, Anil Kumar Kar and Prof. Kabir Mohan Sethy
140. Sectoral and Livelihood Vulnerability to Climate Risk in Indian Himalaya: A Case Study of Almora District of Uttarakhand.
Ashish Kumar Panda, Dr. Anil Kumar Gupta and Prof. Amarjeet Kaur

HALL - III
CHAIRMAN- Prof. Pranab Kumar Mohapatra, Civil Engineering Department, IIT, Gandhinagar
Co-Chairman- Prof. Brijesh Yadav, Department of Hydrology, IIT Roorkee.

141. Flood Risk Management with Real-Time Flood Forecasting.
Nandana Perera, Shyam Prasad, Rob James and Karen Finney

142. Effect of capillary rise on irrigation requirements for wheat.
Arunava Poddar, Navsal Kumar and Vijay Shankar

143. An approach towards mitigation of Cyclone disaster- A case study of Odisha during Phailin.
Anil Kumar Kar, Krishna Kumar Gupta, Joygopal Jena and Dipti Ranjan Jena

144. Flood and Drought Management through Water Resources Development in Odisha.
Pidathala Sunil, Sachin Dhiman and Kanhu Charan Patra

145. Hydrologic analysis and modelling of bridge across Chandrabhaga river.
Jagadish Prasad Patra, Rakesh Kumar and Pankaj Mani

146. Scaling of open channel flow velocity along the centre line of emergent, highly sparse and rigid vegetation patch with rough bed interior of the patch.
Chitrangini Sahu and Dr. Prashanth Hanmaiahgari

147. Regional flood frequency analysis for gauged and ungauged catchments of Upper Narmada and Tapi Subzone 3 (c).
Raksha Kapoor, Rakesh Kumar and Mohit Kumar

148. Developing Strategies for Mitigating Pluvial Flooding in Gurugram.
Abhilash Rawat, Govind M.P. and Jawale Madhuri Vasudev

149. Low Impact Development (LID) Modelling for Stormwater Management.
Nandana Perera, Shyam Prasad and Rob James

HALL - IV
CHAIRMAN- Dr. Ramadhar Singh, PS & Former Head, Irrigation & Drainage, Engineering Division, CIAE, Bhopal
Co-Chairman- Dr. Avdhesh Pratap, Water Law, Management and Constitution Law Expert

150. Assessment of impact of climate change on hydrology of Brahmani and Baitarani river basin.
Raunak Prusty, Aparna Das and Kanhu Charan Patra

Pallavi Kulkarni and Sudhakar Pardeshi

152. Comparison of GCM derived rainfall – a case study in Kerala.
Lini R Chandran and Jairaj PG

Chetan Sharma and Chandra Shekhar Prasad Ojha

154. Modelling CO2 sequestration and its subsequent migration in subsurface.
Shachi Shachi and Brijesh Kumar Yadav

HALL - V
CHAIRMAN- Er. R.N. Mishra, Former CMD, SJVN Limited
Co-Chairman- Er. L.P. Joshi, AGM, THDCI Limited

156. Water Governance and Capacity Building.
Dr. Nanditesh Nilay

David M.N. Gosselin
158. Impact of Environmental flow on Hydro Power Projects - A Case Study.
   Naresh Dongre and Vivek Gupta

159. Hydro-ecological assessment of environmental flows for Satluj river.
   Pradeep Kumar, Jai Nayak and Shobha Ram

160. Ground water governance and interplay between policies in India.
   Akshi Bajaj and Diptimayee Nayak

5. VALEDICTORY FUNCTION

During the valedictory function, Prof. S.K. Mishra, Chairman of the Conference welcomed the gathering. Prof. Ashish Pandey, Organising Secretary of the Conference presented a brief report of the conference and also the draft recommendations of the conference. Prof. A.K. Chaturvedi, Director, IIT Roorkee emphasised the use of emerging technologies for addressing the water resources problem and appreciated the outcome of the conference. He emphasised upon the sharing of these recommendations with the stake holders for their effective implementation in the field. Shri Prakash Pant Ji, Hon’ble Cabinet Minister, Govt. of Uttarakhand, Dehradun was the Chief Guest of the valedictory function. He informed about the various water conservation practices being followed in Uttarakhand and emphasized that the recommendations of the conference would be very useful for not only Integrated Water Resources Development & Management in Uttarakhand under the climate change scenario but also for water managers and practitioners. Shri R.N. Mishra, Former CMD, SJVN Limited, Prof. V. P. Singh, Department of Biological & Agricultural Engineering & Zachry Department of Civil Engineering, Texas A&M University College Station, Texas, USA, Dr. S.K. Jain, Director, NIH Roorkee and Dr. C.V. Dharma Rao, Joint Secretary and Advisor (C&M), National Water Mission, MoWR, RD & GR, Govt. of India also addressed the gathering. During his address, Dr. C.V. Dharma Rao emphasised on the active collaboration between IIT Roorkee and Ministry of Water Resources, RD and GR on various issues and challenges being faced by country in water sector.

Plate 16: Presentation of the conference report by Dr. Ashish Pandey, Associate Professor, WRDM, IIT Roorkee and Secretary IWRS during valedictory function.
Plate 17: Address by Dr. C.V. Dharma Rao, Joint Secretary and Advisor (C&M), National Water Mission, MoWR, RD & GR, Govt. of India and Guest of Honour during valedictory function.

Plate 18: Address by Prof. V.P. Singh, Texas A&M, University and Chairman of the International Advisory Committee of the conference during valedictory function.
Plate 19: Presidential Address by Prof. Ajit K. Chaturvedi, Director, IIT Roorkee during the valedictory function.

Plate 20: Address by Chief Guest during valedictory function.
6. **POSTER & PICO SESSIONS**

On the last day of the conference, a poster session was organised. The students displayed 34 posters, prepared based on their research papers, in the premise of Department of WRDM, IIT Roorkee as per the following details:

**POSTER SESSION**

**CHAIRMAN:** Prof. V.P. Singh, Texas, A&M, USA

**Co-Chairman:** Dr. C.V. Dharma Rao, Joint Secretary and Advisor (C&M), National Water Mission, MoWR, RD & GR, Govt. of India

161. **SWAT based Runoff and Soil Erosion Modelling: a case study of Varanasi region watershed.**
Nikita Shivhare, Padam Omar, Atul Kumar Rahul, Prabhata Kumar Singh Dikshit and Shyam Bihari Dwived

162. **Recharge potential mapping and recharge site suitability analysis in complex hydrological system of Kosi Basin in Mid-Himalayan region.**
Meenu Rani, Kireet Kumar and Himanshu Joshi

163. **A revisit to SCS-CN inspired antecedent moisture content formulae.**
Mohan Lal, S. K. Mishra and Ashish Pandey

164. **Estimation of Surface runoff with SCS curve number method using GIS. A Case Study of Vadodara city.**
Lakhwinder Singh and Deepak Khare

165. **Assessment of satellite-based precipitation estimates over an agriculture based Indian watershed.**
Sushil Kumar Himanshu, Ashish Pandey and Deen Dayal

166. **Reference crop evapotranspiration estimation using remote sensing technique.**
Samuel Mukpuou, Ashish Pandey and V.M Chowdary

167. **Determination of ERA-INETRIM proficiency for rainfall-runoff modelling**
Tanmoyee Bhattacharya, Dr. Deepak Khare and Dr. Manohar Arora

168. **Assessment of evapotranspiration using satellite data: a case study of Tamor watershed, Nepal**
Kul Raj Chalise, Ashish Pandey and Kumar Ghimire

169. **Assessment of irrigation water requirement and its trend in Betwa river basin, India.**
Ashish Pandey, Reetesh Kumar Pyasi and Santosh S. Palmate

170. **Laboratory performance evaluation of a rainfall simulator.**
Vikas Jadhao, Rupesh Bhattarai, Ashish Pandey and S. K. Mishra

171. **Application of hydrologic modelling system (HEC-HMS) for flood assessment; case study of Kelani river basin, Sri Lanka.**
Sivakumaran Rajkumar, S K Mishra and R D Singh

172. **Hydrological Modelling of West Rapti river basin, Nepal using SWAT.**
Shekhar Nath Neupane and Ashish Pandey

173. **Assessing hydrologic alteration due to dam construction in the upper godavari basin**
Santosh S. Palmate and Ashish Pandey

174. **Design of High Head Regulating Radial gate using Microsoft Excel.**
Roshan Kumar Deo, Thanga Raj Chelliah, Sk Shukla and Mayank Jain

175. **Review of flow simulation methods in alluvial river.**
Deepak Dhakal, Nayan Sharma and Ashish Pandey

176. **Research needs for stream power moderation in Hilly torrents for Disaster mitigation.**
Manoj Prasad Patel, Nayan Sharma and Ashish Pandey

177. Study of drought characteristics in ken river basin of bundel khand region in India.

178. Meteorological drought characteristics in eastern India.
Kumar Amrit, Rajendra Pandey and Surendra Mishra

179. SCS-CN method revisited in perspective of strange data.
Shailendrakumar Kumre, Surendra Kumar Mishra and Ashish Pandey

180. Rainwater harvesting system planning for Tanzania.
Msafiri Mussa Mtanda, Sakshi Gupta and Deepak Khare

Harsh Vardhan Singh and Vishwendra Singh

182. Design of pressurized Irrigation system to Improve Irrigation water use efficiency in Canal Command.
Alemayehu Yadesa and Dr. M.L Kansal

183. Effect of land use on runoff curve number in steep slope.
Chakra Bikram Singh, S.K. Mishra and Shailendra Kumre

184. Effect of watershed characteristics on SCS-CN.
Krishna Prasad Dumrakoti, S.K. Mishra and S.K. Kumre

Vishnu Bhandari, Nayan Sharma and Ashish Pandey

186. Event based hydrological modelling of babai watershed using HEC-HMS.
Dinesh Parajuli, J.P. Patra and S.K. Mishra

187. Assessment of blue, green and grey water footprint at river basin level: a case study of the Koshi river basin, Nepal
Kumar Ghimire, R.D Shingh, Ashish Pandey, G.S Murthy and Kulraj Chalise

Collins Andoh, Sakshi Gupta and Deepak Khare

189. Advancement plans for revitalization and development of ankobra river basin in Ghana.
Benjamin Lawortey, Thanga Raj Chelliah and S.K Shukla

190. Water quality indices (wqis) for vadodara enviro channel limited and its member industries
Shambhu Jha and Dr. S. K. Mishra

191. Changes in temporal distribution of rainfall using Precipitation Concentration Index in Rampur watershed of Mahanadi river basin.
Priyanka Gunjan, S. K. Mishra, Anil Kumar Lohani and Surendra Kumar Chandniha

Hailu Birara, Surendra Mishra and Rajendra Pandey

193. Long term historic changes in temperature and potential evapotranspiration over Betwa river basin.
Ashish Pandey, Deen Dayal, Santosh Subhash Palmate, S.K. Mishra and R.P. Pandey

194. Evaluation of Hydro-Meteorological Drought Indices in Dry Land Area, a Case Study of Seonath River Basin.
PICO presentation was organised for some of the research papers and three students were awarded for best presentation namely. Mr. Samuel Mukpuou, Mr. Manoj Prasad Patel and Mr. Mohan Lal students of the Department of WRDM, IIT Roorkee. Prof. V.P. Singh addressed the students and the faculty and encouraged them to take up the R&D studies involving the applications of advanced tools and techniques.
Plate 23: Evaluating Committee and students attending the PICO presentation during the conference.

Plate 24: Prof. V.P. Singh, Texas A&M, University, USA addressing the Evaluating Committee and students during the PICO presentation in the conference.
Plate 25: A group photograph of some of the delegates attended the International conference.

7. EXHIBITION

An exhibition was also organised throughout the conference wherein advanced & state of art equipment were demonstrated. The participants took keen interest during the exhibition and inquired about the capabilities of different equipment.

8. RECOMMENDATIONS

Based on deliberations, plenary and technical sessions, important recommendations were brought out and these are given below:

1. Hydrological data (gauge and discharge, snow melt, physical, chemical and biological water quality, ground water, and lakes and reservoir), hydro-meteorological data (rainfall, snowfall, temperature, evaporation, wind speed, relative humidity, glacial melt), and water quality networks need to be strengthened using advanced instrumentation for measuring data at shorter temporal and spatial resolutions. Application of Space Technology particularly Remote Sensing and Geographic Information System (GIS) for spatial data collection and data processing needs to be encouraged.

2. The data must be archived after passing through the quality checks. The data collected must be shared online by the stakeholders. In this regard a central agency/authority need to be made responsible for disseminating the data to the users after maintaining the necessary protocols.

3. Web-service-based systems be developed to strengthen open machine-to-machine and machine to human data dissemination for retrieval and dissemination of data to the user free of cost.

4. Emerging technologies should be applied to address the field problems, which may entail training of field engineers. Emphasis should be on developing indigenous technologies for addressing water resources problems of the country.

5. Existing dams must be re-evaluated for their safety under the spectre of climate change, and strengthened accordingly.

6. Real time reservoir operation and management must be based on Decision Support System. Emerging technologies must be applied for addressing problems of flash floods, landslides, glacier lake outburst floods, drying of springs, glacier retreat, reduction in the snow-covered areas, erosion and sedimentation, and meandering and shifting of river courses in the Himalayan region.
7. Pollution hotspots, where immediate structural and non-structural measures are needed, must be identified using water quality data.

8. State level action plans need to be developed for effective utilization of water by all the stakeholders and adaptation strategies should be evolved to cope with the impact of climate change on water resources.

9. Appropriate drainage facilities should be provided in urban areas as well as in the proposed smart cities.

10. Measures need to be taken up for enhancing the water use efficiency in all sectors, with particular emphasis on agriculture irrigation which consumes more than 80% fresh water.

11. Application of precision irrigation (including micro irrigation and precision land levelling for gravity irrigation) systems should be promoted for reducing water and nutrient use in agriculture. However, optimum use of fertilizers, insecticides, and pesticides should be insured to avoid soil degradation. There is a need to encourage the use of organic fertilizers.

12. Micro irrigation should be encouraged in canal commands to improve water use efficiency giving due considerations to the leaching requirement.

13. Recycle and reuse of wastewater need to be encouraged to minimize the disposal of wastewater in river systems. The treated wastewater can provide an alternative to the fresh water for irrigation, resulting in an increase of water table and enhancing river flows during the lean season.

14. Hydropower is the cheapest means of energy and has the longest life. There is an urgent need to re-assess the hydropower potential using emerging technologies under climate change and identify potential sites for development of small, medium, and large hydropower projects.

15. Vulnerable areas along the coast line, likely to be affected due to climate change, should be identified.

16. Water governance is one of the major issues which requires immediate attention. Water laws need to be implemented and an awareness campaign should be launched for their successful execution.

17. Water pricing needs to be revisited in view of ongoing over-exploitation of ground water due to free/heavy subsidies in electricity.

18. Pipe Irrigation Networks should be encouraged in arid and semiarid regions, which will facilitate the use of micro-irrigation systems.

19. Integrated Water Resources Management (IWRM) should be taken up for all river basins of India to ensure equitable distribution of water of desirable quality for each sector.

20. Hydrological extremes such as floods and droughts, whose frequencies of occurrence have increased in recent past, need to be properly managed adopting structural and non-structural measures. Interlinking of Rivers, which is one of the flagship programme of the Government of India, should be scientifically investigated for each identified river links using emergent technologies before its implementation.

21. In alluvial areas, erosion and sedimentations are major problems during monsoon season. The sediment management strategies should be decided analysing the sediment data utilizing the emerging technology and tools.

ACKNOWLDGEMENTS

The organising committee is very much thankful to Ministry of Water Resources, RD &GR, NMCG, New Delhi, SJVN Limited, PFC Limited, NTPC Limited, CSIR, New Delhi, THDCIL Rishikesh for sponsoring the conference and the delegates who attended the conference and actively participated in deliberations. The Organisers acknowledge the contributions made by each individual either directly or indirectly for successful organisation of this conference. It is expected that such cooperation would continue in future also.
Organizing Committee

Patrons

Prof. Ajit K. Chaturvedi
Director, IIT Roorkee

Er. A.B. Pandya
President, IWRS & Secretary General, ICID-CIID
Ex-Chairman, CWC

Chairman

Prof. S.K. Mishra
Executive Vice President IWRS &
Head, Department of WRD&M, IIT Roorkee

Co-Chairman

Prof. M.L. Kansal
Professor,
Department of WRD&M,
IIT Roorkee

Prof. Deepak Khare
Professor,
Department of WRD&M,
IIT Roorkee

Organizing Secretary

Dr. Ashish Pandey
Secretary IWRS &
Associate Professor
Department of WRD&M, IIT Roorkee

Joint Organizing Secretary

Dr. Pradeep K. Jha
Treasurer IWRS & Associate Professor
Dept. of Mechanical & Industrial Engg.,
IIT Roorkee
कुल गीत

जयति जयति विद्या संस्थान,
हिम गिरि श्रृंगों से अभिनंदित,
गंगा जल करते कल गान। ॥ जयति॥

शिक्षा आदर्शों में उन्नत,
jeevan शिल्पी भू सचना रत,
‘अर्न मिना न किमपि साध्यम’ व्रत,
यन्त्र कला कौशल अभियान। ॥ जयति॥

जन जीवन प्रासाद उठाकर,
सेतु बांध भू खण्ड जुड़ाकर,
अंतरिक्ष में यान उड़ाकर,
नव युग को देता आहान। ॥ जयति॥

सर्जन हित जीवन नित अर्पित,
धरा स्वर्ण शोभा कर निर्मित,
वैज्ञानिक युग पत में मूर्तित,
भू पर लाता स्वर्ण विहान। ॥ जयति॥

नयी प्रेरणा से दीपित मन,
नव स्वर्णों से हरित लोचन,
नए सत्य की उर में धड़कन,
ध्येय राष्ट्र जीवन कल्याण। ॥ जयति॥

(रचयिता—श्री सुभिरामन्दन पत्नी)

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