



INC of IAH Indian National Chapter International Association of Hydrogeologists



Newsletter

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Governing Body (2024-26)

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Dr. R. P. Singh Kushwah

Edited, designed and
composed by

Dr Ashok Kumar
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www.inciah.org

President's Message

Prof. A. K. Sinha

President, INC of IAH

*Founder Vice-Chancellor,
Chhatrapati Shivaji University, Navi Mumbai
Member, Governing Council, IUAC, GOI, New Delhi
and Founder Groundwater Community Forum*

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Dear Friends

It is always a pleasure to interact with you through messaging, mailing and online meetings, so is now particularly when we are interacting first time after the constitution of a new Governing body (GB) of INC-IAH.

As I take over the second term of President INC-IAH, I am humbled and filled with gratitude towards you for not only reposing faith in me and in my colleagues of new GB but also for participating in democratic process in number larger than ever and taking pains in the constitution of a new GB of INC-IAH. My special appreciation and thanks to all high profiled members, particularly to four brilliant and dynamic lady's members for volunteering for the different positions in the Governing body. However, GB would be always looking towards them for their valued support and cooperation in its conducts for the benefit of all members as it hardly matters who is in BG or who is out of GB as INC IAH is a small body and all members have good interpersonal relation with each other.

I would also like to convey our appreciation for the outgoing members of the GB namely Prof Arunangshu Mukherjee, Ex Vice President; Shri Amlanjyoti Kar, Ex-Secretary, Dr S. K. Shrivastava and Dr Ranjan Sinha Ex-Executive members for their cooperation and support. I take this opportunity to congratulate and welcome to all my



colleagues in new GB who are committed to serve our members, from the most junior to the most experienced, and join with a sense of responsibility to fulfil obligations and duties in a timely and effective manner.

We are keen to continue with the activities such as “INC-IAH lecture Series on groundwater and its sustainability; publication of e-Newsletter and e -Journal; Mentor-Mentee program; Support to Youngsters for international participation; organization of Workshop, Training program, Seminar and Conferences and INC-IAH Awards. The new GB is contemplating to initiate new and innovative programme including those which were announced earlier including young-centric international collaborations and exchange programs; Honor to elderly eminent groundwater experts and INC-IAH’s accessibility to the corridors of the policy makers of our country. We are looking for creation of an INC-IAH Advisory Committee, Editorial Board for e-Newsletter and e-Journal; and a panel of members to be invited to GB meeting time to time. Please volunteer yourself.

We will do our best to make you proud of INC-IAH by pursuing the INC-IAH businesses as per the regulation and guidelines of the INC-IAH’s bylaws and that of IAH.

As the GB of the INC-IAH is having brainstorming sessions to decide the course of actions, I would like to encourage all members to send us suggestions and ideas to consider. INC-IAH is responsive to direct input from its members. So, this is your chance. I encourage all members to write, whether you are a recent student member who just joined the Society, or an experienced volunteer with greater exposure to INC IAH affairs. One of my responsibilities is to facilitate the transformation of great viable proposals into reality.

INC-IAH belongs to all members. You have created and constituted the GB which will work and take various measures as enumerated above to keep yours and India’s head high. However, without your cooperation and indulgence, I am afraid, much cannot be achieved. Therefore, I on behalf of GB solicit your unfailing-support and cooperation to make Indian chapter of IAH most vibrant and visible IAH chapter.

Wish you all very best

(A. K. Sinha)

Secretary's Message



Prof. (Dr) B.S. Chaudhary

Secretary, INC of IAH

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My dearest INC IAH members

I am happy to get the privilege to write this message for the first issue of Volume 11 the e-Newsletter of INC IAH for the year 2024 after assuming the office by the new Governing Body (2024-26) on March 23, 2024. I am sure; you and your family members might be enjoying a good health and spirit. The process of elections for the new GB started almost 4 months back and culminated after declaration of results by the Election Officer [Mr. Y.B. Kaushik](#) on March 18, 2024. We are indeed happy to put on record the appreciation of the new GB for smooth and impartial elections which includes stupendous task of send the ballot papers and receiving these over a period of almost one month. I on behalf of INC IAH and on my own behalf would like to thank each and every member of INC IAH for ensuring great victory for the panel in recently held elections and would like to assure each and every one of you for our renewed commitment to take INC IAH to newer heights in coming days. West, South, Central and the North-western parts of India, the PMKSY(GW) scheme has been envisaged especially in the eastern and North Eastern States. In order to showcase the success of NAQUIM and PMKSY(GW) to the stake holders especially to the respective State and UT Governments, CGWB has been organizing Workshops all over the country.

As we all are aware that the E-Newsletter is a regular feature of INC IAH along with the e-Journal of Geohydrology. [Dr. Ashok Kumar](#) has been putting lot of hard work behind it from last more than two years. IT carries feature articles on groundwater scenario in various parts of the countries from the academics, researchers and corporate professionals. It is worth mentioning here that an International Conference was organized jointly by Indian National Chapter of International Association of Hydrogeologists (INC IAH) and Chhatrapati Shivaji Maharaj University (CSMU), Panvel, Navi Mumbai from 20th to 21st January 2024 at Chhatrapati Shivaji Maharaj University, Mumbai. The theme of the conference was "Addressing Challenges to Groundwater and Environmental Hazard Management Through Socio-Scientific and Technological Approaches". There was total 8 parallel technical sessions in addition to inaugural, plenary, valedictory sessions. It was a two-day grueling deliberation amongst the hydrogeologists, environmental scientist, academia and professional. INC IAH annual awardees were also honored during the inaugural session. Further after the taking over the office by new GB formally on March 23, 2024, World Water



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from March 22 to March 30, 2024 which included Panel Discussion by eminent groundwater experts across India on March 23, 2024 and National Webinars ranging Chhatrapati Shivaji Maharaj University (CSMU), Panvel, Navi Mumbai on March 22, 2024; by Department of Geology, Savitribai Phule Pune University, Pune, Maharashtra, on March 22, 2024, The Early Career Hydrogeologists' Network of IAH on March 22, 2024, School of Environmental Sciences, JNU, New Delhi and Dept. of Geography, Ch. Bansi Lal University, Bhiwani on March 30, 2024. All these events have seen good participation across India.

As India is embarking on Viksit Bharat mission, I call upon all the members of INC IAH for their renewed participation in the activities of INC IAH so that we can see a more vibrant and dynamic chapter at Pan Global level. The vibrancy of this chapter depends on our vibrancy and I am sure that our bigger involvement at various level will definitely boost the image at global level. I am sure that the chapter has a long way to go till it gets recognition as policy interventionist at the state, national and international level and it can be achieved through continuous involvement of its members in various activities involving dialogue at various levels.

The phase of elections is over and now we have to act as a unit which attracts attention at the global level by our activities. It will not be out of place to mention that there is a dire need for organizing an international event at a venue which may be centrally located and can invite international participation and also the participation from larger corporates and our members some from Nov. 2024 to March 2025. Our presence is also required at various international events in the domain of IAH and other water forums.

I would also like to take this opportunity to convey my thanks to all the members of INC IAH who have renewed their membership and request the other members who have not yet got their membership renewed to get it renewed at the earliest so as to continue enjoying the benefits of IAH resources. I whole heartedly welcome all the new members who have got the membership of INC IAH for the first time. I would like to put on record sincere thanks to dear Dr. Ashok Kumar Ji, Treasurer INC-IAH for doing the stupendous work of wonderfully compiling the current issue of the E-Newsletter of INC IAH and ensuring its timely publication. I am thankful for the President, INC IAH, [Prof. \(Dr.\) A.K. Sinha](#); Vice-President, [Dr. Anadi Gayen](#) and all the members of the Executive for their support and guidance all through this time.

I wish you all a healthy and lively time ahead.

Wishing you enjoyable reading of the E-Newsletter of INC IAH,

(B.S. Chaudhary)



Editor's Desk



Ashok Kumar *M.Sc. Tech (IIT-ISM), PhD (PU)*

Treasure, INC of IAH

*Principal Consultant – GW Modelling
(CGWA Accredited IA & Modelling Expert)
Honorary Secretary, VSED, New Delhi
Former Advisor - Hydrogeologist (Cairn India)*

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🌐 <https://wateraquifers.com>

Dear Readers,

It is indeed a great honour to be the newsletter editor for this edition of INC-IAH, and it is an immense pleasure to publish this first edition for 2024.

In this edition, we will recount the various activities in which INC-IAH since the last quarter of 2023 until the end of April 2024. It provides an overview of major activities, such as the Newly constituted Governing Body of INC of IAH, Declaration of INC of IAH Award – 2022, IAH 50th Worldwide Groundwater Congress (2023) at Cape Town, South Africa, successful International Conference at CSMU, Navi Mumbai, World Water Day 2024 - a week long celebrations,

I am an admin for the INC of the IAH website. I have tried my level best to make the website (inciah.org) more informative as well as up-to-date. Most of the information is available on the website. In recent times, there has also been a surge in visitor counts to the website.

The application form for becoming or renewing membership in IAH with applicable fee structures has also been included in this edition. My sincere request to old members is to renew their membership using various available payment options. Existing members may also help in enrolling new members.

This volume contains one very elaborative article by well-known groundwater expert [Dr S. K. Sharma](#), Advisor (Ground Water), WAPCOS Limited, and Ex-Member, CGWB, Ministry of Jal Shakti, Govt. of India.

Last but not least, I would like to thank INC-IAH President [Prof. A. K. Sinha](#), Vice President [Dr. Anadi Gayen](#), Secretary [Dr. Bhagwan Singh Chaudhary](#), and Executive Committee members for their everlasting support throughout the creation of this edition.

Before I pen this, I sincerely request all members, particularly young hydrogeologists, to come forward and add their contributions to make this quarterly newsletter more informative and readable for a large audience. [This is an open newsletter; members may circulate it to an individual or group for wider publicity.](#) This is the only way to grow and make INC-IAH a beautiful place.

Ashok Kumar
Editor, INC-IAH Newsletter, April Edition of 2024



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Newly Elected Governing Body (2024-2026)



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INC of IAH Award – 2022

INC of IAH Award -2022 has been distributed in ceremony during the IAH International Conference (20-21 January 2024) at Chhatrapati Shivaji Maharaj University, Panvel, Navi Mumbai, India, Navi Mumbai

Life Time Achievement Award

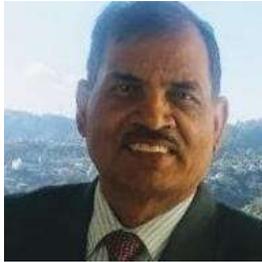


Dr S. N. Rai, Former Chief Scientist, National Geophysical Research Institute, CSIR, Govt. of India, Hyderabad

Dr Shivendra Nath Rai received M.Sc. and Ph.D. degrees (Geophysics) in 1975 and 1986 from Banaras Hindu University. Carried out research work at CSIR-National Geophysical Research Institute till his superannuation as Chief Scientist in June 2014. Developed new generation of predictive models to describe dynamics of water table in response to time varying recharge and/or pumping. Conducted electrical geophysical surveys in Vidarbha, Marathwada and Konkan areas and in and around Hyderabad city for delineation, development and management of groundwater resources. Published research papers in reputed SCI journals, chapters in book.



Ground Water Excellence Award



Dr Subhash Ch. Singh, *Former Senior Scientist (Geophysicist), Central Ground Water Board, Ministry of Jal Shakti, Govt. of India, Bhopal*

Dr Subhash Chandra Singh obtained his M. Sc. (Tech), Ph.D. in Geophysics and has long experience of applying Near Surface Geophysics as a geophysicist for groundwater studies. He served CGWB, in various capacities and retired as Regional Director. Applied Near Surface Geophysics for resolving subsurface Geological geotechnical, Geohydrological and mining related problems and contributed a good number of scientific papers technical reports. His recent widely publicised discovery using Near Surface Geophysics is delineation of about 300 km long subterranean flow in limestone rock of MP. which considerably unveils the mystery of the Saraswati River at Prayag. Conferred upon many Awards and honours



Young Scientist Award



Dr Ashwani Kumar Tiwari, Assistant Professor, School of Environmental Sciences, Jawaharlal Nehru University, New Delhi.

Dr Ashwani Kumar Tiwari completed his M.Sc., M.Phil., and Ph.D. in Environmental Science. His teaching and research areas are Water quality and resource management; groundwater-seawater interaction, mining and aquifer vulnerability. He is recipient of Erasmus Mundus and Marie Skłodowska-Curie Actions Scholarships and had a very productive four years tenure as a Postdoctoral Researcher at the Department of Environment, Polytechnic di Torino, Turin, Italy. He is chair of the Research Funding Working Group of the Marie Curie Alumni Association (MCAA) and is member of various national and international bodies. He is credited with the publication of good number of research papers in reputed journals



Best Paper Award: Female category



Dr Paulami Sahu, Asst. Professor, School of Environment and Sustainable Development, Central University of Gujarat, Gandhinagar, Gujarat

Dr Paulami Sahu, a University of Calcutta Gold Medallist is recipient of 4 design patents (GoI), 15 Awards and many prestigious grants and has published 76 articles, 11 Book chapters, 30 conference papers; She has 904 citations till date and has been Principal Investigator of 4 major projects funded by different national and international funding agencies like CSIR (GoI), DST (GoI), UGC (GoI), CUG etc.; Supervised 07 Ph.D. Research Work. Besides many graduate dissertations work.



Best Paper Award: Male category



Dr Rudra Mohan Pradhan, *National Postdoctoral Fellow, Dept. of Geology and Geophysics, IIT Kharagpur*

Dr Rudra Mohan Pradhan currently works as a National Postdoctoral Fellow at the Dept. of Geology and Geophysics, IIT Kharagpur. Previously, he was a Visiting Research Fellow at the University of Nebraska-Lincoln (USA) and IIT Roorkee. He received his Ph.D. (Fault Zone Hydrogeology) from IIT Bombay and M.Sc. from IIT Kharagpur. To his research credit, he has published several research articles in reputed international journals and also is the recipient of several prestigious international fellowships and grants including the DST-National Postdoctoral Fellowship, Indo-US WARI Fellowship, Goldschmidt Grant, AGU Near-Surface Geophysics Grant, GSA International Grant, IAHS-SYSTA, SERB-ITS Grant, etc. Besides being active reviewer of many International Journal, he has travelled widely to participate in many international events.





IAH International Conference
on
Addressing Challenges of
Groundwater and Environmental
Hazard Management through Socio
scientific and Technological
Approaches

**INC-IAH
INTERNATIONAL
CONFERENCE
(20-21 JANUARY
2024, PANVEL,
NAVI MUMBAI)**

Groundwater Environment and Sustainability



20-21 Jan 2024

Organized by

**Center for Climate Change & Water
Studies (C3WS) & DCE, Chhatrapati
Shivaji Maharaj University Mumbai**

in Association with

**Indian National Chapter of
International Association of
Hydrogeologists (INC-IAH)**



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IAH INTERNATIONAL CONFERENCE (20- 21 JANUARY 2024, PANVEL, NAVI MUMBAI, INDIA)

Addressing Challenges of
Groundwater and
Environmental Hazard
Management through Socio
scientific and Technological
Approaches

Organised by

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Water Studies (C3WS) &
DCE, Chhatrapati Shivaji
Maharaj University Mumbai

in association with

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International Association of
Hydrogeologists (INC-IAH)



Inaugural Function of the Conference

(Left to Right): Professor A. K. Sinha, Presidents INC-IAH on Podium; Prof R. P. Singh Kushwaha, Convener; Prof N. J. Pawar, Vice-Chancellor DY Patil University, Pune; Prof K. L. Varma, Vice Chancellor, CSMU; Prof A. D. Sawant, Former Vice Chancellor University of Rajasthan Jaipur and Mumbai University; Professor Bhadawan Sindh Chaudharv; Prof. R. P. Sharma, Registrar, CSMU



Release of Souvenir cum Abstract Volume



Glimpses of Participants



Glimpses of Participants



Glimpses of Participants

IAH-CSMU MULTIDISCIPLINARY INTERNATIONAL CONFERENCE 1.0

on

ADDRESSING CHALLENGES OF GROUNDWATER &
ENVIRONMENTAL HAZARD MANAGEMENT THROUGH
SOCIO SCIENTIFIC AND TECHNOLOGICAL APPROACHES

(20th to 21st January 2024)

Groundwater Environment Sustainability Vision
SOUVENIR CUM ABSTRACT VOLUME



Jointly Organized by

CENTRE FOR CLIMATE CHANGE AND WATER STUDIES
CHHATRAPATI SHIVAJI MAHARAJ UNIVERSITY
PANVEL, NAVI MUMBAI

and

INDIAN NATIONAL CHAPTER OF INTERNATIONAL ASSOCIATION OF
HYDROGEOLOGISTS

[Souvenir Cum Abstract Volume](#)

IAH-CSMU Multidisciplinary International Conference on Addressing Challenges of Groundwater & Environmental Hazard Management Through Socio Scientific and Technological Approaches (20th To 21st January 2024)

[Download Souvenir Cum Abstract Volume](#)

IAH 50th Worldwide Groundwater Congress

17-22 Sep 2023 – Cape Town, South Africa

Participation by Prof A. K. Sinha, President INC-IAH, in the IAH 50th Groundwater Congress and General Body Meeting of IAH at Cape Town, South Africa on Special Invitation as a Representative of Asian countries



Prof A. K. Sinha, INC-IAH, President, INC-IAH participated in IAH Council Meeting on 17th Sept2023 as a special invitee to represent Asian Countries



Prof Sinha, Jane Dottaridge and others on way to Field visit



Prof. David Kreamer, President, IAH and Prof Sinha, President, INC-IAH at the launch of Free Hydrogeology books at the congress.



Prof A K Sinha interacting with Dr Ashwani K Tiwari, JNU on his excellent presentation on quality of Mine drainage water.



पानीयं परमं लोके जीवानां जीवनं समृतम्।

पानीयस्य प्रदानेन तृप्तिर्भवति पाण्डव।

पानीयस्य गुणा दिव्याः परलोके गुणावहाः ॥

(जल को अग्नि का स्वरूप माना गया है। जल, पृथ्वी की योनि है। जल अमृत की उत्पत्ति का स्थान है। इसीलिए महापुरुषों का कहना है कि, जल सभी प्राणियों का आधार है)

योऽप्युनिष्ठन्नभदयोऽन्तरो यमापो न विदुर्यस्यापः ।

शरीरं योऽपोऽन्तरो यमयत्येषत आत्मान्तर्याम्यमृतः

॥

(जल जगत के प्राण है। जिसमें सब भूत और भुवन है। सम्पूर्ण चर और अचर जगत जल के आधार पर स्थित है)

Some facts about groundwater

- Groundwater is estimated to be 2.8 million trillion gallons.
- Groundwater accounts for one-third of the freshwater used by people in most parts of the world; however, in some territories of the world, this percentage can reach 100%.
- According to NASA satellite data, 13 of the world's 37 major aquifers are deemed severely depleted.
- An estimated 20% of the world's population relies on groundwater-irrigated crops.
- Every day, 53.5 billion gallons of groundwater are used to irrigate crops.
- Nearly half of the inhabitants in the United States and many other developed countries rely on groundwater for their drinking water. However, irrigation is its primary application.
- Groundwater is a natural resource on the verge of being replenished.
- Groundwater is the liquid that seeps through cracks and other gaps in rock and sand beds.
- Groundwater is used to help us grow our food. With 64 percent of groundwater, irrigation is used to cultivate crops.
- Groundwater supplies 99 percent of the world's usable freshwater.
- Around 38% of irrigated fields worldwide are set up for groundwater irrigation.
- More than half of the groundwater withdrawn in many countries is for domestic water supplies, and it provides 25 to 40% of the world's drinking water.
- Groundwater is the most exploited raw material on the planet, with extraction rates currently estimated to be in the range of 982 km³ per year.
- The volume of contemporary groundwater is similar to a 3m deep body of water scattered throughout the continents.

SOFTWARE

Geographical Information Systems

1. **QGIS**: QGIS is a completely open-source GIS tool and can be executed in any operative system. www.qgis.org

2. **SAGA GIS**: It is a GIS platform oriented to spatial analysis. It is a simple but powerful tool for spatial analysis and characterization of basins. www.saga-gis.org

River modeling

3. **HEC-RAS**: This model uses the gradient and topography to evaluate the flow depth, velocities and flooded zones. www.hec.usace.army.mil/software/hec-ras/

4. **iRIC**: iRIC is a software offers a complete simulation environment of the riverbed <http://i-ric.org/en/>

Hydrologic modeling

5. **HEC-HMS**: HEC-HMS is designed to simulate the hydrologic processes in basins. www.hec.usace.army.mil/software/hec-hms

6. **PRMS**: The modeling code PRMS is a modular system of spatially distributed parameters, which represent the physical processes of a basin. www.brr.cr.usgs.gov/projects/SW_MoWS/PRMS.html

7. **SWAT**: It is a tool to evaluate soil and water at a basin scale. www.swat.tamu.edu

Hydrogeological modeling

8. **MODFLOW**: This code performs groundwater modeling based on finite differences developed by the USGS. <http://water.usgs.gov/oq/modflow/>

9. **MT3DMS**: The MT3DMS package is a mass transport model coupled to a flux model in MODFLOW. <http://hydro.geo.ua.edu/mt3d/>

Computational fluid dynamics modeling

10. **OpenFOAM**: Pretty much any physical phenomenon associated to fluid dynamics can be represented with this software. www.openfoam.org

Hydrochemical modelling software

11. **PHREEQC**: It is a computer program is designed to perform a wide variety of aqueous geochemical calculations. <https://www.usgs.gov/software/phreeqc-version-3>



Groundwater News in Media

In a first, Rs 1.1 lakh fine imposed on 22 Bengaluru residents for misusing potable water amid crisis

The majority of violations in connection with improper use of water were detected in the southeast division of Bengaluru where fines totalling Rs 65,000 were levied, officers said.

<https://indianexpress.com/article/cities/bangalore/fine-imposed-bengaluru-residents-misusing-potable-water-crisis-9232866/>

INDIA VOTES 2024 - Poll issues: Water shortage emerges top concern for Delhi electorate

With Lok Sabha elections nearing, water scarcity has emerged as a critical concern in the Capital. Residents are grappling with dwindling water resources and an erratic supply, prompting concerns over basic needs and sanitation.

<https://www.tribuneindia.com/news/delhi/india-votes-2024-poll-issues-water-shortage-emerges-top-concern-for-delhi-electorate-609684>

Depleting groundwater: Why India needs to rethink many agri practices

<https://www.indiatoday.in/diu/story/depleting-groundwater-india-agriculture-farmers-water-intensive-crops-2506372-2024-02-23>

Groundwater irrigation covers more than half of the total irrigated area in India - and its rapid depletion is a major concern in the country. Major crops like sugarcane, rice, cotton, and wheat are becoming more and more difficult to cultivate, given their water-intensive nature.

Imminent risk of a global water crisis, warns the UN World Water Development Report 2023)

Between two and three billion people worldwide experience water shortages. These shortages will worsen in the coming decades, especially in cities, if international cooperation in this area is not boosted, warn UNESCO and UN-Water in the latest edition of the UN World Water Development Report.

<https://www.unesco.org/en/articles/imminent-risk-global-water-crisis-warns-un-world-water-development-report-2023>

Water crisis in seaside villages as salinity ingress rises in K'pada

Kendrapada: With the advent of summer, a large number of seaside villages of Mahakalapada and Rajnagar blocks in Kendrapada district are facing water shortage as salinity ingress in many coastal pockets has been increasing.

<https://timesofindia.indiatimes.com/city/bhubaneswar/water-crisis-in-seaside-villages-as-salinity-ingress-rises-in-kpada/articleshowprint/109259991.cms>

Britain could still face hosepipe bans this summer despite rainfall because of lack of new reservoirs

The UK could have hosepipe bans and water shortages this year despite experiencing the wettest eighteen months on record, experts have warned.

<https://www.standard.co.uk/news/uk/britain-hosepipe-ban-reservoir-rainfall-weather-b1148843.html>

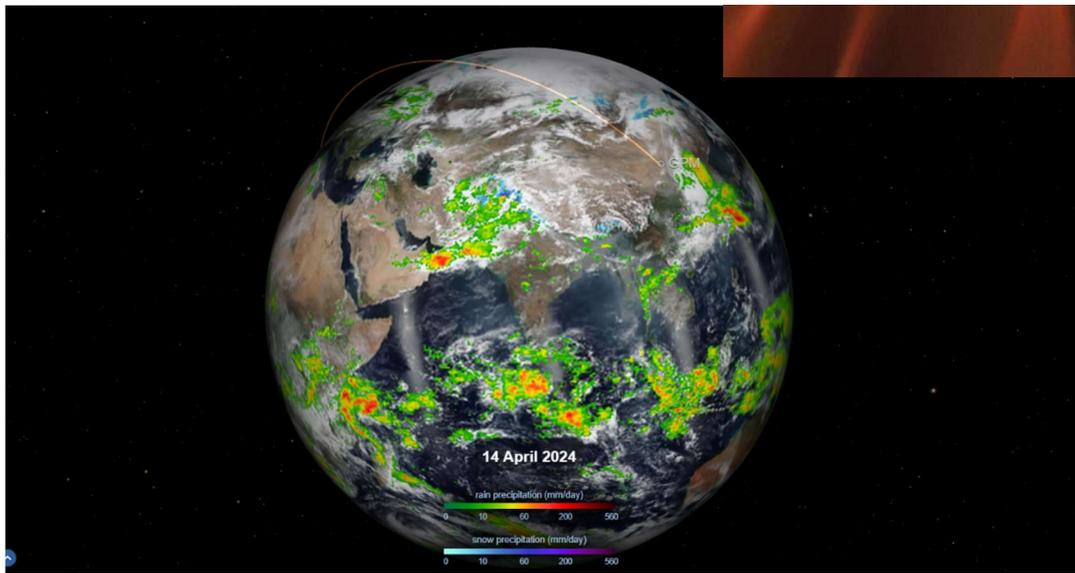
Open-Source Groundwater Modelling Software options besides MODFLOW

iMOD: iMOD is an easy-to-use Graphical User Interface (GUI) that accelerates the Deltares-version of MODFLOW. It offers fast, flexible, and consistent sub-domain modeling techniques. iMOD facilitates large-scale, high-resolution MODFLOW groundwater modeling and allows geo-editing of the subsurface.

Modflow OWHM: The MODFLOW One-Water Hydrologic Flow Model is an integrated hydrologic model based on MODFLOW-2005. It's designed for analyzing conjunctive-use management. The term "integrated" refers to the tight coupling of groundwater flow, surface-water flow, landscape processes, aquifer compaction and subsidence, reservoir operations, and conduit (karst) flow.

IWFM (Integrated Water Flow Model): IWFM is a computer program used for water resources management and planning within a basin. It calculates groundwater flows, soil moisture movement in the topsoil, stream flows, land surface flows, and flow exchange between groundwater, streams, and land surface.

WRF-Hydro (Weather Research and Forecasting Model Hydrological): WRF-Hydro is a community-based, open-source model coupling framework. It links multi-scale process models of the atmosphere and terrestrial hydrology. Its goal is to provide comprehensive hydrological modeling, including surface water and groundwater interactions.



EYE ON IT

Reaching new levels in groundwater monitoring

Traditionally, an aquifer's water levels are measured using wells: Hydrogeologists drill into the ground and measure the pore pressure at depth, a measurement from which they infer the amount of water trapped in sediments. But drilling is expensive, and the measurements produce at best a scattered, incomplete image of an aquifer. Alternatively, satellite data can be used to trace deformations of Earth's surface, which swells up when the ground is waterlogged and subsides as water drains out, but surface data can't provide insight into what's underground.

Now, a new method may sidestep these problems by exploiting another source of information: seismic data. In a study published in *Nature Communications*, researchers made use of the fact that a seismic wave's velocity is related to the mechanical properties of the medium through which it travels. If the traversed sediments are dry, waves propagate rapidly. If the sediments are saturated with water, wave speed is reduced. By analyzing differences in seismic wave velocities (a technique called interferometry), scientists can back calculate how much water is stored underground.

For her research, coauthor Shujuan Mao used records of so-called seismic ambient noise. "The Earth's surface is always vibrating due to ocean waves or human activity," explained Mao, a postdoctoral researcher in geophysics at Stanford University. "Those vibrations are very small, so we don't notice them, but they are recorded continuously by seismic stations and contain a wealth of information about Earth's subsurface—if we can use them."

Hasler, C. (2022), *Reaching new levels in groundwater monitoring*, *Eos*, 103, <https://doi.org/10.1029/2022EO220517>.

UN predicts groundwater level in India will reduce to 'low' by 2025

<https://www.hindustantimes.com/india-news/un-predicts-groundwater-in-india-will-reduce-to-low-by-2025-101698290828085.html>

Around 70 per cent of groundwater withdrawals are used for agriculture, often when above-ground water sources are insufficient. Some areas in the Indo-Gangetic basin in India have already passed the groundwater depletion tipping point and its entire northwestern region is predicted to experience critically low groundwater availability by 2025, according to a new report by the United Nations.

Some countries, like Saudi Arabia, have already exceeded the groundwater risk tipping point, while others, including India, are not far from it.

Titled "Interconnected Disaster Risks Report 2023" and published by the United Nations University – Institute for Environment and Human Security (UNU-EHS), the report highlights that the world is approaching six environmental tipping points: accelerating extinctions, groundwater depletion, mountain glacier melting, space debris, unbearable heat and an uninsurable future.

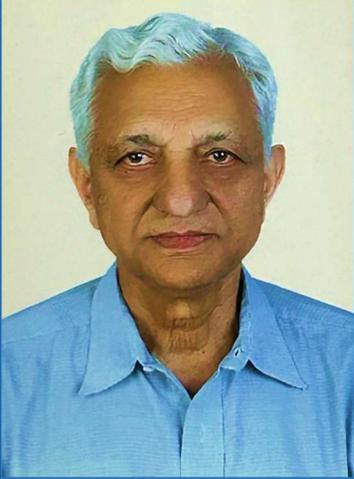
Environmental tipping points are critical thresholds in the Earth's systems, beyond which abrupt and often irreversible changes occur, leading to profound and sometimes catastrophic shifts in ecosystems, climate patterns and the overall environment.

However, the report warns that the aquifers themselves are approaching a tipping point. More than half of the world's major aquifers are depleting faster than they can naturally replenish. When the water table falls below a level accessible by existing wells, farmers may lose access to water, posing a risk to entire food production systems.

"India is the world's largest user of groundwater, exceeding the use of the United States and China combined. The northwestern region of India serves as the bread basket for the nation's growing 1.4 billion people, with the states of Punjab and Haryana producing 50 per cent of the country's rice supply and 85 per cent of its wheat stocks.

"However, 78 per cent of wells in Punjab are considered overexploited and the northwestern region as a whole is predicted to experience critically low groundwater availability by 2025," the report says.

Jack O'Connor, the lead author and senior expert at UNU-EHS, said, "As we approach these tipping points, we will already begin to experience the impacts. Once crossed, it will be difficult to go back. Our report can help us see risks ahead of us, the causes behind them and the urgent changes required to avoid them."



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Groundwater Scenario of India (Tools and Management Techniques)

ABSTRACT

Groundwater resources are moderately extensive across India. Total annual ground water recharge availability for the country has been assessed as 499.08 BCM/yr. as per GEC (2015) guidelines. Annual extractable groundwater resource is assessed as 407.21 BCM. The average state of groundwater development is 59%. Annual groundwater extraction (as on 2023) is 241.34 BCM. Current Annual Groundwater extraction for irrigation, industrial and domestic purposes is 209.74 BCM, 4.01 BCM and 27.57 BCM respectively. Major groundwater over-exploited states are the states of Punjab, Haryana, Rajasthan and NCT Delhi (UT.) in which percent groundwater exploitation is in excess of annual recharging availability that ranges from 135% in Haryana to 163.76% in Punjab state. Groundwater levels are depleting at the rate of 1 to 3m/yr. in groundwater over-exploited regions contributing to increasing costs of well-bore deepening and pump replacements. Groundwater quality problems caused by natural constituents are high salinity, high concentration of Arsenic, Iron and Fluoride. Arsenic concentration in groundwater is present in 10 states, fluoride concentration in 21 and Iron concentration in 24 states. Heavy metals from industrial and mining units and fertilisers & pesticides from cultivated areas also degrade ground water quality and threaten public health.

There is need to restrict unsustainable groundwater uses and resort to Managed Aquifer Recharge (MAR) techniques and Lake/River Bank Filtration systems as Induced recharge measures as well as In-stream modifications in micro & macro watersheds leading to construction & design of suitable check dams and sub-surface dykes. There is great scope for undertaking groundwater management & conservation measures in stressed aquifer areas in various states using conjunctive management of surface & ground water and adopting water conservation measures which may include water recycling, RRR of water bodies, Modular RWH and developing optimal plans for Urban/suburban areas, industrial units and mining project areas using groundwater. The ultimate goal is to achieve sustainable groundwater in water crisis & water scarcity areas in the country.

BACKGROUND

The General sustainability is the dependence & use of ground water resources to meet current & future use demands without causing unacceptable environment & Socio-economic consequences. Sustainable groundwater is the one which is considered as sufficient to meet multiple needs of Municipal, Industrial & Agricultural sectors.

WATER MANAGEMENT & CONSERVATION

Surface & Groundwater Sources

Utilizable Annual surface water in the country is 690 BCM. There is greater scope of increasing the water use in river basins. Annual Groundwater recharge is as 432 BCM, where about 80% of it is available for irrigation purposes.

Conjunctive Management of Surface & Groundwater

The combined use of surface & groundwater resources can maximise socio-economic & environment effects & can contribute to optimizing the water supply and demand balances. Conjunctive water management can be strategic both in fresh groundwater & saline groundwater areas. The methodology should be continually practiced in canal command areas of various states with a view of controlling rising groundwater levels. In the weight of dimension Ground Water Resources & Resultant declining Ground Water Levels, conjunctive use management & Ground Water Recharge enhancements assume significance.

Alternative Water Sources

There is indeed need to explore viable alternatives to securing water supply for various applications. The Desalination, Recycled Wastewater & Storm water are required to be explored. Desalination would include both the Sea Water and Inland Brackish Ground Water (BGW) as alternatives.

Water Conservation

There is need also to undertake water conservation measure which may include Water Recycling, RRR of Water Bodies, Rain Water Harvesting, Water conservation & Recycling, and finally Developing Plan for industrial operations.

The ultimate goal of water conservation is the investigation of water & reducing its unnecessary Wastage, Water Sustainability and Energy & Habitat Conservation

GROUNDWATER RESOURCES OF INDIA

Ground Water Resources Overview

India is the largest user of groundwater in the World and uses about 235-240 BCM of groundwater per year. About 85% of drinking water supplies and more than 60% irrigated agriculture are groundwater dependent. The major use of groundwater, therefore is for irrigation (209 BCM/yr), Domestic and Industrial use are 27 BCM/yr and 3.6 BCM/yr respectively. As per CGWB, the 17% of ground water blocks in different districts of the country are groundwater over-exploited where rate of extraction exceeds the rate of annual recharge of aquifer. Industrial effluents, urban storm drains are contaminating groundwater aquifers. Climate change is enhancing the groundwater crisis.

Country Groundwater Crisis & Challenges

Groundwater crisis & challenges are of complex nature which relate to groundwater over-use and degraded water quality situations. Depletion of renewable groundwater is the first indicator of groundwater scarcity. Level of groundwater development is rather very high in the states of Haryana (109%), Punjab (145%), Rajasthan (125%), Tamil Nadu (85%) and Uttarakhand (70%). Ground Water Quality problems are equally severe in the country with 137 districts suffering from salinity, 203 districts from high fluoride levels, 35 districts from Arsenic levels and 206 districts from iron bacteria in excess of groundwater supplies.

Principal Aquifer System of India

On the basis of hydro-geological character, the country has been classified into 14 Principal Aquifers & 42 Major Aquifers. Two major aquifer system of India are Alluvial Aquifers of Indo-Gangetic plain & Crystalline Hard-rock Aquifers of Peninsular India. Alluvial major Aquifers cover about 31% area of country and is available in the states of Uttar Pradesh, Bihar, West Bengal, Odisha, Assam & Rajasthan. Granite-gneiss aquifer system occupies 20% area of the country in the states of Maharashtra, Madhya Pradesh, Gujarat, Rajasthan, and Karnataka. Sedimentary rock aquifers (Sandstone/Siltstone) occur in the state of Maharashtra, Chhattisgarh, Madhya Pradesh, Gujarat, Karnataka and Rajasthan. Limestone Aquifers covers 2% area in the country in the states of Chhattisgarh and Andhra Pradesh. Basalt Aquifer cover 17% area of the country in the states of Andhra Pradesh, Chhattisgarh, Madhya Pradesh, Maharashtra and Rajasthan.

The CGWB Atlas (2010) of India Aquifers provides account of aquifer maps and aquifer-wise groundwater scenario in various states. Atlas also deals with challenges and issues which need attention of managerial levels for sustainable management of groundwater resources.

Status of Groundwater Extraction in Cities

The CGWB and State Groundwater Departments together assess dynamic groundwater resources of the country as per Groundwater Estimation Committee Methodology (GWEEM). It is biennial publication for use of public. The stage of ground water extraction (%) in major cities of Bengaluru, Chennai, Delhi and Hyderabad for domestic use is very high. Groundwater extraction for agriculture in Pune is very high.

Concerted efforts are required to safeguard against excessive extraction of groundwater leading to depletion in resources and in the levels of groundwater. Compulsory RWH, water conservation and recharge augmentation will help safe-guard the dwindling ground water situations in the country. RWH in houses and buildings has already been made mandatory by Central Groundwater Authority (MoJS).

Current Status of Improving Ground Water use in the Country:

- (i) GoI, Model Groundwater (Sustainable Management) Bill launched in 2017 addresses concerns related to the protection & prevention of drainage to aquifers.
- (ii) Ground Water Management initiatives launched by Ministry of Jal Shakti (MoJS) include Atal Bhujal Yojana and National Project on Aquifer Management (NAQIUM). NAQIUM deals with mapping of Aquifer systems in the country.
- (iii) Jal Jeevan Mission is to provide safe drinking water to all rural house-holds by 2024.
- (iv) Jal Shakti Abhiyan has been launched to transform Jan Shakti into Jal Shakti through Catch the-Rain Campaign.

Ground water use situation in the country is marginally improving. There is still the absolute need to adopt proactive approaches to groundwater management.

Groundwater Dependent Ecosystem:

Typical groundwater dependent ecosystem includes;

- ✚ Springs
- ✚ Fresh water Lakes
- ✚ Permanent Streams
- ✚ Wetlands

Groundwater-fed ecosystems are under stress in the country and undergo severe changes in system due to drought and human activities. Both groundwater depletion and Ecosystem degradation need addressal and safe guard.

Water Resources Information System:

India water resources Information System (IWRS) is an integrated data-base for all water-related data systems. It is developed and maintained by NWIC and is Web-based public platform of utility.

The CGWB has also installed Automatic High frequency monitoring stations by installing DWLRS with Telemetry System under National Hydrology Project (NHP). Total proposed no is 5260. The 6-hourly water level data recorded is being transferred to Central Server through on-line application developed by National Water Information Centre (NWIC).

In addition to above, State Governments, have also their own groundwater monitoring network which are now being strengthened by construction of piezometers and installing of DWLRS with Telemetry system.

The CGWB Groundwater Information System (GWIS) provides access to various thematic data layers of use. It is National Data Base on groundwater level and groundwater quality for use in developing ground water management plans and strategies.

INNOVATIVE TECHNIQUES OF GROUNDWATER MANAGEMENT

Such techniques are identified as drought & water security irrigation strategies as effective water conservation and recharging measures

Managed Aquifer Recharge (MAR) Techniques

MAR Techniques:

- ✚ The main purpose of MAR is to augment groundwater by storing excess surface water later use and restoring depleted groundwater levels due to over-extractions thus enhancing the sustainability of groundwater.
- ✚ MAR techniques can be applied at a range of scales for individual household roofs, to communal buildings, to multiple building complexes as well at the sub-catchment or catchment scale.
- ✚ Finally, the MAR is resource augmentation approach but does not represent a panacea in sustainable water resources management. Its introduction can support an increase in demand.

- ✚ MAR needs to be balanced by holistic and integrated water resource management including water demand management and conservation approach.

Bank Filtration System

It is a New Innovative Technique called “Induced Recharge System” Where production wells located around lake and river shores when pumped establish hydraulic connection with Lake bed/River bed & induce recharge to aquifer. Production wells installed as Lake Bank Filtration (LBF) & River Bank Filtration (RBF) system produce probable filtered water for direct use as drinking water source.

Aquifer Storage & Recovery Techniques (ASR/ASTR)

Conceptually, ASR is a dual-purpose well system where water is injected via pump at designated pressure. In ASR/ASTR well system recovery is made from the same injection well or using different wells. Texas Water Supply Board is an example of using ASR well-field systems of utility. Hydro-geological conditions for setting up ASR/ASTR recharge system include:

- ✚ Aquifer Transmissivity to be in the range of 500 to 2000 m²/day.
- ✚ Optimum Aquifer storage thickness to be greater than 8m.
- ✚ Injection well rate to be 50 to 500 liter/second.
- ✚ Injection rate to be 80% of production well discharge in an area.

Modular Rain Tank Underground Storage

Modular Rain Tanks of various sizes made of recycled material are used as underground system both as water storage & water recharging measures (i.e., for water detention & for aquifer recharge). This innovative technique as against conventional roof top RWH can be fruitfully installed in Golf areas, sports complexes, school playground and along state & National Highways. Any volume of water can be stored. Atlantis Modular Rain Tank is an example of underground storage Water Harvesting Technique. Country, of late, has made beginning in its application.

In-stream Modification

It is a watershed-based system where morphometric analysis of macro & micro-watersheds is carried out to map Run-off producing zones based on drainage density factor of watershed catchments. Such studies help to install small check dams, subsurface dykes, nala-bunds and gabions. Downstream areas of check dams can be irrigated using water wells.

Sustainable Groundwater Assessment & Management

1. Access to reliable information, data & tools is pre-requisite for sustainable groundwater management. Integrated use of regularly updated resource data bases from Central & State agencies and educational institutions is of paramount significance.
2. Sustainability indicators which deserve focus & attention of planners and managers include position of groundwater level decline, water quality degradation, saline water intrusions, inland Brackish Groundwater (BGW), Groundwater simulation and predictive modeling.

3. Sustainable Management of Groundwater Resources: The sustainability of groundwater resources is contingent upon time-management approach where groundwater abstraction rates are adjusted according to recharge pattern. Generally, abstraction rates are higher than sustainable levels in various parts of the country. Abstraction, therefore, need to be lowered to prevent failures in water resource development schemes.

- ✚ Groundwater Management Priorities: These should include;
- ✚ Sustainable long-term yield from aquifers
- ✚ Rational use of water-volumes stored in aquifers over period of demands
- ✚ Groundwater quality preservations
- ✚ Prudent abstraction of groundwater leading to safeguard of aquatic environment
- ✚ Integration of surface & groundwater into water and environmental system

Water utility providers should sustainably also develop alternative water supplies like treatment of surface water, desalination of groundwater and wastewater recycling, all with the objective of optimizing the use of existing fresh and high-quality ground water resource.

Rapid development of groundwater for irrigation use has resulted in agriculture growth in the country but in many an area it has become undesirable situation due to groundwater over-exploitation and salinization.

Integrated water resources management should focus on water quality & demand management aspects. The success factor for groundwater resources protection will involve stakeholder participation in groundwater – based well field adoption & management.

[Techniques of ground water Management: Besides drinking water sector, both agriculture & industrial sectors require diligence in managing water usage and wastewater discharges, need for water management in industrial sector has assumed importance.](#)

Following approach can be considered to help reduce demand for fresh water by industries in participatory mode:

- ✚ Conducting feasibility of water management in industrial units
- ✚ Minimising/reducing water wastage through leaks, evaporation and contamination as basis of industrial water management
- ✚ Recycling and reuse of wastewaters; Installation of cooling tower to recycle water

4. Different Perspectives in Groundwater Sustainability: These are:

- (i) Physical perspective: Water balance of dynamic and non-renewable aquifers
- (ii) Legal perspective: Not to exceeded pumping rates and safe water quality limits
- (iii) Adoptive Management & Climate Resilience: Case-specific assessment to adhere to country needs.

Diverse objective of groundwater sustainability from policy point of view to comprehending groundwater sustainability is “Safe-Yield” i.e., the limit of quantity of water that can be withdrawn regularly & permanently without dangerous depletion of the storage reserves. A sustainable groundwater system is one in which pumping can safely continue indefinitely.

5. **Scientific Evaluation of Groundwater Sustainability:** Groundwater sustainability is a function of Aquifer Performance & governance factors. There is therefore clear need for trans-disciplinary approach and case-applications addressing the effective development & implementation of groundwater sustainability policy based on Multi-process Modelling in participatory fashion.
6. **Frame-work for Sustainable Use of Groundwater:** Initiatives are already under way in the country: Groundwater management & conservation initiatives are being taken by GoI under Atal Jal Yojana, MGNREGA, PMKSY schemes.

We have been engaged in indiscriminate over-exploitation of groundwater and now we are to engage with Sustainable extraction limits and to focus as well on Ecosystem Protection.

7. **Delivering Sustainable & Adaptive Groundwater Management:** by
 - ✚ Refining & improving our policies & practices for sustainable management
 - ✚ Adapt to change in Climate variabilities and increasing use demands
 - ✚ Capacity building & integrating groundwater knowledge as well as awareness
8. **Strategic Priorities:** The vision is now to focus on following strategic priorities (Efforts over the next 20-years):
 - ✚ Protecting groundwater resources and Ecosystem that depend on it
 - ✚ Building community, agricultural & industrial resilience through sustainable ground water extraction and optimal use
 - ✚ Sound groundwater knowledge & Information is required to manage groundwater resources sustainably
 - ✚ Re-addressal of our Drivers of change including changing climate, Land use & land cover changes and changing community perception on sustainable groundwater use
9. **Management measures for Sustainable Management of Groundwater Resources:** GOI has initiated following Sustainable Groundwater Resources Measures:
 - a) Constitution of Central Groundwater Authority (CGWA) for regulation and control of groundwater development in the country to provides no objection certificate (NOC) to user on line.
 - b) The Central Groundwater Board (Ministry of Jal Shakti, GOI) has circulated Master Plan for Artificial Recharge of Groundwater to State Government to enable them formulate deleted and area-specific Rain Water Harvesting & Groundwater Recharging Program.
 - c) Ministry of Jal Shakti has circulated a Model Bill to all States / UT to help them enact suitable legislation for regulation of Ground Water Development which also includes provision for Rain Water Harvesting.
 - d) GOI has launched Atal Bhojal Yojana (ABY) Scheme to promote suitable Ground Water Management & Improve the Ground Water Management in priority area of seven states.
 - e) Govt. has also initiated the Jal Jeevan Mission (JJM) to provide safe & adequate Drinking Water to Rural Households. The JJM focus is on Ground Water Recharge & Grey Water Management.Govt. has also developed Guideline-Frame Work for regulation of Groundwater Extraction to ensure its sustainable use.

INTEGRATED WATER RESOURCE MANAGEMENT (IWRM) -HYDRO-GEOLOGICAL TOOLS & METHODS: CURRENT SCENARIOS ARE VERY MINIMAL AND NEED APPLICABILITY AND USE IN COMING FUTURE.

The Tools & Methods are outlined as below:

Elements of IWRM

It is to deal with assessment and extraction of water resources and water demands for purpose of planning and decision making. IWRM steps include assessment, development and management of water resources projects. Hydro-geological studies for IWRM purposes has now to pay regard to ground water dynamics and interaction between surface and ground water, quality of ground water including information dissemination to public, planners and decision levels in governments.

Demand Management

The concept of water conservation methods and water demand management measures have become inescapable necessity of time for future ground water resources planning & management.

Ground water Models

Groundwater-flow, Groundwater-quality and Transport models are normally required to be developed and used for protection of impacts of groundwater development scenarios including simulation of interactions between surface and groundwater. IWRM is therefore considered as absolute approach for sustainable development and management of insufficient and scarce water resources. Groundwater model applications have started gaining momentum in the country with efforts of Central Groundwater Agency (CGWB) and Educational Institutions.

ASSESSMENT OF TEMPORAL TRENDS IN INDIA'S GROUNDWATER

Groundwater sustainability Assessment using multi-decadal trend analysis of Groundwater Levels (GWLs) Groundwater dependency on irrigated agriculture has posed challenge for its sustainability. For proper management of water resources, long term behaviour of GWLs needs to be understood by water user communities and Government organizations.

Spatio-temporal variation maps are required to be prepared for assessing variation of GWLs and groundwater depletion rates using Geo-statistics and analyzing water level fluctuations using standardized Depth to Water Level Index (SDWLI). The CGWB, a central groundwater agency, should educate water managers and communities about such procedures and methods of utility.

GROUNDWATER CRISES IN THE COUNTRY

Largest depletion of groundwater is occurring in northern region of the country and NCT Delhi can be said to be the focal-point of fast-growing crisis. With projections in water demands, major populous cities will expectedly run out of groundwater-based drinking water supplies. To preventing fresh groundwater crisis, it is imperative to conserve & manage groundwater in close cooperation of rural and urban communities. The governments should also consider Desalination of Brackish Groundwater (BGW) as alternative supportive measure.

CLIMATE-PROOFING URBAN WATER SUPPLY INFRASTRUCTURE

Climate variability lead to enhanced frequency & magnitude of weather events and result in loss to property, urban infrastructure, flooding, landslides as well as causing health problems in cities and towns. Additionally, the urban population growth and floating population also put pressure on city water resources and supplies.

Climate proofing & resilience of water supply infrastructure with support of stake-holders is urgent need of time. Both governments and investment institutions are required to spend more on climate-proofing. Therefore, the state-specific frameworks that integrate water management with climate change adaptation measures become pertinent, relevant and prerequisite.

GROUNDWATER MODELING

Groundwater Flow Model to aid in Water Resources

Groundwater-flow models are to be constructed to provide a tool for supporting the management of groundwater resources in groundwater over-exploited areas. The model is to be based on hydraulic pumping well test data. The wholesome data to be used to developing hydraulic model include rainfall, geologic field data, aquifer pump test data and hydraulic-head of shallow wells. The model result will include simulated aquifer parameters. Models are to be used to estimating sustainable yields and MODFLOW model can be used for the said purpose.

[Integrated Groundwater and Surface Water Modeling](#)

Optimizing quantity and economic return form integrated use of surface water and ground water is still a new subject in India. Application of optimization methods to problems of allocating appropriate quantities of ground water and surface water under varied climate and soil conditions in relation to policy frame-work has because an urgency. Mathematical models to aid planners & users in determining optimum allocations of water resource need development. In order to develop such integrated numerical & Optimization models, a sound understanding of physical characterizes of surface water supply and distribution system as well as of the underground aquifer system is necessary. Besides few individuals in Govt. agencies and Academic Institutions the persons particularly engaged in irrigation water management have no knowledge, training & practice with development and use of mathematical models.

In order to spearhead Integrated Water Resources Management Activities (IWRM) a well-coordinated set-up to backup irrigation water agencies & users with Decision Support System (DSS) is but necessary. Today we do not have structured Computer aided mathematical modelling cells in central/state agencies engaged in irrigation development work.

In view of above it is desirable to establish a sub-centre of Integrated Ground Water Modeling Centre, Denver (USA) in CGWB with Modeling cells in each state to help developing alternative water allocation plans of operation using decision variables & developing outreach with farmers and user agencies with translated versions of outcomes in language understandable to user communities. This centre can over the years develop into a Groundwater modeling centre of Southeast Asia region.

GROUNDWATER QUALITY SURVEILLANCE

General

By and Large, ground water is relatively clean than surface water Dissolved elements in ground water induce calcium, Magnesium, Sodium & Potassium. Field measurements of Conductance normally provide data/information on dissolved solid concentration.

Ground Water Quality Problem

Most groundwater quality problem relate to high salinity, hardness and high concentration of Iron, Arsenic and Fluoride. Probable water Quality concerns therefore, relate to Iron bacteria, water hardness, coliform bacteria etc. Coliform bacteria is indicator of harmful magnesium & high nitrate level as of organic contaminations.

Ground Water Contamination Sources

Any substance which is added to water determines its quality. Ground Water contamination sources mostly include, agriculture activities, septic tanks, landfill sites & dumps, urban area run-off, natural leaching & salt water incursion, spills, industrial effluents, mining operations & abandoned wells.

Water Quality Corrections

Corrections could include Aeration/Filtration water softeners, Chlorination/Filtration.

1. Ground Water Quality Protection: Groundwater protection measures relate to regulatory/non-regulatory approach; while former involve legal constraints on contamination activities, the later include public education & training aspects of strategies. The water (prevention & control of pollution) Act enacted in 1974 & amended in 1988 has provisions for maintenance of whole some of water in the country The Act also establishes standards for water quality & effluents.
2. Preparation of Ground Water Protection Plan: Various maps required for water quality protection planning include aquifer vulnerability maps, Ground water level contour maps, collections and analysis of water samples for domestic & municipal wells and computing travel-times from potential contaminant sources to water wells. All such measures are to be adopted for implementing plan in participatory mode with association & cooperation of citizen groups and water associations. With proper managerial measures of water resources, no individual should be without potable water.
3. Groundwater Quality Modeling: Water quality modeling is essential paradigm because it provides quantitative description as well as prediction of quality of water system. It can cover various pollutants and different types of water quality issues. Many areas in different states are groundwater contaminated by Arsenic, Iron bacteria and Flouride concentrations. Water quality modeling need much more educative exercises for the knowledge and use of water user organizations and communities more than the use of groundwater flow models. The Central Agency (CGWB) should prepare Water quality modeling case-studies for the knowledge, know-how and use of Drinking water Resource Development departments in the States. Sobek, DELFT 3D, MT 3D & MODFLOW softwares can be used in the process.

HYDRO-GEOLOGICAL EXPERIMENTATION AND NEW METHODOLOGIES:

The desirability is to include:

Mapping Groundwater Flow System

Using Geoelectric, Seismic Reflection and Ground Penetrating Radar to map unsaturated aquifer (Empty Aquifer Space) in soft rock and hard rock areas as well as for analyzing Groundwater Levels (GWLs).

GEORADAR

Georadar System are used to targeting and mapping ground water table in Alluvial areas as well as mapping Sedimentary rocks and Lineaments & fractures over Hard Rock areas.

Geohydrological Decision Support Analysis

For water development projects, the decision-model, the Simulation models for groundwater flow and uncertainty models for uncertain parameters have to be used.

In addition to the above, for groundwater management, problem-oriented planning under conditions of uncertainties are also desirable exercise while using hydrogeological analysis and techno-economic and ecological criteria.

Hydrogeological Information System

In order to support hydrogeological related activities by information management system, the development and application of Data-scarce model need to be used progressively.

BASE-FLOW EVALUATION IN RIVER BASINS

Base-flow estimation is useful study which can support decision-makers to developing appropriate strategies for sustainable management of diminishing water resources and ecosystems under stress of changing climate and socio-economic conditions. Groundwater depletion in adjoining areas of Rivers/stream basins causes reductions in base-flow. River base-flow data are not permanently assessed in the Rivers of India which hampers location and designing of Sub-surface Dykes for use of groundwater upstream of Dam-bunds.

GROUNDWATER DECLINE & DEPLETION SCENARIO

- a) Ground Water Decline & Depletion: Ground water depletion and decline in water levels has been caused in the country by indiscriminate groundwater pumping. This is key-issue associated with ground water use. Many areas in different states of India are experiencing depletion in groundwater levels and resource. To name some such are the sates of Punjab, Haryana, Rajasthan, Tamil Nadu etc.
- b) Groundwater Depletion Scenario: Some areas in Ganga River basin have already attained ground water depletion heights and the entire northwestern region of the country is expected to face critically low ground water availability from 2024 onwards. About 17% blocks of various districts in different states are ground water over-exploited. Being largest user of ground water, country uses 230 BCM groundwater per year. Many cities are already facing groundwater shortage for drinking water supply. About 60% of irrigated agriculture and 85% of drinking water supply depends on groundwater. It, therefore, demands protection of aquifers against groundwater over-exploitation and pollution via recharging as well as adopting groundwater regulatory measures.

c) Negative Effects of Groundwater Depletion: These include;

- ✚ Drying up of wells
- ✚ Reduction of water in streams & lakes
- ✚ Deterioration in Water quality
- ✚ Lowering of ground water Levels
- ✚ Declining of ground water yields
- ✚ Increased pumping costs

d) NASA-Gravity Recovery and Climate Experiment (GRACE) Satellite Data: Based on Grace Satellite data, NASA identified massive areas of groundwater depletion in Indian states of Rajasthan, Haryana and Punjab between 2002 and 2008.

SPRINGSHED MANAGEMENT

Spring is a natural opening on land from where water flows from aquifer to land–surface. The catchment of springs is known as Spring-shed. The Spring-shed is the area of land surface that contributes groundwater to a spring. Springs have drinking water supply value in hilly regions of the country. Hill area residents and tourists alike enjoy springs' recreational values.

There are some 5 million springs in India of which 3 million alone exist in six Indian Himalayan states of Uttarakhand, Himachal Pradesh, Mizoram, Ladakh, Arunachal Pradesh & Nagaland.

Challenges & Threats to springs include:

- (i) Reduction in discharge due to decline in area rainfall
- (ii) Increase in salinity due to spring-flow decline

Spring-shed studies are reported from Sikkim & Uttarakhand states besides some spring-shed practices in Tripura and Nagaland states. All concerned states are required to build team of experts and conduct spring area hydrogeological investigations, monitoring of spring water quality and conduct RRR of Springs using Remote Sensing & GIS technique. The objective of working for spring shed management will be improving the treatment and ecological value of major springs in various states. Scientist & engineering teams will also function to classify major & minor springs with respect to magnitude of their discharge rates in indifferent states and help hill-area communities to restoring drying up of springs.

ARTESIAN BELTS OF INDIA:

Artesian belts of India stretch along Foot-hill region of Himalayas. Artesian well is a well that brings groundwater to the land surface without pumping since it occurs under pressure. Artesian well taps into aquifer that is under pressure and which makes water to rise into well without the use of pump. Artesian water bears high mineral content.

Bhabar-Tarai belt also locally known as Kandi-Sirowal belt in Jammu region is artesian belt demarcated by Spring-line that separates boulder formation from low lying relatively less coarse sedimentary belt. The Kandi-Tarai belt also serves as Trans-boundary aquifer that discharge auto-flow water to neighboring country.

Besides Kandi-Sirowal belt in Himalayan foot-hill region, artesian zone also exists in Mallabar Coastal Plain of Southern Kerala. The Udham Singh Nagar district of Uttarakhand bears several auto-flowing wells whose unmanaged water yield is diminishing.

There is an inescapable need of time to plan artesian belt groundwater management for water stressed areas in Indian states where auto-flow water zones exist.

SUSTAINABLE GROUNDWATER MANAGEMENT – A WAY FORWARD

Sustainable Groundwater Resource is the Development & use of groundwater to meet current & future demand without causing detrimental environmental/socio-economic consequences sustainable groundwater management is important since it support climate- resilient water supplies & helps meeting goals of drinking water supplies.

There is urgency now to arrest non-sustainable practices such as groundwater over pumping, destruction of wells, salinization of soils & water resources. Water management & numerical groundwater modeling tools are to be used in addressing, protecting and integrating problems of groundwater use, over-use, depletion & pollution. Web-based ground water management platform can now provide real-time & timely information of groundwater system in present day digital world.

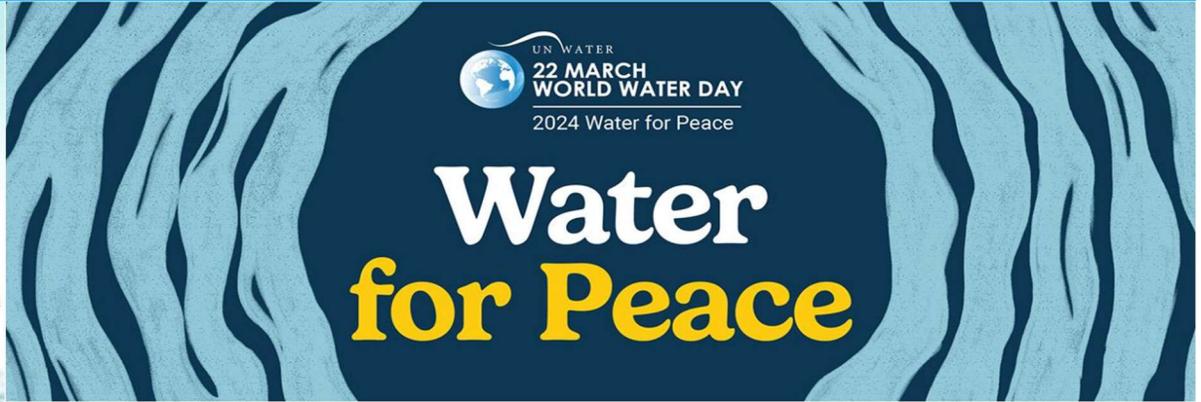
CONCUSION

Groundwater is both a human necessity as well as catalyst for socio-economic & environmental concerns in the country. The water sustainability/environmental factors and constraints are matters of concern. Main problems in groundwater development and use are depletion of ground water as consequence of its over-use and degradation of water quality and pollution.

The groundwater resources are therefore required to be sustainably developed, properly conserved and protected against development and its management has to be achieved on the basis of evaluation of groundwater based on sound data-base, hydrogeological & hydro-geomorphological maps, Aquifer Maps, Managed Aquifer Recharging Systems (ASR/ASTR), Lake & River Bank Filtration Systems, In-stream Modification measures and Modular Rain-Tank based Water harvesting Systems. Integrated Water Resources Management will be the right approach to sustainable ground water management of depleting groundwater resources. The suggestive MAR methods, data bases, field and lab tools and information system as well as skilled personnel are to be considered as back-bone of sustained groundwater management.

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World Water Day 2024

World Water Day Celebrations

What is World Water Day?

World Water Day celebrates water and inspires action to tackle the global water crisis. A core focus of World Water Day is to support the achievement of Sustainable Development Goal (SDG) 6: water and sanitation for all by 2030.

World Water Day is an annual United Nations Observance – held on 22 March – focusing on the importance of freshwater, coordinated by UN-Water and led by one or more UN-Water Members and Partners with a related mandate.

World Water Day 2024: Water for peace

Water can create peace or spark conflict.

When water is scarce or polluted, or when people have unequal, or no access, tensions can rise between communities and countries.

More than 3 billion people worldwide depend on water that crosses national borders. Yet, only 24 countries have cooperation agreements for all their shared water.

As climate change impacts increase, and populations grow, there is an urgent need, within and between countries, to unite around protecting and conserving our most precious resource.

Public health and prosperity, food and energy systems, economic productivity and environmental integrity all rely on a well-functioning and equitably managed water cycle.

Creating a positive ripple effect

The theme of World Water Day 2024 is 'Water for Peace'.

When we cooperate on water, we create a positive ripple effect – fostering harmony, generating prosperity and building resilience to shared challenges.

We must act upon the realization that water is not only a resource to be used and competed over – it is a human right, intrinsic to every aspect of life.

This World Water Day, we all need to unite around water and use water for peace, laying the foundations of a more stable and prosperous tomorrow.



Water for peace



INC of IAH

Reg. Off.: O/o Central Ground
Water Board, Bhujal Bhawan,
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www.inciah.org

Indian Chapter



INDIAN NATIONAL CHAPTER (INC) OF INTERNATIONAL ASSOCIATION OF HYDROGEOLOGISTS (IAH)



Panel Discussion

23rd March, 2024 at 2.30 pm to 3.30 pm

On the occasion of

World Water Day-2024

Theme: Water for Peace

Distinguished Panelists



Prof. (Dr) A. K. Sinha

President, Indian Chapter of IAH,
Founder Vice-Chancellor,
CSM University, Navi Mumbai



Sh. A.K. Agarwal

Former Chairman,
Central Ground Water Board
Govt. of India, Faridabad



Prof (Dr) Shashank Shekhar

Professor, Department of Geology,
Delhi University, New Delhi



**Dr Vishwanath
Srikantaiah**

Water Conservationist,
Bengaluru



Prof. (Dr) Shaji E.

Professor and Head,
Department of Geology,
University of Kerala



Dr Anoop Nagar

Former Regional Director (NWR)
and Member, CGWB, Govt. of
India, Faridabad

Welcome



Dr Anadi Gayen

Vice President (INC-IAH),
Regional Director, CGWB,
Kolkata

Moderator



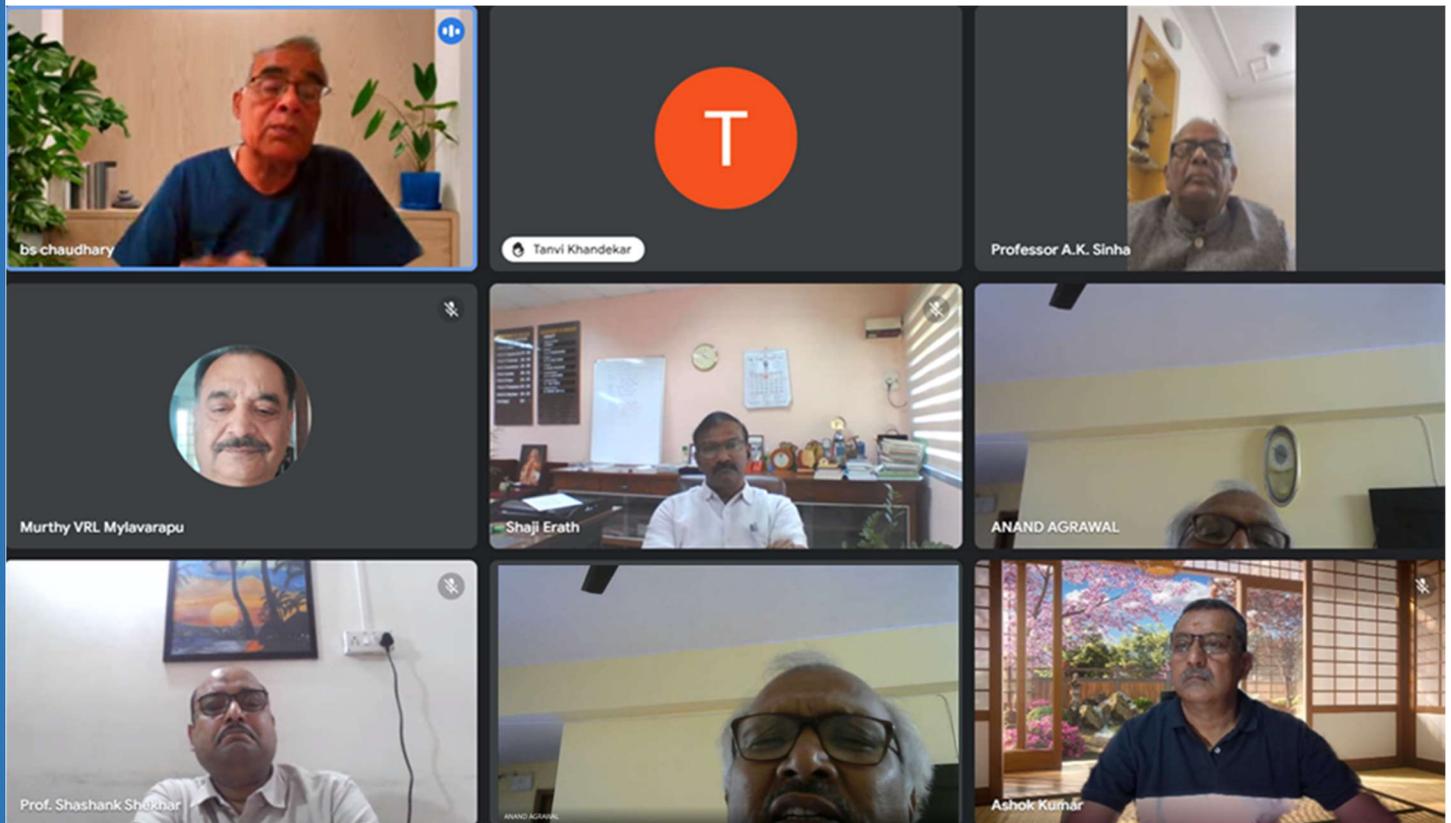
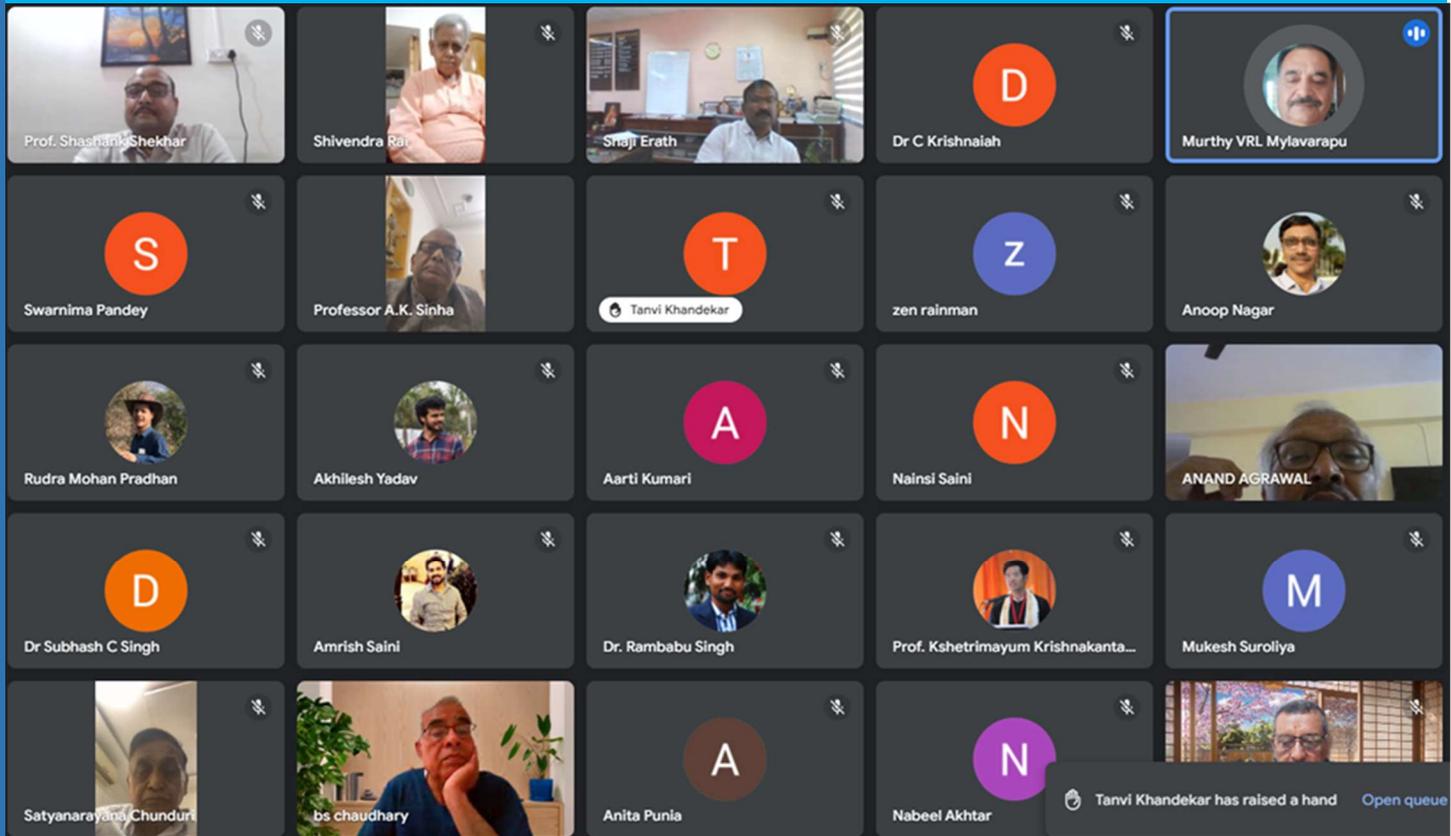
Dr BS Chaudhary

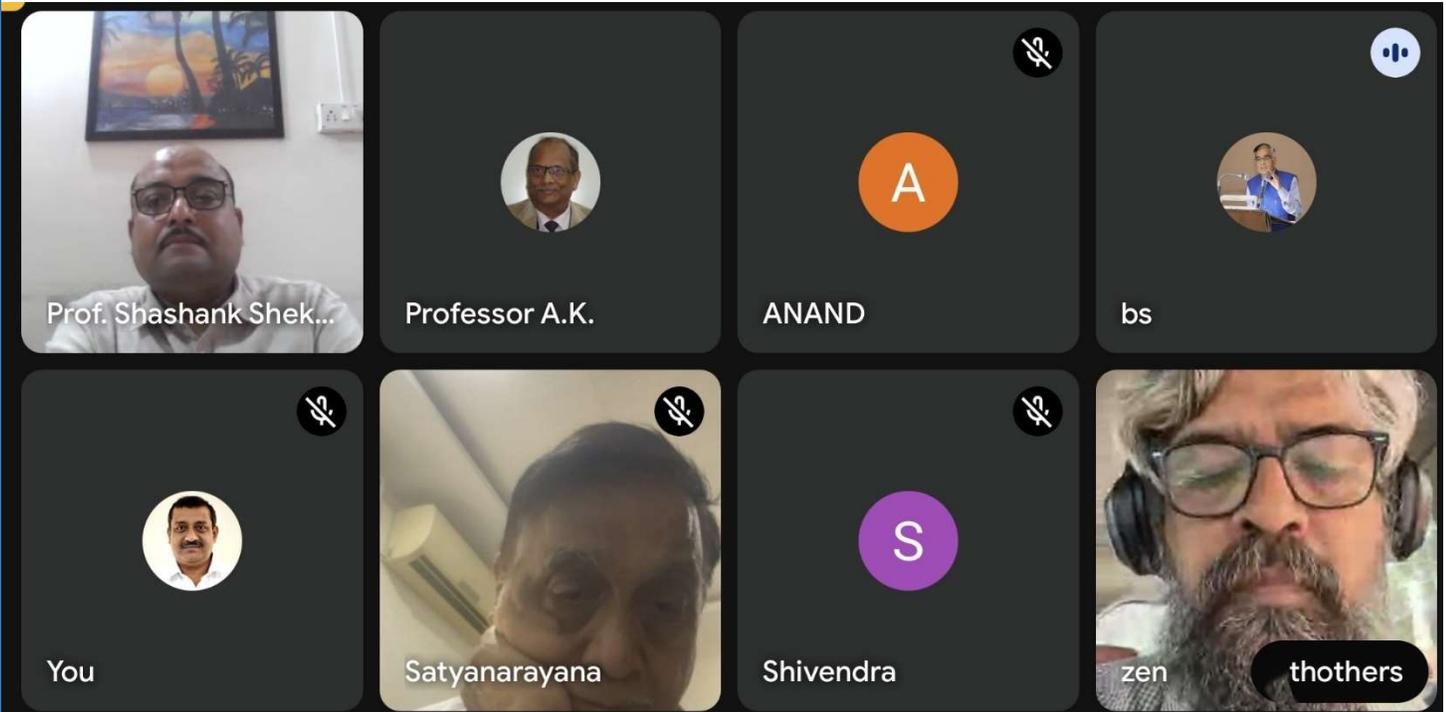
Secretary, Indian Chapter of
IAH, Professor, Department of
Geophysics, Kurukshetra
University, Kurukshetra



Meeting Admin: Dr. Ashok Kumar, Treasurer (INC-IAH)
M: 9818174707 E: ashok.kumar@inciah.org

Meeting at link: meet.google.com/ucv-mukc-dce







National Webinar

Theme: Water for Peace

Date: March 30, 2024

Time: 04:00 – 05:00 PM

Link to Join: meet.google.com/jkf-cvjh-spf



Invited Speaker

Prof. A. K. Sinha

President, INC-IAH &
Founder Vice Chancellor of
CSM University, Mumbai



Invited Speaker

Prof. B. S. Chaudhary

Fellow-DAAD, SAAEG & IWRS
Department of Geophysics,
KUK & Secretary INC-IAH



Patron

Prof. Deepti Dharmani

Vice Chancellor
CBLU, Bhiwani



Co-Patron

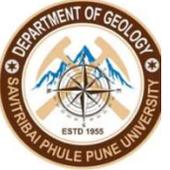
Dr. Reetu Singh

Registrar
CBLU, Bhiwani

Jointly Organised by

**Department of Geography, CBLU, Bhiwani
&**

**Indian National Committee of the International Association
of Hydrogeologists (INC-IAH)**



SAVITRIBAI PHULE PUNE UNIVERSITY DEPARTMENT OF GEOLOGY

INDIAN NATIONAL CHAPTER [INC] OF INTERNATIONAL
ASSOCIATION OF HYDROGEOLOGISTS [IAH]

Jointly organise an online session on the occasion of

WORLD WATER DAY

Distinguished Speakers



Prof. (Dr) A. K. Sinha
Chief Guest
Former Vice-Chancellor, CSM
University, Navi Mumbai President,
Indian Chapter of IAH



Bhagyashri Maggirwar
Keynote Speaker
Deputy Director, Groundwater Surveys
and Development Agency,
Water Supply and Sanitation Department,
Government of Maharashtra, Pune.

Keynote Topic : "Harmony Below the Surface: Integrating Community Participation
for Sustainable Aquifer Management and Peaceful Water Governance"



Scan the QR to join the meet.

WATER FOR PEACE



Prof. Bhavana Umrikar
Co-ordinator
Dept. of Geology
SPPU

Meeting Link : <https://meet.google.com/kae-zrfp-pug>

Date 22/03/24

Timing: 11:30am - 12:30pm

Department of Geology, Savitribai Phule Pune University,
Ganeshkhind, Pune [411 007]

World
Water Day
2024



Water for
peace



INC of IAH

Reg. Off.: O/o Central Ground
Water Board, Bhujal Bhawan,
NH-IV, Faridabad – 121001

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Suhani Srujanika

Department of
Geology,
Savitribai Phule
Pune University,
Pune -411 007

s.srujanika@gmail.com

World Water Day Celebration at Department of Geology, Savitribai Phule Pune University, Pune

Uniting Voices for Sustainable Water Governance

In commemoration of World Water Day, the Department of Geology at Savitribai Phule Pune University, in collaboration with INC-IAH (International Association of Hydrogeologists, Indian National Chapter), organized a thought-provoking talk on the theme of "Water for Peace." The online event focused on the crucial topic of "Harmony Below the Surface: Integrating Community Participation for Sustainable Aquifer Management and Peaceful Water Governance."

Prof. A. K. Sinha delivered a discourse on the sustainability of water as a resource, reflecting on its historical significance and stressing the paramount importance of fostering harmony within communities in relation to water. He, along with Prof. Bhavana Umrikar, expounded on the pivotal role played by the Indian chapter of the International Association of Hydrogeologists in nurturing young researchers and students interested in the groundwater domain.

We were honored to host Ms. Bhagyashri Maggirwar, Deputy Director of the Groundwater Surveys and Development Agency, Water Supply and Sanitation Department, Government of Maharashtra, as the esteemed speaker. Ms. Bhagyashri Maggirwar provided a comprehensive overview of water's centrality to sustainable development goals, addressing challenges such as aquifer depletion, water scarcity, and conflicts. She contextualized these issues within the current landscape of Maharashtra, emphasizing the intertwined nature of water security, peace, and community participation. Using examples like the longstanding dispute between Karnataka and Tamil Nadu over the Cauvery River water, as well as ongoing legal conflicts in Maharashtra, she underscored the potential for water disputes to escalate into conflicts and stressed the critical importance of aquifer management in fostering harmony. Ms. Maggirwar highlighted successful community-led aquifer management initiatives, citing the World Bank project in Jalgaon district as a model for socio-economic balance acquisition. Furthermore, she underscored the transformative potential of water diplomacy, citing The Indus Waters Treaty as a prime example, and called for collaborative, capacity-building efforts and long-term planning to achieve sustainable aquifer management and peaceful governance. The event served as a catalyst for meaningful dialogue and collective action towards safeguarding our water resources for generations to come.

The event sparked meaningful discussions and exchanges of ideas among attendees, who were mostly graduates, post-graduates and research scholars, fostering a deeper understanding of the complexities surrounding groundwater management and water governance.

We extend our heartfelt gratitude to Ms. Bhagyashri Maggirwar for sharing her expertise and insights with us, as well as to all the distinguished guests, participants, and attendees who made this event a success.

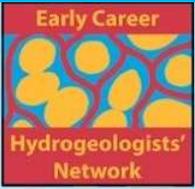
The talk was elevated by the esteemed presence of distinguished guests. Among them stood Prof. A. K. Sinha, the venerable President of INC-IAH, whose wisdom and guidance illuminated our path toward sustainable water governance. Alongside him, Prof. Bhavana Umrikar's radiant spirit and scholarly insights ignited sparks of inspiration among attendees.

Dr. C. Krishnaiah, Dr. Ravindra Marshetwar, Dr. Devkumar Mahisekar, Dr. Suresh Pawar, Dr. Rambabu Singh, Mr. Dharendra Mani Tripathy and Ms. Namita Khand brought a wealth of knowledge and experience, enriching our discussions with their diverse perspectives. Additionally, we were delighted to welcome industrial participants, including representatives from GeoEXterra Technologies.

**World
Water Day
2024**



The Early Career Hydrogeologists' Network International Association Of Hydrogeologists



Organizing Webinar on



World Water Day 22 March 2024

World
Water
Day
2024



Speaker

Prof. (Dr.) A.K. Sinha

President INC-IAH,
Former Vice-Chancellor of Chhatrapati Shivaji Maharaj University
Panvel, Navi, Mumbai -410206 Maharashtra

Title of talk

Exploring the Nexus of Groundwater and Sustainable Development Goals with a perspective on Global peace.

Meeting Link

<https://meet.google.com/iwm-viug-dmg>

Abstract

Groundwater constitute the 97% of all the available fresh water and widely exploited and used to drive the development processes.

Global leaders at the UNO worried to bring in peace and harmony globally by addressing developmental need instituted 15yrs Millenium Development goals and subsequently another 15 yr global program entitled " Sustainable development Goals under Agenda 2030. Any Development programme to be sustainable be economically feasible, environmentally integrated and socially beneficial. Groundwater being most dominant component of fresh hydrological system has to be sustainably used to make any development program Sustainable.

Therefore, the lecture would be based on analysis and understanding of SDGs vis a vis groundwater use and availability. Groundwater sustainable use be ensured by adopting best management practices to achieve the SDGs.

Time

06:30 PM to 07:30 PM (IST, Indian Standard Time)

Programme Schedule

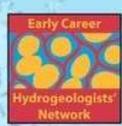
Welcome to the speaker (03 minutes), Talk (40 minutes), Question answer/ discussion (15 minutes), Vote of thanks (02 minutes)

Host



Dr. Ashwani K Tiwari

Member of ECHN, IAH (India)
Assistant Professor
School of Environmental Sciences
Jawaharlal Nehru University



<https://echn.iah.org>

Water
for
peace



CHHATRAPATI SHIVAJI MAHARAJ UNIVERSITY

Panvel, Navi Mumbai



DEPARTMENT OF CIVIL ENGINEERING & FACULTY OF SCIENCE WITH
INDIAN CHAPTER OF INTERNATIONAL ASSOCIATION OF HYDROGEOLOGISTS

CELEBRATES

WORLD
Water
DAY



Theme: Leveraging
Water for Peace



Dr. Keshav Badaya
Hon'ble President



Prof. (Dr.) Keshari Lal Verma
Hon'ble Vice-Chancellor
Coordinator



Prof. (Dr.) R.P. Sharma
Registrar, CSMU



Prof. (Dr.) R.P. Singh Kushwah
Dean Engineering
Director CSWS

Keynote Speaker



Prof. (Dr.) A.K. Sinha
President INC-IAH

Guest Speaker



Prof. (Dr.) I.C. Sharma
Principal, GIT Jaipur

Keynote Speaker



Dr. Nitin Goyal
Principal Scientist and Chair
CSIR-NEERI, Research and
Innovation Centre, Mumbai

Co coordinator



Prof. Nitesh V. Gopnarayan
Asst. Professor
Civil Engineering

Date: 21th March 2024, Venue: Pratapgad Seminar Hall Time: 11.30 am to 01.00 pm

World
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2024

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CONSERVATION OF WATER

Student Voice



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CONSERVATION OF WATER # 1

3rd Year Students, Civil Department

(Supervised by Mr. Vikash Kumar Sangadiya, Rajasthan Institute of Engineering Technology, Jaipur)

Conserving Our Liquid Gold: Advanced Tech for a Sustainable Future

Water is the lifeblood of our planet, and with a growing population and climate change putting pressure on freshwater resources, conservation is more critical than ever. Thankfully, innovative technologies are emerging to help us use water more wisely, both indoors and outdoors.

Smart Homes, Smart Water Use:

Inside our homes, several technologies are making a splash:

Leak Detection Systems: Using sensors and algorithms, these systems can pinpoint hidden leaks, preventing gallons of water from silently going to waste. Some advanced systems can even shut off the water supply automatically.

Water-Efficient Fixtures: Low-flow showerheads and faucets, often equipped with aerators that mix air water, can significantly reduce water use without compromising performance.

Smart Appliances: Washing machines and dishwashers with built-in sensors adjust water usage based on the load size, preventing unnecessary water consumption.

Intelligent Irrigation for a Greener Future:

Our lawns and gardens are major water consumers. Here's where tech steps in to save the day:

Smart Irrigation Controllers: These weather-based systems use local weather data and soil moisture sensors to deliver the optimal amount of water to plants, minimizing evaporation and runoff.

Soil Moisture Sensors: These sensors directly measure the water content in the soil, sending signals to irrigation systems to adjust watering schedules and avoid overwatering.

Greywater Recycling System: Greywater, gently used water from sinks and washing machines, can be treated and reused for irrigation, reducing reliance on freshwater sources.

Beyond Homes and Gardens:

Innovation is extending water conservation efforts beyond homes and yards:

Precision Agriculture: Techniques like drip irrigation deliver water directly to plant roots, minimizing waste in agricultural fields.

Advanced Leak Detection for Cities: Sensor networks and data analytics can pinpoint leaks in underground pipes, a major source of water loss in urban areas.

Desalination Technologies: While desalination has its drawbacks, advancements are making it a more efficient option for turning seawater into freshwater in coastal regions.

By embracing these advanced technologies, we can become smarter water users, ensuring a sustainable future for this precious resource. Remember, every drop counts.

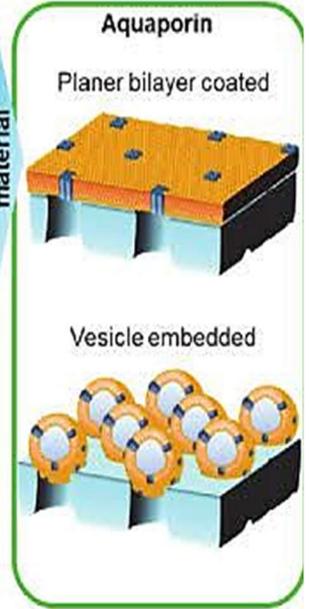
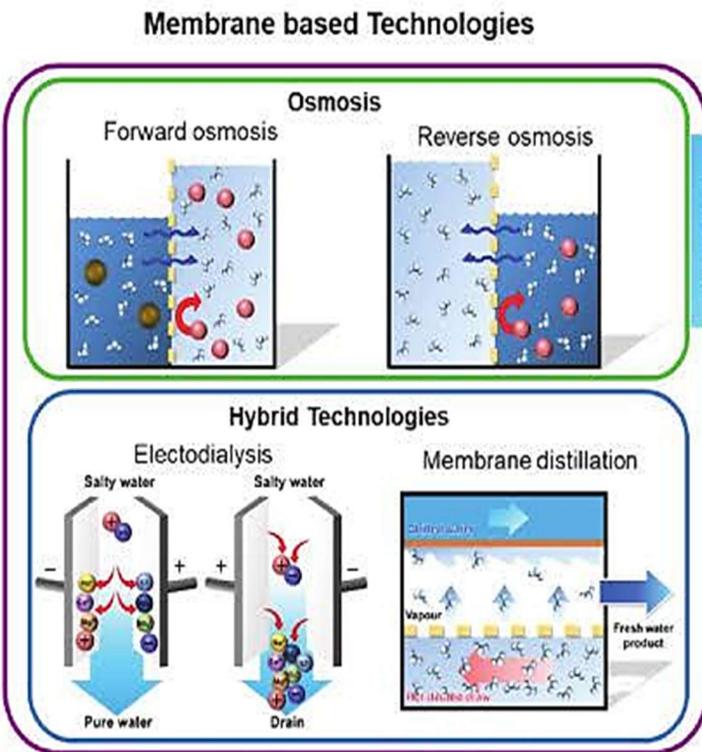
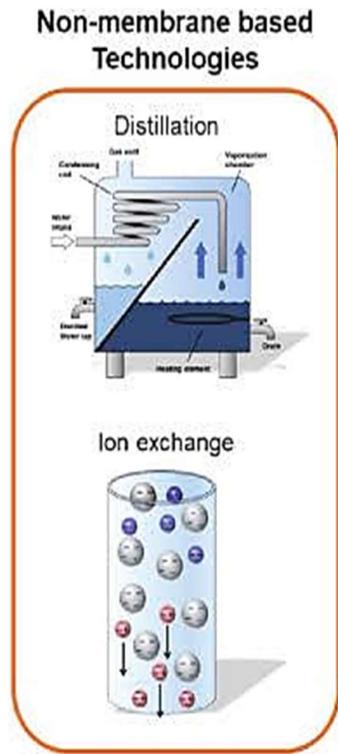


Fig.1 Water Purification Technologies

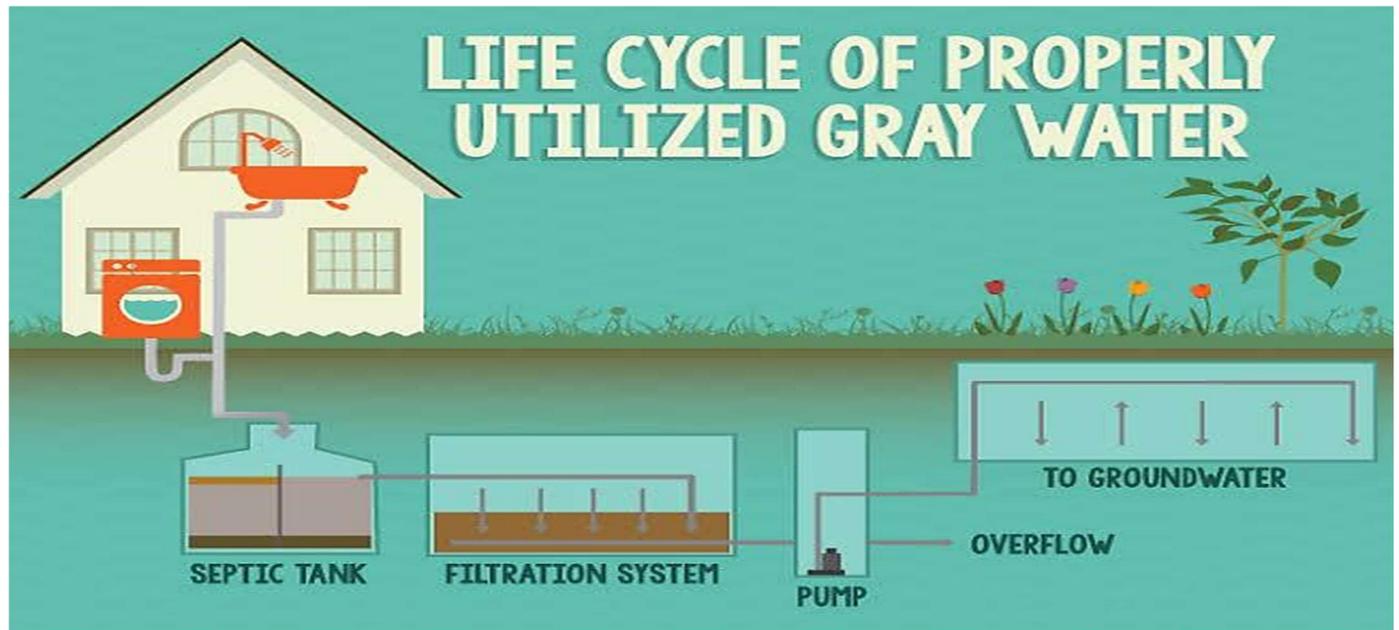


Fig.2 Gray Water life Cycle

CONSERVATION OF WATER # 2

3rd Year Students, Civil Department,

(Supervised by Mr. Vikash Kumar Sangadiya, Rajasthan Institute of Engineering Technology, Jaipur)

There are three things (oxygen, water, and food) without which we cannot live on the earth. But the most precious thing is oxygen, water, and food because we cannot live without oxygen even for a second. Clean water is also important as we need it in daily activities, especially drinking.

Already the percentage of clean water was less, but due to the industrial activities, our clean water under the ground is getting dirty and polluted. Because of the lack of fresh mineral water has been sold in the local shops for many years. And, people are ready to buy it worth 30 to 35 Rs because they know that simple tap water may not be clean, especially in public places.

With the increasing rate of people's carelessness (regarding water saving and safety) and population, it is sure that our future generations must suffer a shortage of clean water. A very little percentage of the earth's water is suitable for drinking, and many people (at the place of water shortage) survive on much less water per day.

Percentage of Clean Water

Three-fourths of the earth is covered by water, from which 97% water is ocean water means salt water and is completely unfit for our consumption. The left percentage (about 2.7 percent) is fresh drinking water; however, around 70 percent of this is available as ice sheets and glaciers in Antarctica. So, we only have one percent of fresh water, which is fit for human use.

We need to practice water conservation on an urgent basis to make the presence of this precious resource in our life. We also need to stop contaminating the drinking water resources through the direct passage of sewage, toxic chemicals, and other wastes into it. The increasing rate of population, deforestation and rapid urbanization are increasing the need for clean water and leading to water pollution and scarcity

There are various simple ways which we can use daily and save gallons of water daily. Following are save water techniques which we must use to save water at home and other places:

- We should use shower heads with low-flow (also called energy-efficient shower heads), low-flush toilets, and composting toilets (instead of conventional western toilets as they use large volumes of water) or dual flush toilets (it uses very less water than others).
- Keep the tap close while doing hand washing, toothbrush, face wash, dishes, etc.
- Collect rainwater during the rainy season to use in toilet flush, watering plants, sprinkle in the garden, etc. Using raw water like sea water or non-purified water in the toilet is also good.
- We should be habitual of reusing or recycling wastewater.
- We should promote rainwater harvesting, using high-efficiency clothes washers, weather-based irrigation controllers, garden hose nozzles, low flow taps in wash basins, swimming pool covers, automatic faucets, etc., for water conservation.
- Water saving techniques should also be given priority in the commercial areas as it is a big area where gallons of water can be saved daily.

CONSERVATION OF WATER # 3

Mr. Devesh Lawania,

8th Sem, Dept. of Civil Engineering, Rajasthan Institute of Engineering & Technology, Jaipur

Water conservation refers to the responsible use and management of water resources to ensure their sustainability for current and future generations. It involves reducing unnecessary water usage, preventing wastage, and implementing practices to efficiently utilize available water resources. Water conservation is crucial due to increasing water scarcity in many regions around the world, exacerbated by factors such as population growth, climate change, and inefficient water management practices.

There are various strategies and methods for water conservation, including:

1. **Efficient irrigation techniques:** Using drip irrigation, micro-irrigation, or other water-efficient methods in agriculture can significantly reduce water usage.
2. **Fixing leaks:** Repairing leaks in plumbing systems, faucets, and irrigation systems helps prevent water wastage.
3. **Water-saving appliances:** Installing water-efficient appliances such as low-flow toilets, showerheads, and washing machines can reduce water consumption in households.
4. **Rainwater harvesting:** Collecting and storing rainwater for various uses, such as watering plants, flushing toilets, or even for drinking purposes, can help reduce reliance on traditional water sources.
5. **Xeriscaping:** Landscaping with native plants that require minimal water can reduce outdoor water usage in gardens and landscaping.
6. **Education and awareness:** Promoting awareness about the importance of water conservation and providing education on water-saving practices can encourage individuals and communities to adopt water-efficient behaviors.
7. **Policy and regulation:** Implementing water conservation policies, regulations, and incentives at the local, regional, and national levels can encourage industries, businesses, and individuals to adopt water-saving practices.

Overall, water conservation is essential for sustainable water management, environmental protection, and ensuring access to clean water for all people and ecosystems now and in the future.

GROUNDWATER SCENARIO IN INDIA

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Groundwater is the largest freshwater resource used for public drinking water supply, irrigation, and industrial uses worldwide. Groundwater resources are being used more quickly due to growing demand, which has led to their exploitation and associated unfavourable repercussions, including decreasing water levels, land degradation, and water contamination. In ground water studies, one of the most important issues is the quality of the groundwater. Water is one of the most important elements on earth. All plants and animals require water to survive. Water is necessary for life on Earth.

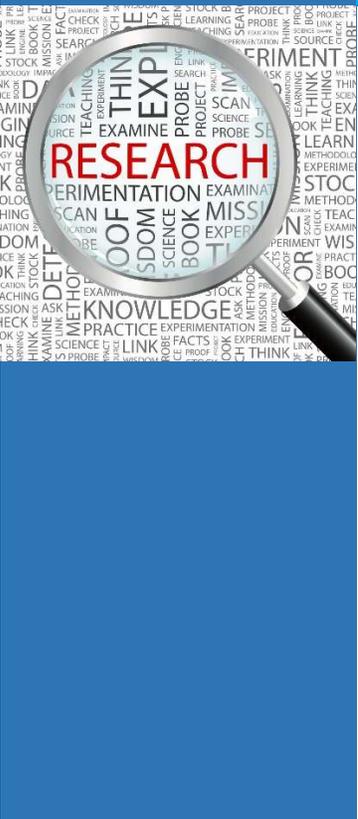
Water Scenario

- The ocean occupies about 70.8% of the earth surface and 29.2% land.
- About 97.3% of the world water saline and only 2.7% is fresh water.
- About 75.2% fresh water is ice caps and glaciers and is not available for the requirement of mankind.
- About 22.6% fresh water is occurred as ground water.
- About 56% groundwater lies in water bearing formations deeper than the 800 m below the ground surface.
- About 44% of groundwater lies in water bearing formation at depth less than the 800 m below the ground surface.
- Globally 3240 km³ of fresh water is withdrawn and used annually out of which 69% for agriculture, 23% for industry, and 8% for domestic use.

Most importantly, the water that people drink and utilise for various purposes must be clean. The quality of water is of upper most importance compared to quantity in any water supply planning and especially for drinking purpose. The chemical, physical and biological characteristics of ground water determine its usefulness for irrigation, municipal, commercial, industrial, institutional and domestic water supplies. Aquifer is a process where in a combination of geologic, geophysical, hydrologic and chemical field and laboratory analysis are applied to characterize the quantity, quality and sustainability of ground water aquifers.

The amount of water can be stored above the ground or under the ground in aquifer. i.e, surface storage in like River, Lakes or Ponds is widely applied and represent the majority of the installed global storage capacity. Aquifer storage is often cost effective as compared to above ground alternative that require the construction of water treatment plant and surface reservoir.

22th March celebrated as "World Water Day". Natural resources must be exploited in a way that will not reduce their availability to future generations, according to the fundamental tenet of "sustainable development."



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Compiled by Mr. Bhavesh Dinu Patil based on posting on INC-IAH official WhatsApp



Upcoming Groundwater Events



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Upcoming Groundwater Events

8-13 Sep 2024 – Davos, Switzerland

IAH Events

IAH World Groundwater Congress

Interacting Groundwater. Share your findings and get a comprehensive update on the latest international developments on groundwater and their relevance for society in a scenic Alpine setting.

The IAH World Groundwater Congress is the premier international groundwater event organised under the auspices of the International Association of Hydrogeologists (IAH). After Wuhan and Cape Town, the IAH World Groundwater Congress returns to Europe for its 51st edition. Organised by the Swiss Society of Hydrogeology (SSH) and the Centre for Hydrogeology and Geothermics of the University of Neuchâtel (CHYN), the event will take place at the renowned Davos Congress Centre in Switzerland. During the week-long event, delegates from academia, government and industry will share the latest findings on groundwater, present innovative solutions and discuss pressing societal challenges. Evening events and mid-week excursions provide additional networking opportunities in a scenic Alpine setting. For more information and to get involved visit: www.iah2024davos.org.

Organised by The Swiss Society of Hydrogeology (IAH Switzerland National Chapter) and the Centre for Hydrogeology and Geothermics of the University of Neuchâtel.

 <https://www.iah2024davos.org/>

24 Apr 2024 – Delft (Netherlands) and online

Other Events

Water Action Agenda Symposium

Water Action Agenda. The Water Action Agenda is a key result of the UN 2023 Water Conference, held in March 2023. It includes over 830 voluntary commitments made by the international water community to accelerate efforts toward Sustainable Development Goal 6, which calls for universal water and sanitation access.

The symposium brings the network of commitment leads together to reflect on the progress of the implementation of Water Action Agenda commitments, to share experiences and perspectives on progress and to promote next steps.

Speakers include:

Eddy Moors, Rector, IHE Delft Institute for Water Education

René van Hell – Director Inclusive Green Growth Department, Ministry of Foreign Affairs, The Netherlands

Madhushree Chatterjee, Chief, UN Department of Economic and Social Affairs

Angelo Imperiale, Researcher, IHE Delft Institute for Water Education

Sareen Malik, Executive Secretary, African Civil Society Network for Water and Sanitation

Kala Vairavamoorthy, Executive Director, International Water Association

Young Water Professionals.

Price: no fees

Organised by IHE Delft Institute for Water Education.

 <https://www.un-ihe.org/events/water-action-agenda-symposium>



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27-28 May 2024 – Ben-Gurion University of the Negev (BGU), Sde Boqer Campus, Israel

Other Events

International Water Summit

The Zuckerberg Institute for Water Research (ZIWR) is pleased to announce the 2024 International Water Summit and the awarding of the Zuckerberg Water Prize during May 27–28, 2024, at Ben-Gurion University of the Negev (BGU), Sde Boqer Campus, Israel.

This biannual Water Summit will assemble leading scholars from around the world in the broad field of water science and technology, and will cover four main topics related to water scarcity in a changing world – Climate Change & Water Resources; Emerging Contaminants in Water; Water Challenges in the Developing World; and Water: Water Technologies.

The Zuckerberg Water Prize (sum of USD 60,000) will be awarded during the Water Summit to acknowledge outstanding achievements and global impact of an individual or organization in the broader field of water.

The summit will address applied and fundamental questions related to the nexus of water, humanity, and the environment. Discussions will be held on cutting-edge research, related challenges, and future directions as well as implications for policy makers. The summit will also include roundtable discussions with active participation from the audience. Researchers that would like to share their studies can submit an abstract for a poster session.

Organised by The Zuckerberg Institute for Water Research (ZIWR), Ben Gurion University, Israel.

<https://www.watersummitziwr.com/> watersummit@bgu.ac.il

17-20 Jun 2024 – Burlingame/San Francisco, California

Other Events

Toward Sustainable Groundwater in Agriculture – Linking Science and Policy

3rd International Conference on groundwater issues in agriculture/food production; global groundwater-food-ecosystem nexus. This three-day international conference with a pre-conference workshop day will bring together leading scientists, policy analysts, policy and decision makers, and agricultural and environmental stakeholder representatives from around the world to define and highlight the science of and the challenges in agricultural groundwater resources management and groundwater quality protection. The conference will also offer a forum to identify promising technical and policy solutions that provide a sustainable future for groundwater and food production at regional, national, and global scales.

Within the water-energy-food-ecosystem nexus, this conference specifically highlights the real world challenges, science, solutions, and emerging policies centered around the multi-faceted, inter- and transdisciplinary interface between groundwater and agriculture.

Abstracts can be submitted for both oral and poster presentations. **SUBMIT ABSTRACTS BY 31 JANUARY 2024.**

Organised by University of California Davis, Water Education Foundation.

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IAH membership Form 2024 (Renewal / New Membership)



Indian National Chapter of International Association of Hydrogeologists (INC of IAH)

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Application for membership (*Membership through Indian Chapter and payment in India Rupees*)

To join IAH use our quick online service at <http://www.iah.org> (credit or debit card payments only)
or complete this form and send by email (as a pdf for security), mail or fax to:

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Given names _____ Gender: Male/Female

Full mailing address _____

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Employer/Organisation/University _____

Experiences/interests in groundwater/hydrogeology _____

Please indicate number of years' experience: student/early career /10+ / 20+ / 30+/retired

Categories & fees 2024	Applicable Fee in EURO for India (Transitional Country)	Applicable Fee in INR for India through INC-IAH
Member	€ 46.00	INR 4,200
Online Member	€ 36.00	INR 3,300
Student Member	€ 22.00	INR 2,000
Student Online Member	€ 14.00	INR 1,300
Retired Member	€ 24.00	INR 2,200

Fee payment method to become / renew IAH membership for 2024 in Indian currency through INC-IAH

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- Through INC-IAH: Depositing membership Fee by cheque in Bank of Baroda in the name of "INC of IAH" A/C No. 26430200000544 (Bank of Baroda, CGO Complex, NH-IV, Faridabad-121001 (Haryana)).
- Through INC-IAH: Online transfer to "INC of IAH" Bank of Baroda A/C No. 26430200000544, IFSC Code: BARB0CGOFAR.
- Direct payment to IAH on <http://iah.org> (in EURO)

Details Required: (A). Renewal: Payment proof with membership number and category of membership opted **B. New Membership:** Fill up the form and send details to the Treasurer, INC of IAH

by email: ashok.kumar@inciah.org

Contact: President – 9829010304, Vice President – 9433588814, Secretary – 7027666480, Treasurer – 9818174707