CSE-Online Training Programme on

Using AI, GIS, and Remote Sensing for Mapping Potential Groundwater Recharge Zones in Urban & Rural Areas

October 13- November 3, 2025

The Centre for Science and Environment (CSE) successfully conducted a two-week online training programme titled **"Using AI, GIS, and Remote Sensing for Mapping Potential Groundwater Recharge Zones in Urban and Rural Areas"** from **October 13 to November 3, 2025**. The course aimed to build the capacity of government officials of CSE partner countries to apply modern geospatial and artificial intelligence tools for groundwater management and planning. A total of 64 participants attended the training program. The participants are from the Federal Ministry of Environment, Nigeria, the Ministry of Health, Tanzania and the Ministry of Water and Environment, Uganda. The training also have a healthy gender balance, with 25 per cent female and 75 per cent male participants.

The training programme officially commenced on October 13, 2025**,** with an introductory session aimed at orienting the participants to the structure and objectives of the course. The course adopted a blended learning approach, comprising live expert-led virtual sessions**,** interactive discussions, and self-paced online modules delivered through the Moodle learning platform**.**

In his welcome address, **Mr. Vivek Kumar Sah**, **Programme Officer, Water Programme, CSE**, introduced the key themes of the training and provided a detailed walkthrough of the Moodle platform. He guided participants on how to access course materials, attend live sessions, participate in discussions, and complete assessments. The introductory session also served to clarify the expectations from participants and highlight the learning outcomes of the programme.

The first virtual session of the online training, held in **October 2025**, was led by **Ms. Swati Bhatia, Deputy Programme Manager, CSE**. Her session focused on **"Groundwater Challenges and Source Sustainability."** She discussed the growing stress on groundwater resources due to over-extraction, contamination, and poor recharge practices. The presentation highlighted key strategies for sustainable groundwater management, including recharge zone identification, source protection, and community-based

monitoring. Ms. Bhatia also emphasized the need for integrating scientific approaches and policy measures to ensure long-term water security in both rural and urban contexts.

The second virtual session of the online training, held on **October 15, 2025**, was led by **Mr. Pradeep Kumar Mishra, Deputy Programme Manager, CSE**. His session focused on **"Groundwater Estimation Methodologies,"** where he discussed various techniques and tools used to assess groundwater availability, recharge potential, and extraction trends. The session also covered the importance of accurate data collection, aquifer mapping, and the use of modern technologies such as GIS and remote sensing in improving groundwater assessment and management practices.

The third virtual session of the online training, held on **October 16, 2025**, was led by **Mr. Vivek Kumar Sah, Programme Officer, CSE**. His session focused on the basics of coordinate systems and the collection of field data for groundwater studies. He explained the fundamental concepts of geographic and projected coordinate systems, their relevance in mapping and spatial analysis, and demonstrated practical methods for collecting accurate field data. The session helped participants understand how geospatial accuracy and field validation contribute to reliable groundwater mapping and management.

The fourth virtual session of the online training, held on **October 22, 2025**, was led by **Mr. Vivek Kumar Sah, Programme Officer, CSE**. His session focused on an **introduction to QGIS and Google Earth Pro** Software's and their applications in groundwater potential zone mapping. He demonstrated how these tools can be used for spatial data visualization, layering, and analysis, enabling participants to identify suitable areas for groundwater recharge. The session provided practical insights into using open-source geospatial software for effective groundwater assessment and management.

The fifth virtual session of the online training, held on **October 25, 2025**, was led by **Prof. N. S. R. Prasad, Assistant Professor, NIRDPR, Hyderabad**. His session focused on the **application of geoinformatics for planning, monitoring, and impact analysis of watersheds**, with practical examples from the field. He explained how geospatial technologies can support effective watershed management through real-time monitoring, data-driven decision-making, and performance evaluation. The session also showcased successful case studies demonstrating how GIS and remote sensing tools enhance the efficiency and sustainability of watershed development programmes.

The sixth virtual session of the online training, held on **October 27, 2025**, was led by **Dr. S. Kaliraj, Scientist, National Centre for Earth Science Studies**. His session focused on **creating various thematic maps from collected data** and **superimposing these maps for analysis to identify potential groundwater zones**. He

demonstrated practical techniques for integrating multiple data layers—such as geology, geomorphology, land use, and slope—to assess groundwater potential. The session also included successful case studies showcasing how thematic mapping and geospatial analysis can effectively guide groundwater recharge planning and management.

The seventh virtual session of the online training, held on **October 30, 2025**, was led by **Mr. Pradeep Kumar Mishra, Deputy Programme Manager, CSE**. His session focused on identifying groundwater recharge structures in different hydrogeological regions. He explained how variations in soil type, geology, topography, and rainfall influence the selection and design of recharge structures. The session also highlighted region-specific best practices and demonstrated how scientific assessment and geospatial tools can support effective planning and implementation of groundwater recharge interventions.

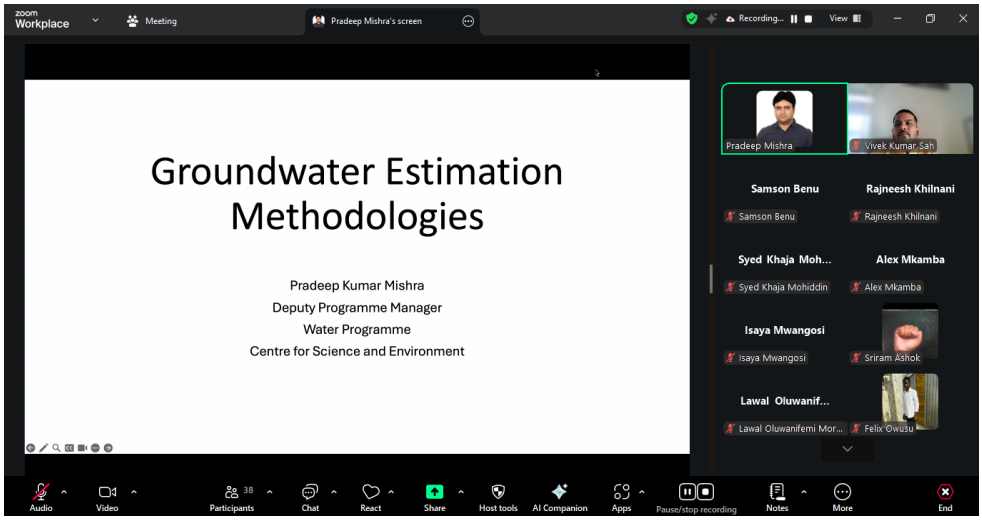
The eighth virtual session of the online training, held on **November 1, 2025**, was led by **Dr. Arijit Ghosh, Assistant Professor, Noida International University**. His session focused on data integration using Artificial Intelligence (AI) and Machine Learning (ML) for the prediction of groundwater potential zones in hard rock areas**.** He explained how AI and ML techniques can be applied to analyze complex hydrogeological datasets and improve the accuracy of groundwater potential mapping. The session also included examples of successful applications demonstrating the role of emerging technologies in advancing groundwater resource assessment and management.

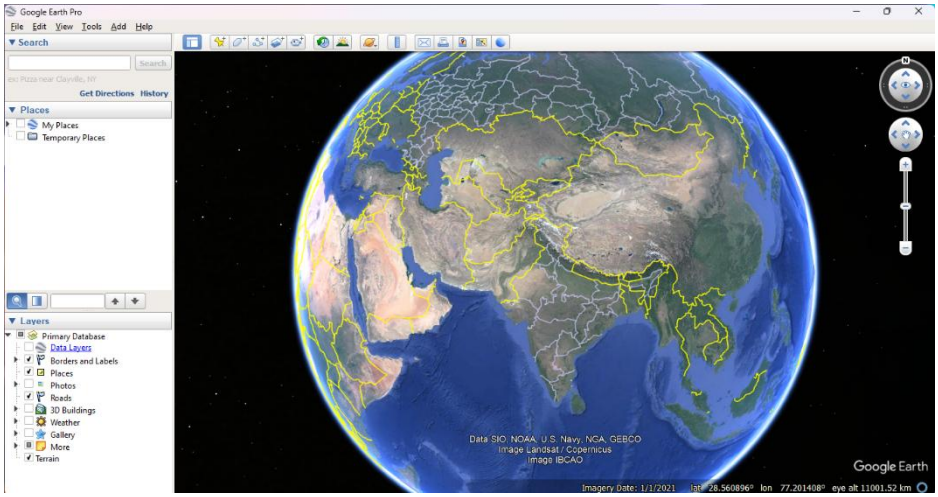
The ninth virtual session of the online training, held on **November 1, 2025**, was led by **Dr. Soumyaranjan Sahoo, Scientist, National Institute of Hydrology, Roorkee**. His session focused on an introduction to hydrological modeling and estimating surface runoff and groundwater recharge using the SWAT model. He explained the fundamental concepts of hydrological modeling, data requirements, and the practical applications of SWAT in watershed-scale analysis. The session also highlighted how modeling tools can support better water resource planning, management, and decision-making.

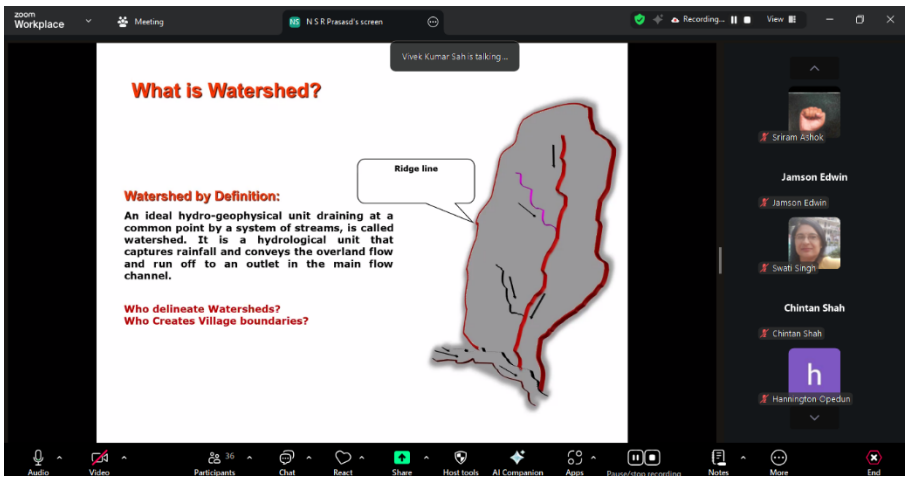
The tenth and last virtual session of the online training, held on **November 3, 2025**, was led by **Dr. Mushtaq Shaikh, Senior Geologist, GSDA, Maharashtra**. His session focused on Artificial Intelligence in Groundwater Management: Innovations, Challenges, and Future Prospects. He discussed how AI technologies are transforming groundwater monitoring and decision-making through data analytics, predictive modeling, and automation. The session also highlighted key challenges such as data limitations, technical capacity, and integration with existing systems, while emphasizing the potential of AI-driven solutions to enhance sustainable groundwater management in the future.

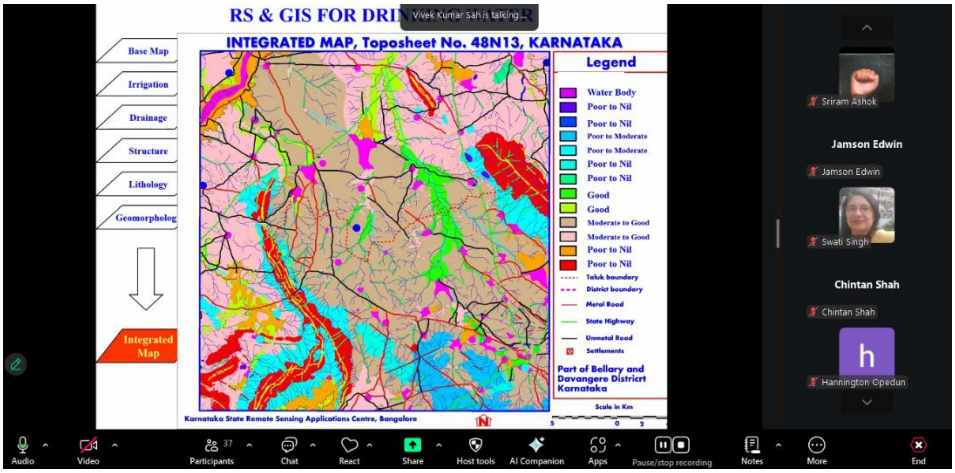
A **Q&A session** was also organized by the **CSE team** on **November 3, 2025**, to address participant's queries and clarify concepts covered during the training. The interactive session provided an open platform for participants to engage directly with experts and revisit key topics. The discussion encouraged experience-sharing among participants, fostering peer learning and deeper understanding. The CSE team also shared additional resources and practical suggestions based on the questions raised, making the session a valuable opportunity to reinforce learning and support the real-world application of the training content.

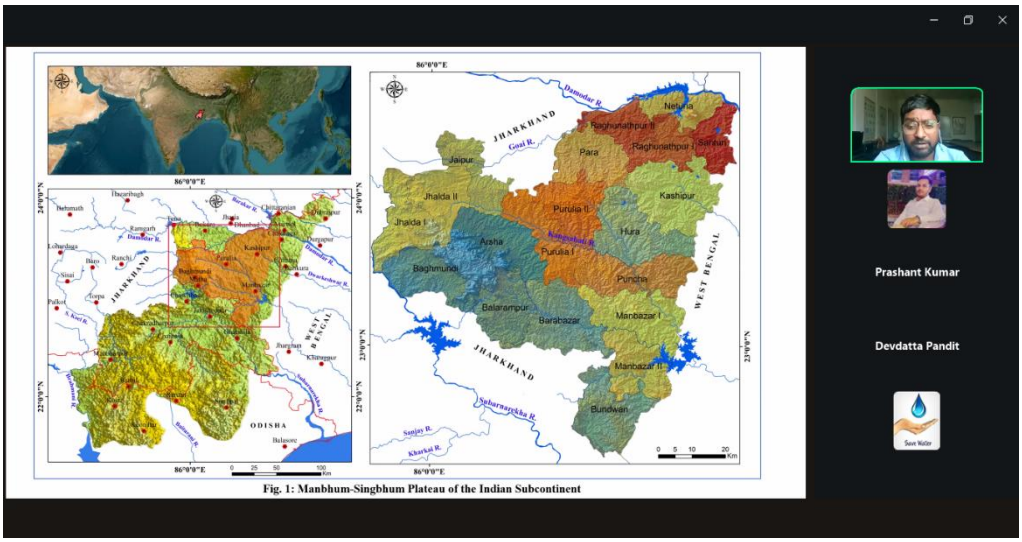
Snaps of the virtual sessions.

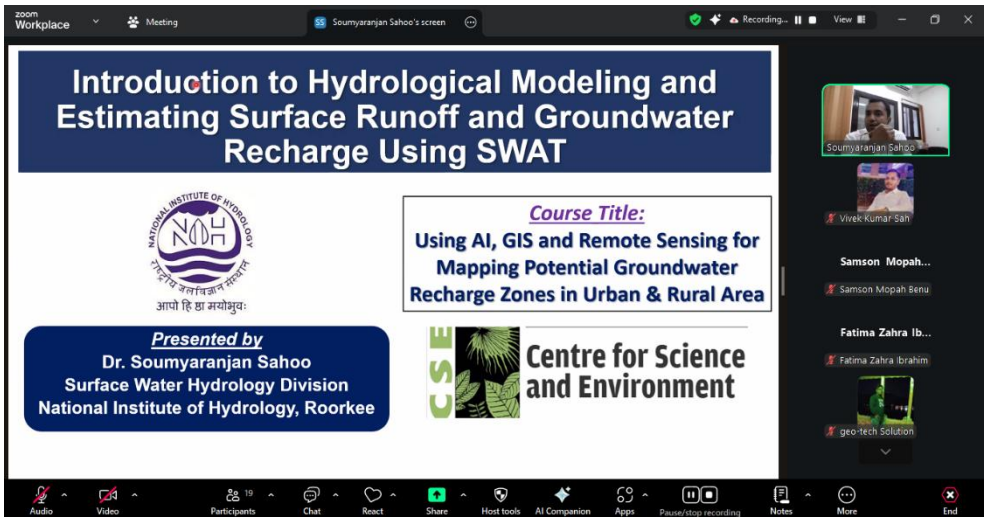


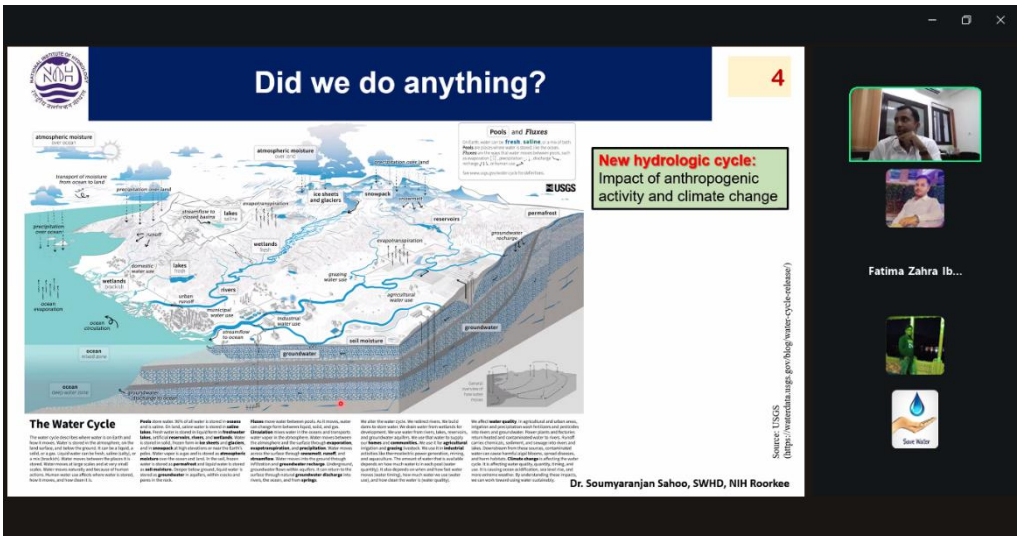


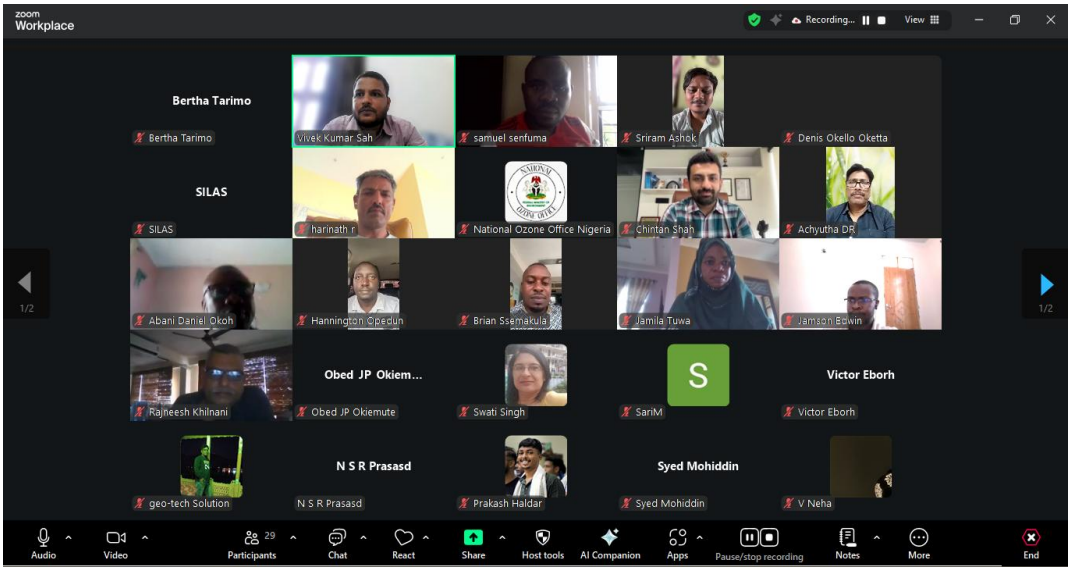

What is Watershed?
Ridge line
Watershed by Definition:
An ideal hydro-geophysical unit draining at a common point by a system of streams, is called watershed. It is a hydrological unit that captures rainfall and conveys the overland flow and run off to an outlet in the main flow channel.
Who delineate Watersheds?
Who Creates Village boundaries?
Vivek Kumar Sah is talking...
Sriram Ashok
Jamson Edwin
Swati Singh
Chintan Shah
Hannington Opedun


INTEGRATED MAP, Toposheet No. 48N13, KARNATAKA
Base Map
Irrigation
Drainage
Structure
Lithology
Geomorpholog
Integrated Map
Legend
Water Body
Poor to Nil
Poor to Moderate
Good
Moderate to Good
Taluk boundary
District boundary
Metal Road
State Highway
Unmetal Road
Settlements
Part of Bellary and Davangere Districrt Karnataka
Karnataka State Remote Sensing Applications Centre, Bangalore
Vivek Kumar Sah is talking...
Sriram Ashok
Jamson Edwin
Swati Singh
Chintan Shah
Hannington Opedun


JHARKHAND
WEST BENGAL
ODISHA
Jaipur
Jhalda II
Jhalda I
Purulia II
Purulia I
Arsha
Baghmundi
Balarampur
Barabazar
Manbazar I
Manbazar II
Bundwan
Para
Raghunathpur II
Raghunathpur I
Neturia
Kashipur
Hura
Puncha
Damodar R.
Goel R.
Kangsabati R.
Subarnarekha R.
Sanjay R.
Kharkai R.
Fig. 1: Manbhum-Singhbhum Plateau of the Indian Subcontinent
Prashant Kumar
Devdatta Pandit


Introduction to Hydrological Modeling and Estimating Surface Runoff and Groundwater Recharge Using SWAT
आपो हि ष्ठा मयोभुवः
Course Title:
Using AI, GIS and Remote Sensing for Mapping Potential Groundwater Recharge Zones in Urban & Rural Area
Presented by
Dr. Soumyaranjan Sahoo
Surface Water Hydrology Division
National Institute of Hydrology, Roorkee
Centre for Science and Environment
Soumyaranjan Sahoo
Vivek Kumar Sah
Samson Mopah...
Samson Mopah Benu
Fatima Zahra Ib...
Fatima Zahra Ibrahim
geo-tech Solution


Did we do anything?
4
New hydrologic cycle:
Impact of anthropogenic activity and climate change
The Water Cycle
Dr. Soumyaranjan Sahoo, SWHD, NIH Roorkee
Fatima Zahra Ib...


Bertha Tarimo
Vivek Kumar Sah
samuel senfuma
Sriram Ashok
Denis Okello Oketta
SILAS
harinath r
National Ozone Office Nigeria
Chintan Shah
Achyutha DR
Abani Daniel Okoh
Hannington Opedun
Brian Ssemakula
Jamila Tuwa
Jamson Edwin
Obed JP Okiem...
Obed JP Okiemute
Swati Singh
SariM
Victor Eborh
Victor Eborh
Rajneesh Khilnani
N S R Prasasd
N S R Prasasd
Prakash Haldar
Syed Mohiddin
Syed Mohiddin
geo-tech Solution
V Neha