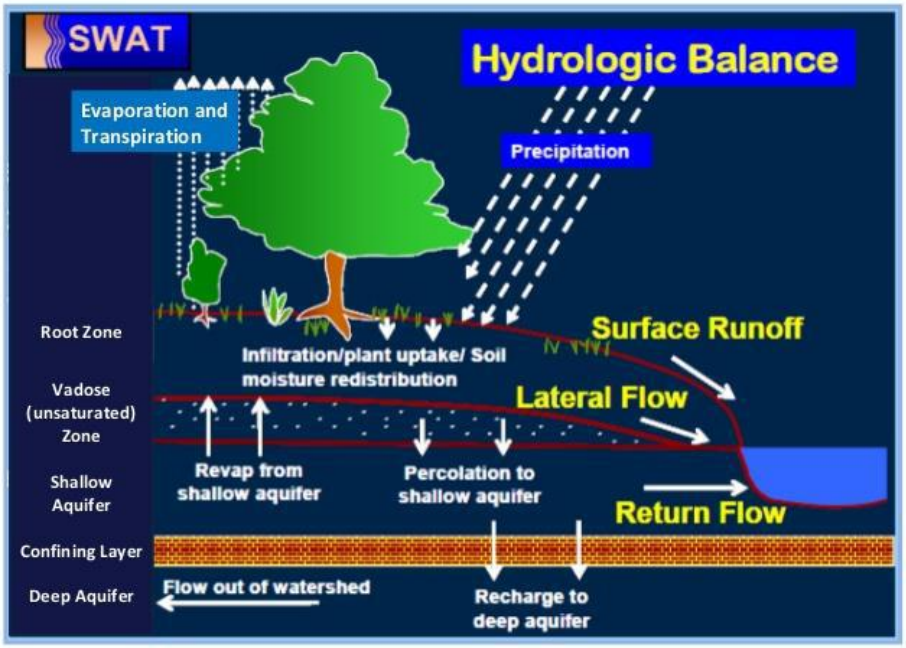
A BRIEF REPORT ON

NHP sponsored
Five-days online training course on

HYDROLOGICAL MODELING USING SWAT

(November 30 – December 04, 2020 at NIH, Roorkee)



Compiled by:

Dr Manish K Nema, Scientist-D
Dr Vishal Singh, Scientist-C

WATER RESOURCES SYSTEMS DIVISION
NATIONAL INSTITUTE OF HYDROLOGY
ROORKEE- 247667 (UTTARAKHAND)

Training Course Organizers

Director	Dr J V Tyagi
Nodal-Officer, NHP	Dr Sanjay Kumar Jain, Scientist-G
Training-Coordinator, NHP	Dr Anil K Lohani, Scientist-G
Course Coordinators	Dr Manish K Nema, Scientist-D Dr Vishal Singh, Scientist-C
Division	Water Resources Systems Division
Organisation	National Institute of Hydrology (NIH) Roorkee - 247667 (Uttarakhand)

TABLE OF CONTENTS

1.0 INTRODUCTION

Water is a vital natural resource. For planning, designing, execution and management of water resources efficiently, the hydrological modelling is an essential aspect of any development project. This training course is designed to impart and transfer the working knowledge of using a semi-distributed hydrological model called SWAT.

SWAT, a river basin or watershed scale model, is a physically-based, spatially distributed, continuous model that operates on a daily time step. It is a product of four decades of modelling efforts by USDA-ARS, USDA-NRCS and Texas A&M University. It was developed to predict the impact of land management practices on water, sediment and agricultural chemical yields in large complex watersheds with varying soils, land use and management conditions over long periods. It can incorporate the effects of tanks and the reservoirs/check dams off-stream as well as on-stream. The major advantage of SWAT is that it does not require much calibration. It, therefore, can be used on ungauged watersheds, can predict relative impacts of alternative scenarios such as changes in management practices, climate and vegetation on water quality and quantity. Model output includes all water balance components at the level of each watershed and is available at daily, monthly or annual time steps. SWAT model has been extensively used to address water resources and nonpoint-source pollution problems for a range of scales and environmental conditions across the globe.

SWAT typically uses the ArcSWAT interface to create its inputs that work in the licensed ArcGIS environment. The Quantum GIS (QGIS) is a free and open-source GIS that performs most GIS functions as in commercial GIS. Given its robustness and wide use in academic and professional environments, the present training course conducted using QSWAT, a QGIS interface for SWAT model.

2.0 OBJECTIVES

The training course was designed to introduce participants to QGIS, SWAT model and SWAT-CUP, mandatory and optional inputs to the model, preparation of database and set up of SWAT using QSWAT interface. The course covered many advanced topics including sensitivity analysis, model calibration, validation and uncertainty analysis using SWAT-CUP.

The course contents were designed for five days' duration devoted to SWAT set up including spatial and non-spatial data preparation, data input, model execution, and visualisation and interpretation of results using QGIS interface and model calibration and validation using SWAT-CUP. By the end of the course, the participants were capable of using the model on their own.

3.0 INAUGURATION

The five days training course was organised from November 30 to December 04, 2020, in online mode from NIH Roorkee. Dr JV Tyagi, Director, NIH inaugurated the training course, NIH in the gracious presence of the Dr Sanjay K Jain, Sci-G & Nodal-Officer-NHP and Dr Anil K Lohani, Sci-G & Training-Coordinator of NHP at 10:15 am on November 30, 2020. The function was presided over by Dr Manish K Nema, Sci.-D & Course Coordinator, WRS

Division, formally welcomed all the participants and briefly informed about the training course and its objectives. Nodal-Officer and Training-Coordinator of NHP have mentioned about the various activities of NHP and other training. The Director NIH briefed about the training and the SWAT modelling and various activities of NIH to the participants. Dr Vishal Singh, Sci-C offered a vote of thanks to all the attendee of the session.

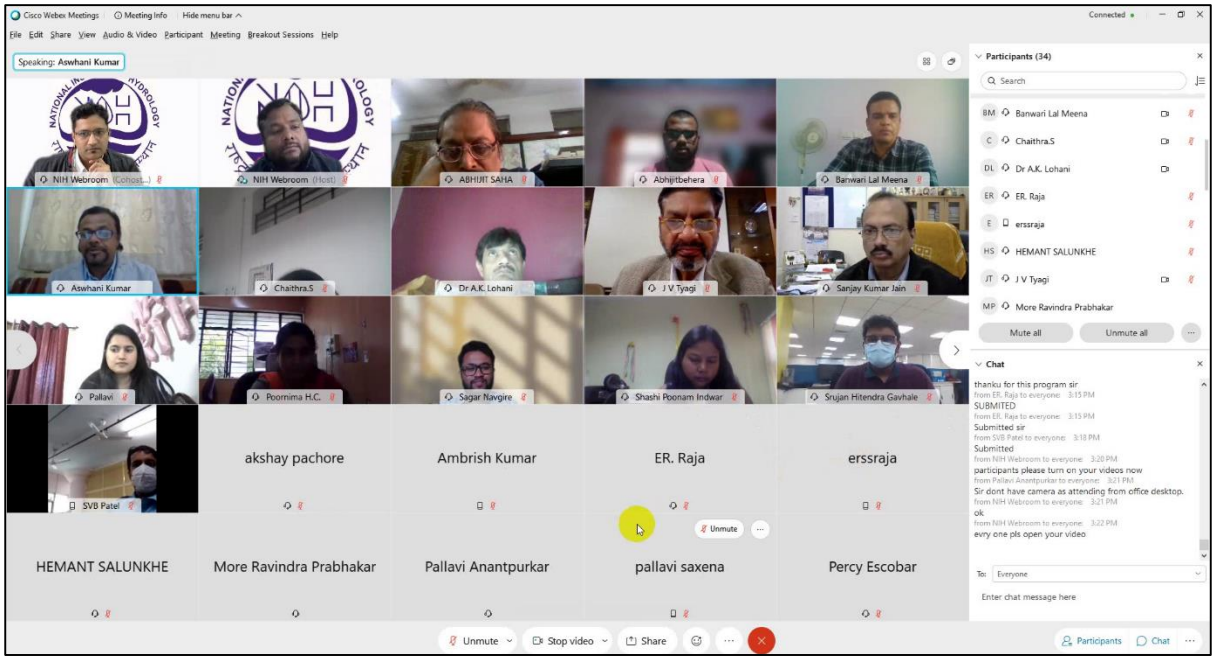


Fig. 1. The screen-shot during the Inauguration Session of the training

4.0 PARTICIPATION

This training course was sponsored by the National Hydrology Project (NHP) for the participants from various states and central PMU of NHP. A total of 103 registrations were received through the online portal of NHP MIS. After scrutiny, 54 participants have been selected for the training. Finally, a total of 32 Nos. of participants from 17 states and 3 central PMU have successfully completed the course. A list with various detail of participants is provided in Annexure-I

5.0 COURSE CONTENT AND FACULTY

The course consists of online lectures supported by hands-on sessions on computers to cover both theory and practice in the right proportion. The training lectures provided by the subject experts of National Institute of Hydrology, Roorkee. The course was conducted as a two-way interaction with the participants so that the problems and experiences of participants from academia as well as field organisations are shared. Broadly, the following topics were covered in the course:

- Basics of Hydrological modelling
- Introduction to QGIS;
- Data requirement of SWAT;

- Hands-on sessions for preparing spatial datasets for SWAT using RS and QGIS
- SWAT theory and model applications;
- Preparation of non-spatial data
- Introduction to QSWAT interface; model set up;
- Sensitivity, calibration/validation and uncertainty analysis using SWAT-CUP-SUFI2;
- Visualisation and interpretation of SWAT outputs.
- A Case Study of Snowmelt Runoff Modeling using SWAT

6.0 SCHEDULE

The duration of the training course was five days. The training courses included 08 lectures, 09 online tutorial and hands-on sessions, and one Multiple Choice Question (MCQ) based Online Test quiz session. The detailed schedule of the training course is given at Annexure-II.

8.0 FEEDBACK FROM PARTICIPANTS

The participants highly appreciated the smooth organisation and sound management of the training course. Online feedback was collected via filling Google-Form survey by the participants. Participants were agreed that the course content supported and delivered the training objectives, and the course provided opportunities to them for practising and reinforcing what was taught. The feedback suggests that the participants were happy about the course information provided was at an appropriate level to understand the learning objectives. The overall verdict on the training based on the feedback provided by the participants is shown in the Fig. below.

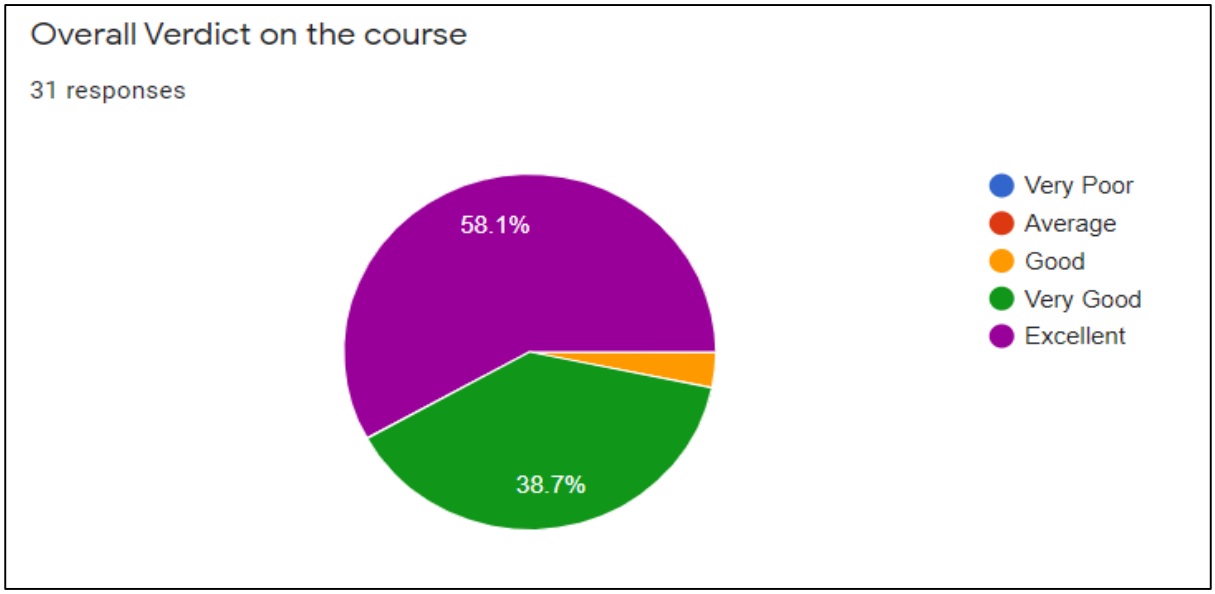


Fig. 2. The overall feedback of the training course

In their views, the instructors were knowledgeable about the course content and were responsive to questions and other needs. However, some of the participants expressed the need for more practical sessions, longer course duration, and to include more modelling contents, etc.

9.0 VALEDICTORY FUNCTION & CERTIFICATE DISTRIBUTION

The valedictory function of the training course was held on December 04, 2020, at 3:15 pm. Director, NIH was the chief guest of the session, and the session was graced by NHP officials. The Course Coordinator, Dr Manish K Nema, Sci.-D, WRSD, presented a brief report of the five days training course. During the valedictory function, few of the participants have also shared their learning experience during the training programme. Dr Vishal Singh, Sci-C, offered a vote of thanks to all the dignitaries and all the participants for their since participation. The training certificates to the participants have been sent by email. A sample of the training certificate, which was distributed to the participants, is enclosed in Annexure-III.

10.0 FINANCIAL ASPECTS

The total budgetary provision for the training course was Rs. 26750/- (Rs. Twenty-Six Thousand Seven Hundred Fifty only). A brief break-up of the expenditure is presented in the following Table 1:

Table 1 Total Budget of Training

Sl. No.	Items	Estimated expenditure (₹)
1.	Session Tea	1000/-
2.	Honorarium for Faculty (As per Annexure-I)	21750/-
3.	Memento	4000/-
	Sub-Total	**26,750**/-

ANNEXURE-I: LIST OF PARTICIPANTS

SN	Name	Designation	Department	State	Mobile No.	Email ID
1	Abhijit Behera	Research Assistant	Agricultural and Food Engineering	West Bengal	8847845575	Abhijitbehera91@gmail.com
2	Abhijit Saha	DIRECTOR, PEMC	Irrigation & Waterways Department	West Bengal	9433509798	ovijeet@rediffmail.com
3	Akshay Bajirao Pachore	JRF at CWPRS	River Rejuvenation	Maharashtra	8605190540	abpachore@gmail.com
4	Ambrish Kumar	Junior Engineer (Civil)	Water Resources Department	Jharkhand	9661536148	cauchyriemann2014@gmail.com
5	Anjana kansara	Assistant engineer	Water resources department	Rajasthan	9352121706	aerwslip.sirohi@gmail.com
6	Ashwani Kumar	Associate Professor	Education Department (CEPT University)	Gujarat	9925011279	ashwani@cept.ac.in
7	Bijendra Kumar Baghel	Deputy Director	Water Resources Department	Madhya Pradesh	9406568775	baghel.bijendrakumar@gmail.com
8	Banwari Lal Meena	Scientist B	Central Water & Power Research Station (CWPRS)	Maharashtra	9422538257	meena.banwarilal@gmail.com
9	Chaithra S	Assistant Engineer	Water resources development organization	Karnataka	9620507646	chaithra07@gmail.com
10	Hemant Hindurao Salunkhe	Assistant Professor	Civil Engg. Department	Maharashtra	8446064626	hemant.salunke@gmail.com
11	Lumboksing Nongphud	Junior Engineer (Civil)	Water Resources Department	Meghalaya	9774068964	lumbok.sing@gmail.com
12	Mala Vamshi Raj	Assistant Executive Engineer	Irrigation and CAD	Telangana	9704997842	iamvamshi.raj@gmail.com
13	Mohamed Niyaz J	Project Engineer	HPC - Scientific and Engineering Applications Group	Maharashtra	7758845654	mohamedniyaz3@gmail.com
14	Mohammad Zakir Hussain	Assistant Executive Engineer	WRD Surface Water	Andhra Pradesh	8008104265	zakirhussain_ce@yahoo.com
15	More Ravindra Prabhakar	Executive Engineer	Water Resources Department	Maharashtra	8637791890	rpmore1971@gmail.com

16	Pallavi Amol Anantpurkar	Sub-Divisional Engineer	Water Resource Department	Maharashtra	9975376526	pallavianantpurkar@gmail.com
17	Pallavi Saxena	Assistant Engineer	Water Resources Department	Madhya Pradesh	9977437703	pallavisatisaxena@gmail.com
18	Percy Escobar Soto	Assistant Executive Engineer	Damodar Valley Corporation (DVC)	West Bengal	9986697788	escobars.percy@gmail.com
19	Poornima H. C.	Assistant Executive Engineer	Water Resources Development Organization	Karnataka	9740027391	poornima073@gmail.com
20	Raja S	Executive Engineer	Water Resources Department	Tamil Nadu.	9894187062	erssraja@gmail.com
21	S. Monisha	Assistant Engineer	Water Resources Department	Tamil Nadu	8220762940	monishavave999@gmail.com
22	Sagar Suresh Navgire	Junior Engineer	Water Resources Department	Maharashtra	8237510397	sagarnavgire42@gmail.com
23	Sangeeta Meena	Assistant Engineer	Water Resources Department	Rajasthan	9549446625	tanurocks19@gmail.com
24	Santanu Jharimuni	College Faculty	Geography	West Bengal	8900717706	sanu.jharimuni@gmail.com
25	Shafeeullah S	Geologist	Water Resources Department,	Karnataka	9343237560	shafee_ulla@rediffmail.com
26	Shekhar Saini	SRA NIH ROORKEE	SWH Division NIH Roorkee	Uttarakhand	9761040606	shekharsaini606@gmail.com
27	Shilpi Maurya	Junior research fellow	Chemistry	Maharashtra	7985562402	Shilpi.maurya1994@gmail.com
28	Shruthi H.G	Assistant Engineer	Water Resource department	Karnataka	9620933212	shruthihg20@gmail.com
29	Srujan Hitendra Gavhale	Project Engineer	HPC : Scientific and Engineering Application	Maharashtra	9960367778	srujan1894@gmail.com
30	Sujoy Patra	Deputy Director (Dist. Plan)	Irrigation & Waterways Dept.	West Bengal	9432904738	sujoy.patra@gmail.com
31	Teiborlang Marwein	Junior Engineer	Water Resources Department	Meghalaya	8787576030	tbm1826@gmail.com
32	Yogeetha S	Assistant Engineer	Water Resources Development Organization	Karnataka	9036240416	yogeethawrdo@gmail.com

ANNEXURE-II: TRAINING SCHEDULE

TIME	TOPIC	FACULTY
DAY 1: 30.11.2020: MONDAY		
1000 - 1030	Inauguration of Course and Brief about the Training Course	
1030 - 1130	Hydrological Modeling	AKL
1130 - 1300	Introduction of SWAT Modeling and Data Requirements	JVT
1300 - 1430	Break	
1430 - 1530	Calibration and Validation in Hydrological Modeling	AKL
1530 - 1630	Introduction of GIS, Its Applications and QGIS Brief	MKN
DAY 2: 01.12.2020: TUESDAY		
1030 - 1130	Open Data Sources for Hydrological Modeling	VS
1145 - 1300	Demonstration of the SWAT Model	JVT
1300 - 1430	Break	
1430 - 1530	Tutorial and Hands-on Practice – SWAT Setup and Watershed Properties	VS/MKN
1530 - 1700	Tutorial and Hands-on Practice – SWAT HRU analysis, Weather Generator & Run	VS/ MKN
DAY 3 : 02.12.2020: WEDNESDAY		
1030 - 1130	Snowmelt Runoff Modeling using SWAT	VS
1145 - 1300	Tutorial – SWAT Snow Hydrology Module	VS/ MKN
1300 - 1430	Break	
1430 - 1530	Tutorial and Hands-on Practice – SWAT Run, SWAT Check & Visualization of Results	MKN/VS
1530 - 1700	Tutorial and Hands-on Practice – SWAT Data Editing and Re-run	MKN/VS
DAY 4 : 03.12.2020: THURSDAY		
1030 - 1130	Introduction of SWAT CUP, Model Parameterisation and Sensitivity Analysis using SUFI2	MKN

1145 - 1300	Tutorial and Hands-on Practice – SWAT CUP Database Preparation	VS/MKN
1300 - 1430	Break	
1430 - 1530	Tutorial and Hands-on Practice – SWAT CUP Calibration and Uncertainty Analysis– SUFI2-I	VS/MKN
1530 - 1700	Tutorial and Hands-on Practice – SWAT CUP Calibration and Uncertainty Analysis – SUFI2-II	VS/MKN
DAY 5 : 04.12.2020: FRIDAY		
1030 - 1130	Tutorial and Hands-on Practice – SWAT CUP Calibration and Uncertainty Analysis – SUFI2-III	MKN/VS
1145 - 1300	Tutorial and Hands-on Practice – SWAT CUP Calibration and Uncertainty Analysis – SUFI2-IV	MKN/VS
1300 - 1430	Break	
1430 - 1515	Multiple Choice Question-based Online Test for the Participants	MKN
1515 - 1545	Valedictory Function	

FACULTY:

JVT: Dr J V Tyagi, Director, NIH and Course Director

AKL: Dr Anil K. Lohani, Sci.-'G', NIH and NHP-Training Coordinator;

MKN: Dr Manish K Nema, Sci-'D', NIH and Course Coordinator

VS: Dr Vishal Singh, Sci.-'C', NIH and Course Co-coordinator

ANNEXURE-III: FORMAT OF CERTIFICATE

NIH/NHP/2020-21/T-8/22

NATIONAL HYDROLOGY PROJECT
NATIONAL INSTITUTE OF HYDROLOGY
ROORKEE

आपो हि ष्ठा मयोभुवः

CERTIFICATE

This is to certify that

Sangeeta Meena

has participated in the on-line training course on

"Hydrological Modelling Using SWAT"
November 30 – December 04, 2020

Organised by

National Institute of Hydrology (NIH), Roorkee
under
National Hydrology Project (NHP)

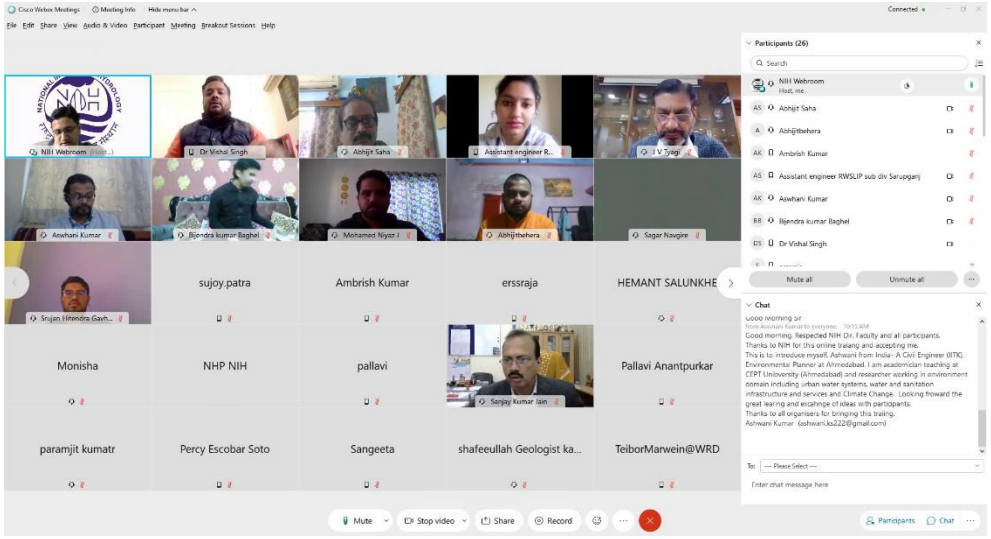
The aim of the Training course was to provide the participants with the necessary skills and knowledge on Hydrological Modelling with hands on training on SWAT model.

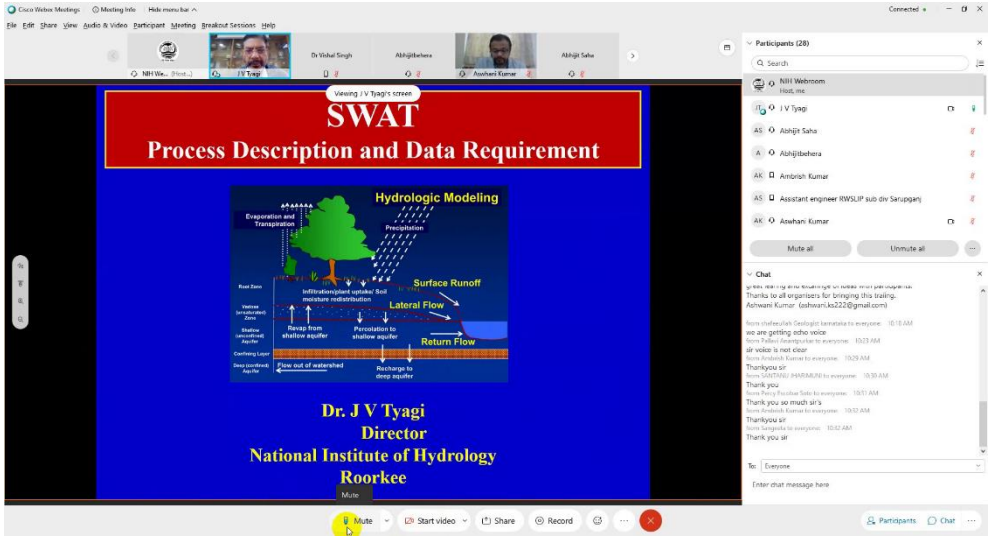
A.K. Lohani
Scientist G&Training Coordinator
National Institute of Hydrology, Roorkee

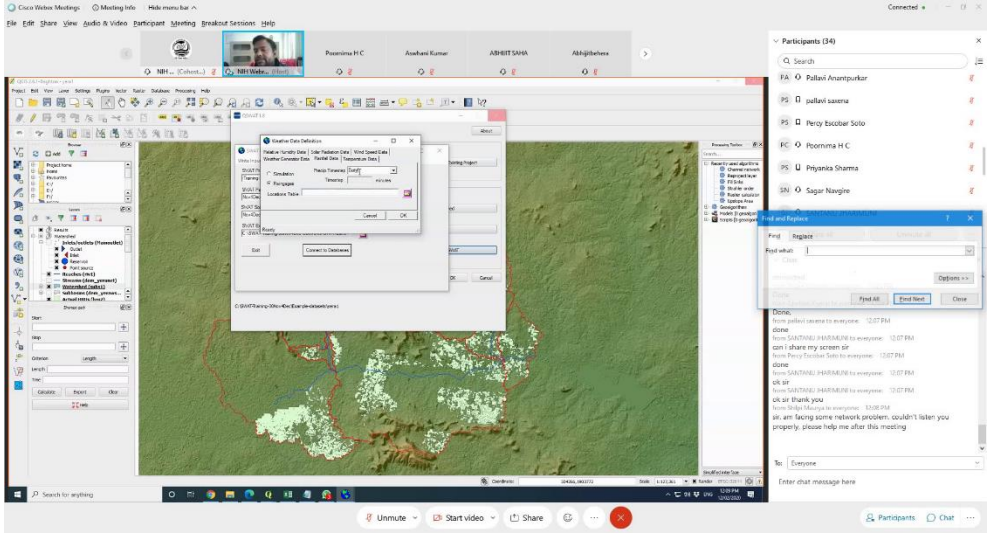
Sanjay Kumar Jain
Scientist G&Nodal Officer
National Institute of Hydrology, Roorkee

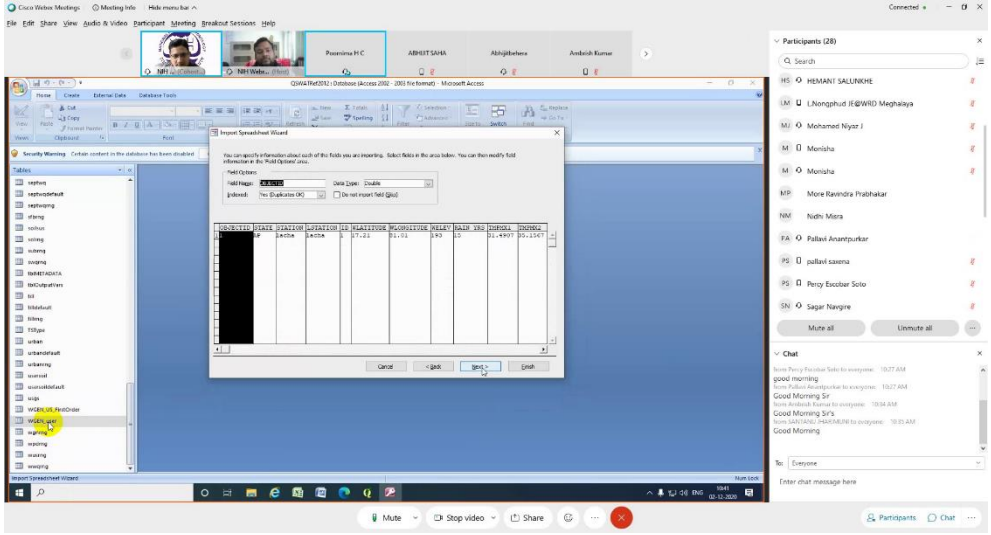
J.V. Tyagi
Director
National Institute of Hydrology, Roorkee

FEW GLIMPSES OF THE TRAINING COURSE









Few Glimpses of the Training Course