"Applied Groundwater Flow and Transport Modeling with MODFLOW"

Training Workshop

.....26 July 2018-03 August 2018@IIT Roorkee.....

Overview

The use of computer modeling tools has become a standard practice in many groundwater investigations. Groundwater resources evaluation, groundwater management, groundwater quality assessment, contamination site assessment and remediation, environmental impact review, and other groundwater related activities frequently rely on computer models as a means of understanding groundwater flow, groundwater-surface water interactions, groundwater budgets, and the fate of contaminants in the subsurface. This course introduces the conceptual principles and practical aspects of groundwater modeling in an intuitive yet comprehensive manner. The course objective is to demystify the use of groundwater models by providing solid understanding of the principles, methods, assumptions, and limitations of groundwater models, as well as hands on experience with the planning, preparation, execution, presentation, and review of a modeling project. The course reviews the concepts of groundwater flow and transport, and of finite difference and finite element methods. It then provides an overview of various software programs for groundwater flow and transport modeling and accompanying pre- and post-processing programs. The course includes hands-on exercises based on the USGS MODFLOW flow model and MODPATH and MT3D transport models. The course is taught by experienced instructors familiar with many aspects of groundwater modeling and California hydrogeology. At the end of the course, participants should be able to understand and actively engage in planning, supervision, and/or review of groundwater modeling projects.

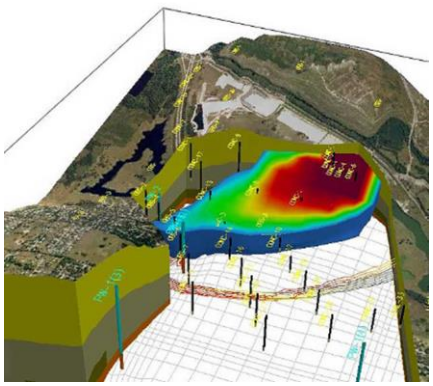
Objectives:

The key objectives of the course are for the participants:

1. To have a well-founded knowledge of the principles in groundwater flow and transport modeling.
2. To have familiarity with the major elements of groundwater modeling studies.
3. To gain hands-on experience in designing simple groundwater flow and transport studies with MODFLOW, MODPATH, and MT3D.
4. To be familiar with using popular groundwater modeling software.
5. To obtain fundamental understanding of the capabilities and limitations of groundwater modeling.
6. To understand the appropriate role of groundwater models in groundwater flow and contaminant transport assessment and management.

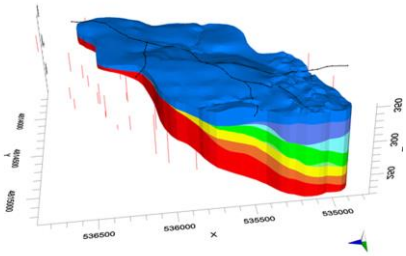
Modules	**A: Duration : July 26 - August 3, 2018** **B: Venue : Department of Hydrology, Indian Institute of Technology Roorkee**
You Should Attend If…	**Number of participants for the course will be limited. Total No. of Seat:30** • You are a student or faculty from academic institution dealing water related topics; • You are a civil/agriculture engineer, or environmental science interested in water quantity and quality issues in groundwater systems; interested in modelling of subsurface flow and solute transport. • You are a person from industry/research organization and interested in learning about Subsurface flow and groundwater contamination modelling.
Fees	The participation fees for taking the course is as follows: **Participants from abroad : US $400** **Industry : ₹ 10000** **Academic Institutions/Research Organizations: ₹ 5000 Research scholar/student: ₹3000** The above fee includes all instructional materials, computer use for tutorials and assignments, Laboratory equipment usage charges, free internet facility. The participants will be provided with accommodation on payment and availability basis.

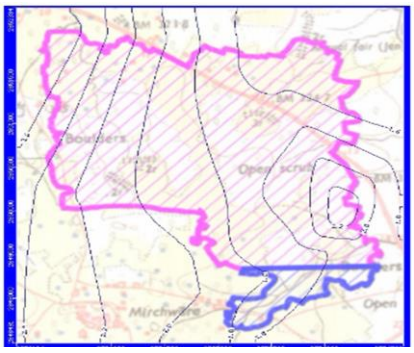
Course module



- Groundwater Fundamental; The Water Balance ‘Engine’ of Flow Models
- Principles of Modeling: Finite Difference, Finite Element
- The Drivers of Groundwater Flow: Boundary Conditions, Parameters
- Overview of Groundwater Modeling Software: MODFLOW and Groundwater Vistas, HYDRUS, COMSOL etc.

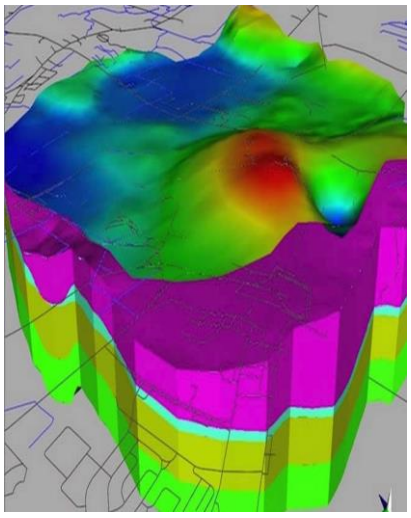
- Integrated flow modelling approach; integrating geological data, rock properties, with flow equations; different integration models
- Use of experiments in measuring parameters controlling flow in porous medium; focus on capillary pressure; relative permeability etc.; review of experimental methodology
- Equations governing basics of flow and transport in porous medium; review and derivations





- Numerical modelling of subsurface flow; Designing numerical and steady state models; Transient Flow Simulation: time-stepping, rewetting
- Numerical discretization, Open source codes; capabilities and limitations of the tools,
- Particle Path Tracking for Source Area Determination and Simplified Contaminant Transport Modeling

- MODFLOW boundary conditions, packages/sinks and sources
- Transport Modeling with MT3D, Sensitivity Analysis, Calibration and Validation
- Hand on training with the different experimental setups used in contamination transport investigation.
- Case studies examples: Management and remediation of contaminated sites.
- Case-studies examples; worked example of setting up a numerical model for flow and transport using one of the tool; plot results



The Faculty

Prof. Thomas Harter, Ph.D., received a B.S. in hydrology from the Universities of Freiburg, Germany and a M.S. in hydrology from the University of Stuttgart, Germany. He received his Ph.D. in hydrology (with emphasis on subsurface hydrology) at the University of Arizona. In 1995, he joined the faculty at the Department of Land, Air, and Water Resources, University of California, Davis.

Prof. Harter is in charge of the University of California Cooperative Extension Groundwater Hydrology Program. His research focuses on nonpoint-source pollution of groundwater, groundwater resources evaluation under uncertainty, groundwater flow modeling, and contaminant transport. Dr. Harter has done extensive modeling of integrated groundwater – surface water systems at the basin scale, heterogeneous aquifer/vadose zone systems, and contaminant transport, from the field scale to the site scale and to the basin scale.

Dr. Brijesh Kumar Yadav is an Associate Professor at Department of Hydrology, IIT Roorkee since June 2012. He is an awardee of the prestigious Ramanujan Fellow by Government of India and has received many research and constancy projects from various funding agencies.

Dr. Yadav received his B.E. in Agricultural Engineering from CTAE Udaipur and completed M.Tech. in Civil Engineering (Water Resources) from IIT Delhi. Subsequently, he started his doctoral work at IIT Delhi on "Mathematical Model of Phytoextraction for Contaminated Soils". In November 2006, he moved to UNESCO-IHE (Institute for Water Education) Delft, Netherlands and worked on his PhD research with the Pollution Prevention and Control group in the Environmental Resources Department for two years. Then he moved to Utrecht University, Netherlands for his postdoctoral work with Environmental Hydrogeology group in Department of Earth Sciences. Subsequently, he worked at University of California, Davis from July-December 2010 on subsurface modeling. From January 2011- June 2012, Dr. Yadav was working as a Ramanujan fellow in Department of Civil Engineering at IIT Delhi before joining the faculty position at IIT Roorkee.

In addition, he is teaching an undergraduate (Engineering hydrology) and postgraduate courses: 1) Groundwater hydrology, 2) Water resources system analysis, and 3) Soil-water contamination modelling along with supervision of PhD and M.Tech. students at IIT Roorkee. His current research focuses on multiphase flow modelling, soil water flow and solute transport analysis, Nonpoint source pollutant movement through deep and heterogeneous vadose zone, Phytoremediation of heavy metal polluted sites, Bioremediation of hydrocarbon polluted soil and groundwater resources, CO_2 sequestration in subsurface and risk analysis. Dr. Yadav has published more than 20 peer reviewed international journals and made about 35 presentations at various international conferences/workshops.

ABOUT ROORKEE

Roorkee is a part of the State of Uttarakhand and is located at the foothills of Himalayas. Roorkee Railway Station is on the main line of Northern Railways having direct links to Delhi, Mumbai, Calcutta, Amritsar, Jodhpur and Shri Ganga Nagar. The place is also within easy reach by road from Del hi (200 km) and Chandigarh (18 0 km). It is located on Delhi – Haridwar and Delhi – Dehradun bus routes.

Course Co-ordinator

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1st GIAN Training Workshop on “Remediation & Management of Polluted Groundwater Sites”

2nd GIAN Training Workshop on “Integrated Modeling of Subsurface Flow and Solute Transport in Porous Media-Challenges and Opportunities”

REGISTRATION AND
ACCOMODATION REQUEST FORM
(To reach electronically by 01 July 2018)

Department of Hydrology, Indian Institute of Technology Roorkee
Roorkee, Uttarakhand

After Completion, please send hard copy to:

Dr. Brijesh Kumar Yadav, **Department of Hydrology, IIT Roorkee** **Roorkee – 247 667 (Uttarakhand)** **Phone: (01332)284755, Fax: (01332) 2273560** **Email: brijeshy@gmail.com** **brijkfhy@iitr.ac.in** **Mobile: +91-8979534484**	Affix passport size photograph

1. Name of applicant (in block letters): Ms./Mr.……

2. Designation.....
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3a. Residential address with pin code

Tel:
Mobile:

3b. Official address with pin code

Phone (Off.) Fax: Email:
Fax: Email:

3c. Name of the Institute where employed

3d. Name of the Department

4. Highest Academic Qualification
5. Branch of Specialization
6. Teaching Experience in Years

7. Needs of Accommodation: Yes/No
Types: AC Single/AC Double/Non-AC Single

8. Fee Detail: a) DD No. ……..Date:……..Bank:……..

Date: **Signature of applicant**

Note:

(i) Application should reach DOH Office at the above address latest by 15th Dec., 2016. Scanned copy must be sent by e-mail.
(ii) Accommodation facilities will be provided inside the IIT Roorkee campus on payment basis only.
(iii) Please come to Roorkee to attend the workshop, only if you have received intimation.