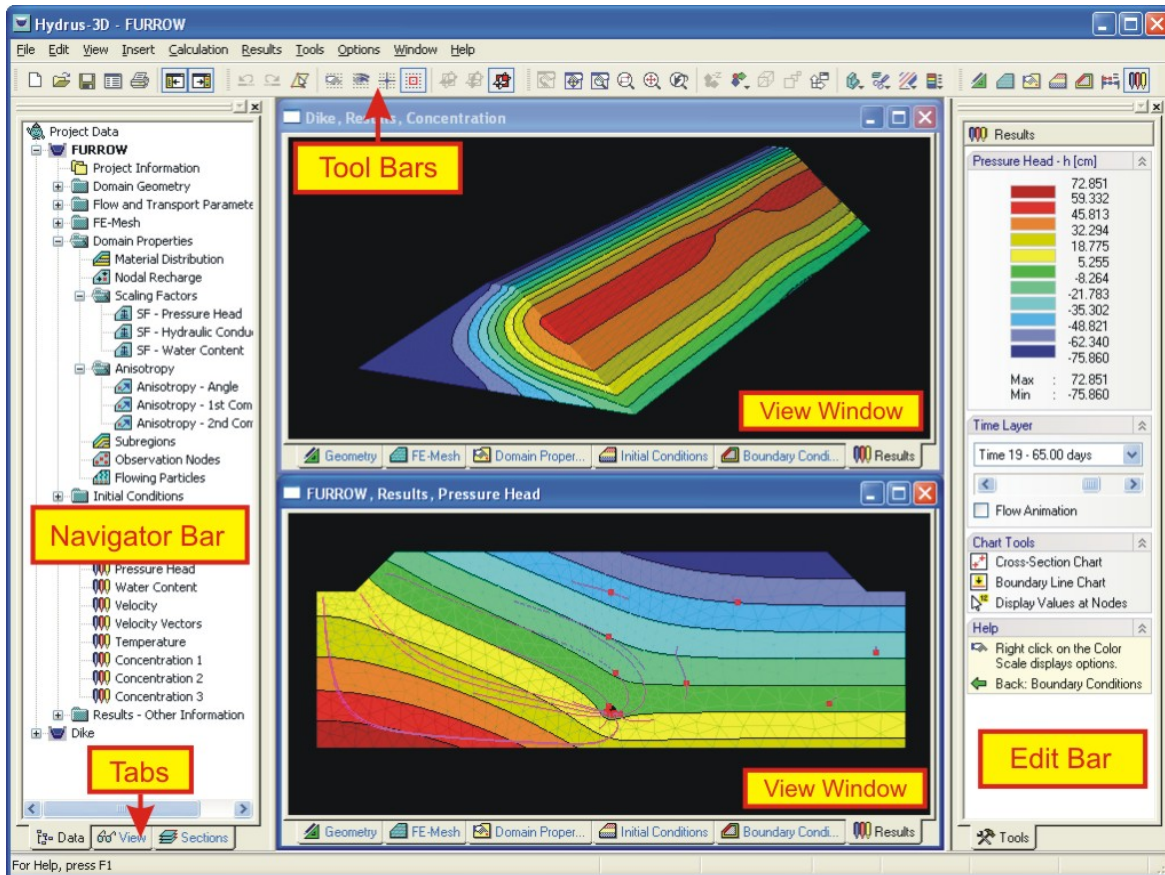


APPLIED MODELING OF WATER FLOW AND CONTAMINANT TRANSPORT IN THE VADOSE ZONE



Instructor:

Dr. Jirka Simunek
University of California Riverside, USA

Venue:

Flinders University, Adelaide , Australia
July 5& 6, 2007

Organisers:

Drs Tapas Biswas, Gerrit Schrale & John Hutson
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South Australian R&D Institute, CRC for Irrigation Futures & Flinders University
GPO Box 397, Adelaide SA 5001
AUSTRALIA

APPLIED MODELING OF WATER FLOW AND CONTAMINANT TRANSPORT IN THE VADOSE ZONE USING HYDRUS COMPUTER SOFTWARE PACKAGES

OVERVIEW

The HYDRUS modelling package is increasingly becoming the 'Standard' tool for modelling variable saturated (coupled saturated and unsaturated) flow in porous media; it is being used world wide by government agencies, consultants, and universities. The software is robust and its reliability has been proven during the past decade. It is the perfect tool for modelling water flow and solute transport under precision irrigation; its time-marching scheme allows modelling the flow problem in real time (e.g., we can investigate the spatial and temporal distribution of drippers).

Water flow and associated chemical transport through unsaturated soil zone (vadose) also control the quantity and quality of water flow to groundwater and surface streams. Soil and groundwater pollution is an ever-increasing, worldwide problem. Most subsurface pollution problems stem from activities involving the vadose zone between the soil surface and the groundwater table. Once contaminants enter groundwater, pollution is essentially irreversible, or can be remediated only with extreme costs.

This course is designed to familiarize participants with the principles and mathematical analysis of variably-saturated flow and transport processes, and the application of state-of-the-art numerical codes to site-specific subsurface flow and transport problems.

COURSE DESCRIPTION

The course begins with a detailed conceptual and mathematical description of water flow and solute transport processes in the vadose zone, followed by a brief overview of the use of finite element techniques for solving the governing flow and transport equations. Special attention is given to the highly nonlinear nature of the governing flow equation. Alternative methods for describing and modeling the hydraulic functions of unsaturated porous media are also described.

"Hands-on" computer sessions will provide participants an opportunity to become familiar with the Windows-based STANMOD, HYDRUS-1D and HYDRUS (2D/3D) software packages. Emphasis will be on the preparation of input data for a variety of applications, including flow and transport in a vadose zone, variably-saturated flow through a dam, flow and transport to a tile drain, and two-dimensional leachate migration from a landfill through the unsaturated zone into groundwater. Calibration will be discussed and demonstrated by means of both one- and two-dimensional inverse problems.

COURSE SOFTWARE

The course introduces a new generation of Windows-based numerical models for simulating water, heat and/or contaminant transport in variably-saturated porous media. These include the HYDRUS-1D and HYDRUS (2D/3D) codes for one- and two-dimensional simulations, respectively, the STANMOD code for evaluating solute transport in the subsurface using one- and multi-dimensional solutions of the advection-dispersion equation, the RETC code for evaluating the hydraulic properties of unsaturated media, and the Rosetta code for estimating the soil hydraulic properties (and their uncertainty) from soil texture and related data. HYDRUS-1D and HYDRUS (2D/3D) are supported by interactive graphics-based interfaces for data-preprocessing, generation of unstructured as well as structured finite

element grid systems, and graphic presentation of the simulation results. Except for HYDRUS (2D/3D), all software packages are in the public domain.

COURSE HANDOUTS

Course handouts include lecture notes prepared by the instructor. Documentation of the RETC, STANMOD, HYDRUS-1D and HYDRUS-2D models is on a CD that will be given to each course participant.

INSTRUCTOR

Dr. Jirka Simunek is a Professor of Hydrology with the Department of Environmental Sciences of the University of California. His expertise is in numerical modeling of subsurface water flow and solute transport processes, equilibrium and nonequilibrium chemical transport, multicomponent major ion chemistry, field-scale spatial variability, and inverse procedures for estimating the hydraulic properties of unsaturated porous media. His numeric models, HYDRUS-1D and HYDRUS-2D, are used by virtually all scientists, students, and practitioners modeling water flow, chemical movement, and heat transport through variably saturated soils. He has authored and coauthored over 100 peer-reviewed publications and over 20 book chapters. Dr. Simunek is a recipient of the Soil Science Society of America's Don and Betty Kirkham Soil Physics Award and serves currently as chair-elect of the Soil Physics (S1) of SSSA. He is an associate editor of Water Resources Research, Vadose Zone Hydrology, and Journal of Hydrological Sciences.

COURSE LOCATION

The course will be held in the Computer Lab, Rm. 2030, Physical Sciences Building at the Flinders University, Sturt Road, Adelaide. A map of the campus can be found at <http://www.flinders.edu.au/map/>. A city and campus map will be sent to you upon request.

ENROLMENT & REGISTRATION

Enrollment is limited. Please register by sending the duly filled in attached registration form to Pauline Bowden: Bowden.Pauline@saugov.sa.gov.au or by fax: 08-830339424. All enquiries to Dr Tapas Biswas at biswas.tapas@saugov.sa.gov.au or by phone: 08-83039730.

The fee for the short course is \$650 paid by 1st June and thereafter \$750 till 15th June. Fee covers instruction, course notes, refreshments, and certificate of participation. A dinner is planned for all the workshop participants on the night of 5th July. Lodging and outside workshop meals are not covered.

TRANSPORTATION AND LODGING

The Flinders University campus is located in Bedford Park, just south of the Central Business District of Adelaide, the capital city of the State of South Australia. It is 30 min drive from the Adelaide International/Domestic Airport and can be reached by taxi or rental car. Participants are encouraged to stay at the Arkaba Hotel (<http://www.arkabahotel.com.au>). Please see details in the attached registration/accommodation form. Alternately you can arrange your own accommodation. A bus will be available to transport participants from the Arkaba Hotel to the Flinders University.

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COURSE OUTLINE

4 July 5:00 – 8:00 PM Arkaba Hotel, Adelaide

Registration & Welcome
Nibbles and Drinks

5 July 8:30 AM-6:00 PM Flinders University, Adelaide

Registration and software installation
Official Opening

Morning Tea

Lecture 1: Conceptual and mathematical description of variably-saturated water flow and solute transport processes, root-water uptake, nonequilibrium transport, decay chains, initial conditions, boundary conditions;

Lecture 2. Analytical modeling of solute transport in the subsurface, equilibrium and nonequilibrium transport models, parameter estimation.

Computer session 1: Modeling subsurface solute transport using the STANMOD code; direct and inverse applications.

Lunch

Lecture 3: Review of the hydraulic properties of unsaturated porous media; measurement, description, parameter estimation.

Lecture 4: Review of numerical methods for solving the variably-saturated water flow and solute transport equations; Application of finite element method to 1D flow and transport; The HYDRUS-1D software package - model structure and examples.

Computer session 2: Application of HYDRUS-1D to simple one-dimensional problems.

Afternoon Tea

Lecture 5: Inverse modeling; application of HYDRUS-1D to laboratory and field experiments.

Computer session 3: Advanced one-dimensional forward and inverse problems with HYDRUS-1D.

Dinner 7:15 PM Arkaba Hotel, Adelaide

6 July 8:30 AM-5:30 PM Flinders University, Adelaide

Lecture 6: Application of finite element method to 2D variably-saturated water flow and solute transport; The HYDRUS (2D/3D) software package - model structure, examples; Pre-and post-processing with HYDRUS (2D/3D) using the finite element mesh generator.

Computer session 4: Application of HYDRUS (2D/3D) to simple one-dimensional problem.

Morning Tea

Computer session 5: Application of HYDRUS (2D/3D) to simple two-dimensional problem.

Computer session 6: Application of HYDRUS (2D/3D) to complex two-dimensional problem A.

Lunch

Computer session 7: Application of HYDRUS (2D/3D) to complex two-dimensional problem B.

Afternoon Tea

General session: Other applications; discussion

Applied Modeling of Water Flow and Contaminant Transport in the Vadose Zone - 5 & 6 July 2007

REGISTRATION FORM

Limited to 30 persons only (first come first serve basis)

To be returned to Pauline Bowden by email to bowden.pauline@saugov.sa.gov.au or fax on (08) 83039424

Please enter your details below.

Details

Family Name:

Given Name:

Title:

Gender:

Preferred Name for Badge:

Department:

Institution:

Postal Address:

(institution address)

Telephone:

Fax:

Email:

Accompanying person's name:

Accompanying person is responsible for own cost of dinner \$50

Official Dinner

Venue:

Arkaba Hotel- Glen Osmond Room

Start Time:

6.45pm for a 7.15pm start

Attendance:

Yes, I will attend

Number of persons

No, I won't attend

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Registration Fees

Please keep a copy of this registration as your tax invoice

All fees are quoted in Australian Dollars (\$AUD) inclusive of GST (Goods and Services Tax).

This fee includes the cost of the official dinner to be held on 5 July

Registration Type

Normal Delegate	\$650.00	RECEIVED BY 1/06/07
Normal Delegate Late	\$750.00	RECEIVED BY 15/06/07
Accompanying Person	\$ 50.00	Dinner only, no registration

The completed registration form will be processed only if accompanied by full payment of fees.
Payments will be accepted by **Cheque, Visa or MasterCard.**

Option 1 Cheque Cheque enclosed for \$

Please cross all cheques "Not Negotiable" and make payable to Primary Industries and Resources SA

Option 2 Credit Card ***PLEASE ENSURE YOU ENTER ALL 16 DIGITS OF YOUR CARD CLEARLY***

Visa		Card Holders Name	
MasterCard		Card Number	
		Expiry Date	
		Cardholders Signature	

TOTAL AMOUNT TO BE DEBITED \$

Please do not send cash, however money orders and cheques will be received with no liability accepted.

Send to:
SARDI Sustainable Systems
C/- Pauline Bowden
GPO Box 397, ADELAIDE SA 5001

Accommodation

All rates listed are inclusive of GST and are per room/per night including continental buffet breakfast.

Arkaba Hotel (http://www.arkabahotel.com.au), 150 Glen Osmond Road, Fullarton (08) 8338 1100			
Charges are Corp Rate	Single Occupancy	Twin share	Smoking/ Non Smoking
Standard	\$120.00	\$135.00	
New Deluxe No Spa	\$135.00	\$150.00	
New Deluxe with Spa	\$145.00	\$160.00	
Executive	\$150.00	\$165.00	
Luxury	\$165.00	\$180.00	

It is your responsibility to arrange payment for your accommodation.

Closing date for bookings is 7 June 2007

Bookings

Number of persons:

Number of nights:

Arrival date:

Departure date:

Accommodation Choice

	Standard	New Deluxe NS	New Deluxe WS	Executive	Luxury
Single Room:					
Twin Share:					
Share persons Name					

To secure your preferred choice of accommodation it is advisable to register your preferences as soon as possible. Please list 1st preference, 2nd preference and 3rd preference for Accommodation types. Organising room sharing is a good way to keep accommodation costs down.

Enquiries and changes to bookings:

All enquiries regarding accommodation booking and its changes should be made through Pauline Bowden, bowden.pauline@saugov.sa.gov.au or fax on (08) 83039424 not directly to the hotel

Hotel check in / out times: check in time: 2.00 PM and check out time: 11.00 AM

Transport

You will be responsible for your own transport to and from the Arkaba Hotel.

A bus will be available to transport participants from the Arkaba Hotel to the Flinders University (see below)

Arkaba to Flinders Uni

5-Jul	ETD 8.00 am	ETA 8.30 am
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Flinders Uni to Arkaba

5-Jul	ETD 6.10 pm	ETA 6.40 pm
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Arkaba to Flinders Uni

6-Jul	ETD 8.00 am	ETA 8.30am
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Flinders Uni to Arkaba

6-Jul	ETD 5.45 pm	ETA 6.15 pm
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