Partially-saturated flow and transport; HYDRUS; HP1; Upscaling; Pore-Network Modeling — Utrecht University, July

Scope

Migration of solutes, nanoparticles, and colloids in the subsurface is affected by a multitude of complex, interactive physical, geochemical and microbiological processes. Simulation of these processes requires knowledge of physical processes of partially-saturated water flow and convective-dispersive solute transport with a range of biogeochemical processes. Computational modeling is an extremely valuable tool for analyzing such complex problems.

Upscaling from pore to core

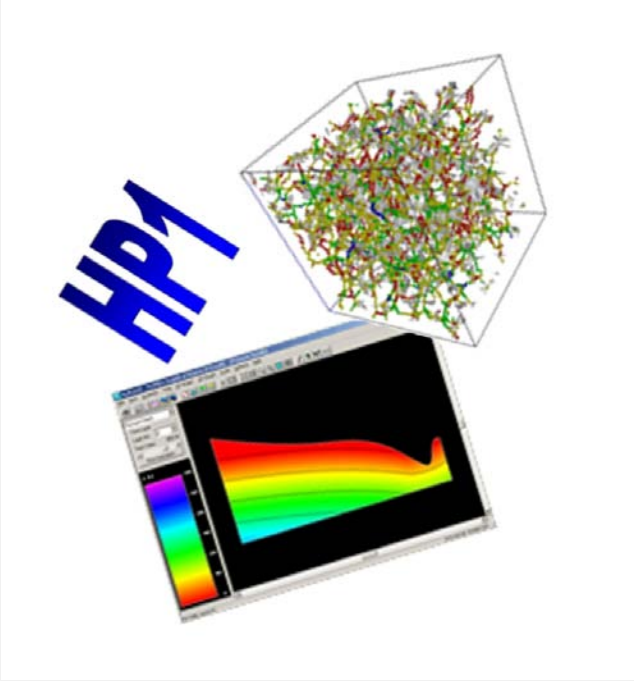
For understanding reactive transport process in complex porous media, it is crucial to identify and understand flow and transport processes at the microscopic (pore) scale, and then try to describe their manifestation at the continuum (core and field) scale. A powerful approach for transferring pore-scale information to the larger scale, and establishing relationships among the scales, is pore-scale modeling. Using pore-scale modeling, one can simulate flow and transport in detail by explicitly modeling mass transfer across interfaces and mass fluxes through pores. Micro-scale hydrodynamic and reactive processes can be explicitly modeled in detail and their effects at the larger scale quantified.

In this course

This course is designed to familiarize participants with the principles and numerical analyses of partially-saturated flow and coupled multi-component reactive transport, as well as application of state-of-the-art numerical codes at both the pore and continuum scales. Applications to solute transport, virus and colloid transport, and biodegradation will be discussed in detail. Although participants should have a general background in the principles of subsurface hydrology, the course gives an introduction to some theoretical aspects of water flow, solute transport. Hands-on computer sessions will familiarize participants with the basic use of the software packages.

Course Software

The course introduces a number of Windows-based numerical modeling software packages for simulating water, heat, and/or contaminant transport in partially-saturated porous media. These include the HYDRUS-1D and HYDRUS (2D/3D) codes, PHREEQC-2 for geochemical calculations, and HP1 for one-dimensional biogeochemical fate and transport.



Lecturers

Al Cunningham, Center for Biofilm Engineering, Montana State University, Bozeman, Montana, USA.

Niels Hartog, Deltares-Soil and Groundwater Systems, Utrecht Area, Netherlands.

Diederik Jacques, Performance Assessment Unit, Institute of Environment, Health, and Safety, Belgian Nuclear Research Centre, Mol, Belgium.

Yan Jin, Department of Plant and Soil Sciences, University of Delaware, Newark, Delaware, USA.

Jack Schijven, Microbiological Laboratory for Health Protection, National Institute of Public Health and the Environment, Bilthoven, Netherlands

Jirka Simunek, Department of Environmental Sciences, University of California, Riverside, California, USA.

Martinus Th. van Genuchten, Department of Mechanical Engineering, Federal University of Rio de Janeiro, RJ, Brazil.

Amir Raoof, Faculty of Geosciences, Utrecht University, Utrecht, Netherlands.

S. Majid Hassanizadeh, Faculty of Geosciences, Utrecht University, Utrecht, Netherlands.

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Programme

Module 1, (2-4 July):

DAY 1
- An overview of vadose zone flow and transport modeling
- Introduction to HYDRUS software packages

DAY 2
- On the characterization and measurement of the hydraulic properties of unsaturated porous media
- Application of HYDRUS-1D to direct problems
- Parameter estimation and inverse modeling with HYDRUS
- Application of HYDRUS-1D to inverse problems

DAY 3
- Application of HYDRUS (2D/3D) to simple two dimensional problems
- HYDRUS practicals and general HYDRUS sessions

Module 2, (5-9 July):

DAY 4
- Fundamentals of mass transfer between phases
- Introduction to biogeochemical equilibrium and reactive transport modeling
- Introduction to PHREEQC and HP1

DAY 5
- Chromatograhic transport of major cations
- Applications in PHREEQC and HP1
- Pore Network modeling, introduction
- Virus transport

DAY 6
- Pore Network modeling, unsaturated
- Virus transport
- Biodegradation

DAY 7
- Pore Network modeling, upscaling
- Virus transport
- Biodegradation

DAY 8
- Biodegradation

Target audience

The course is intended for graduate students, researchers and professionals wishing to expand their knowledge of water flow, contaminant transport and biogeochemical reactions in variably-saturated porous media.

Registration

Please register via
http://www.geo.uu.nl/hydrogeology/reactive

Registration fee (includes lodging, lectures, course material, refreshments, lunches, and conference dinner):

Early bird registration fee (till April 12th):
Module 1: €200; Module 2: €750
Both modules: €900

Regular registration fee: Module 1: €250; Module 2: €900
Both modules: €1100

There is a 15 % discount for student members of the International Society for Porous Media (InterPore), http://www.interpore.org/

Computer exercises will be carried out on your own personal laptops. Please inform us if you are not able to bring your own laptop.

Venue and Lodging

The Summer School will be held at the TNO/Deltares Auditorium and Boothzaal of the Main Library of the Utrecht University.
Lodging will be provided at Utrecht University Campus dormitories, De Uithof, Utrecht.

Information:

Visit http://www.geo.uu.nl/hydrogeology/reactive

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Upscaling and modeling of reactive transport in partially-saturated porous media

2-9 July, 2010
Utrecht University
The Netherlands

Organized by

Environmental Hydrogeology Group, Department of Earth Sciences, Faculty of Geosciences, Utrecht University, Utrecht, Netherlands

- Amir Raoof (UU)
- S. Majid Hassanizadeh (UU/Deltares)
- Hans Gehrels (Deltares)
- Rien van Genuchten
- Ruud J. Schotting (UU/Deltares)
- Margreet Evertman (UU)

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