Introduction to Flow, Solute and Heat Transport Modelling in Porous media

Short Course (2 days, 14 hours)

First day program

Unit 1: Flow Equation (theory) (1,5 Hrs)

Hydrogeological parameters – Darcy's law – hydraulic gradient – hydraulic conductivity – groundwater flow equation –– groundwater continuity equation – Finite Difference approximation

Unit 2 Principles of heat and solute transport process (theory) (1,5 Hrs)

Physical processes: advection – dispersion equation – chemical processes: decay – retardation/reaction – adsorption – Courant and Peclet number – Source representation: contaminants and heat

Unit 3 Groundwater flow and transport modeling (theory) (2,5 Hrs)

Introduction to groundwater models – types – data requirement for modelling – Model formulation–conceptualization – model domain discretization – boundary condition – initial conditions – steady state models – unsteady-state models – calibration

Unit 4 Groundwater flow model (exercise) (1.5 Hrs)

Implementation of a three-dimensional numerical flow model: conceptual model description – model domain discretization – properties setup – boundary conditions setup

Second day program

Unit 4 Groundwater flow model (exercise) (3 Hrs)

Implementation of a three-dimensional numerical flow model: internal conditions setup – model run – model calibration – results discussion

Unit 5 Solute transport modeling (exercise) (4 Hrs)

Advective transport: backwards and forward particle tracking analysis – definition of capture zones – Advective-dispersive-diffusive transport: source setup – transport parameters setup – model run – model results comparison and discussion.

N.B. A solid background in hydrogeology is required as admittance requirement.

Software: Modflow-USG with Groundwater Vistas 9 user interface

At the end of the course the student will have to:

- *Know the fundamental principles that regulate water flow in porous and fractured aquifers*

- *Know the terms and basic principles of numerical modelling of groundwater flow*
- *be able to reconstruct and understand the underground hydrogeological structure*
- *apply the knowledge acquired in the field of groundwater resources management and remediation of contaminated sites*
- *Be able to use the MODFLOW numerical code with the GroundwaterVistas interface*
- *Be able to independently implement and calibrate a groundwater flow model to simulate its behaviour and predict responses to specific stresses*
- *Be able to communicate the results of his activity clearly*