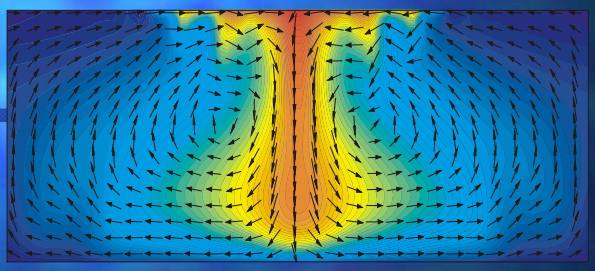
SEAWAT Training Course



2010 Salt Water Intrusion Meeting
June 16 – 25, 2010
Ponta Delgada, Azores, Portugal

USGS
science for a changing world

Presentation 1

Welcome/Introductions

Instructors

- Christian Langevin—Research Hydrologist, USGS, Reston, Virginia
- Alyssa Dausman—Hydrologist, USGS, Fort Lauderdale, Florida
- Joseph Hughes—Research Hydrologist, USGS, Tampa, Florida

Course Purpose

- Present the fundamentals of modeling variable-density groundwater flow using the SEAWAT computer program

You!

- Participant introductions
- Name, employer, experience in groundwater flow and transport modeling
- Future projects involving variable-density groundwater flow modeling?

Course Participants

Computer Programs Used in This Course

- SEAWAT Version 4
- MODFLOW-2000
- MT3DMS
- Groundwater Vistas
- Modelviewer
- MODPATH
- ZONEBUDGET
- PEST
- Excel

Course Materials

- Class presentations
- Class exercises
- SEAWAT manuals
  - Version 4: Langevin et al. (2007)
  - Version 3: SEAWAT-2000 (Langevin et al., 2003)
  - Version 2: Guo and Langevin (2002)

Supplemental References

- MODFLOW-2000 manual (Harbaugh et al., 2000)
- MT3DMS manual (Zheng and Wang, 1999)
- MT3DMS v5.2 Supplemental User's Guide (Zheng, 2006)
- Original MODFLOW Documentation (McDonald and Harbaugh, 1988)
- Applied Groundwater Modeling (Anderson and Woessner, 1992)
- Applied Contaminant Transport Modeling (Zheng and Bennett, 2002)
- Seawater Intrusion in Coastal Aquifers—Concepts, Methods, and Practices (Bear et al., 1999)

Graphical User Interfaces (GUI's) for MODFLOW-2000

- Free from USGS:
  - MFI2K
- Five popular commercial interfaces
  - PMWIN
  - Groundwater Vistas
  - Visual MODFLOW
  - Argus
  - GMS

Course Schedule

- Presentations
  - Presentation 1: Welcome/Introductions
  - Presentation 2: Variable-Density Groundwater Modeling: Applications and Tools
  - Presentation 3: Fluid Properties
  - Presentation 4: Concepts and Equations of Variable-Density Groundwater Flow
  - Presentation 5: Concepts and Equations of Solute and Heat Transport
  - Presentation 6: MODFLOW
  - Presentation 7: MT3DMS—Solution Schemes
  - Presentation 8: MT3DMS—Packages
  - Presentation 9: SEAWAT Concepts
  - Presentation 10: Variable-Density Flow (VDF) Process in SEAWAT
  - Presentation 11: Instructions for Using SEAWAT
  - Presentation 12: Evaluating output from SEAWAT

Course Schedule (cont.)

- List of Exercises
  - Exercise 1: Using Groundwater Vistas
  - Exercise 2: PARTICLEFLOW—Understanding Advection and Dispersion
  - Exercise 3: Calculating Hydrostatic Conditions
  - Exercise 4: Henry Problem
  - Exercise 5: Modified Henry Problem
  - Exercise 6: SWI— Part I. Design and run a 2D cross-section model to obtain the steady-state pre-withdrawal distribution of head and salinity
  - Exercise 7: SWI— Part II. Design and run a 3D model to determine the effects of groundwater pumping on saltwater interface movement
  - Exercise 8: SWI— Part III. Determine wellfield protection area
  - Exercise 9: SWI— Part IV. Simulation of multi-species solute transport


Course Schedule (cont.)
Case Studies and Benchmark Problems
Effect of Heterogeneity on Aquifer Storage and Recovery
Submarine Groundwater Discharge to Biscayne Bay
Deep Well Injection in Southern Florida
Turkey Point Nuclear Cooling Canals
Henry and Hilleke Physical and Numerical Laboratory Experiment
SEAWAT Benchmark Problems
Null Space Monte Carlo Analysis with the Henry Problem
Effect of Numerical Dispersion on Predictions with a Saltwater Intrusion Model
Tidal Fluctuations and Transient Dispersion
Parameterization of an Initial Concentration Field
Double Diffusive Finger Convection
SUTRA