

**Advanced Topics in Groundwater Modeling:
*Calibration, Uncertainty & Optimization***

April 15-17, 2009

**Instructor:
Jim Rumbaugh**

Environmental Simulations, Inc.
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**Location:
Hilton Tampa Westshore**
2225 North Lois Avenue
Tampa, Florida 33607
Phone: (813) 877-6688
www.hilton.com

**Cost
\$1,200**

Cost includes lunch each day
Participants are asked to bring a laptop computer
Contact Jim Rumbaugh (see above) to Register
Limited to ~12 to 14 participants

Instructor Bio:

Jim Rumbaugh, hydrogeologist and groundwater modeler, has over 25 years of experience in application of groundwater models and in development of groundwater modeling software tools. He is the co-author of the Groundwater Vistas software and is President of Environmental Simulations, Inc., a company that specializes in groundwater modeling. Jim is an active member of the American Society for Testing and Materials (ASTM) where he is a past Chairman of ASTM Subcommittee D18.21 on Groundwater and Vadose Zone Investigations. Subcommittee D18.21 was funded by U.S. EPA to develop standards for groundwater modeling practice. Jim was honored by the National Ground Water Association with the 1999 John Hem Excellence in Science and Engineering Award by NGWA. This award is given to those who have made a significant, recent scientific or engineering contribution to the understanding of groundwater. Jim teaches groundwater modeling seminars throughout the USA, Europe, Australia, and New Zealand. The Australia and New Zealand seminars are co-taught with John Doherty, author of the PEST calibration software.

Registration:

To register for this seminar, simply send Jim an email at JRumbaugh@GroundwaterModels.com or give us a call at (610) 670-3400. Invoices will be sent out approximately 6 weeks prior to the course date. Payment can be by check, credit card, or wire transfer to our bank.

The course is limited to 12 to 14 attendees.

Other Notes:

- Lunch will be provided each day. Please let us know if you have special dietary needs at least 2 weeks prior to the course.
- Please bring a laptop computer to the seminar. If you do not have a license for Groundwater Vistas on the laptop, we will provide a temporary license for the seminar. If you cannot bring a laptop, please let us know and we will provide one for you. Groundwater Vistas Version 5 will be used in the seminar, along with the latest version of PEST.
- You are welcome to bring project work with you to try these calibration/uncertainty/optimization techniques on a model that is familiar to you.
- For financial reasons, we do not arrange for a special block of rooms at the hotel. The seminar will be at the *Hilton Tampa Westshore* and there are lots of other hotels nearby if you prefer to stay elsewhere.
- The training room is just past the front desk at the hotel.
- The seminar starts at 9 am the first day. On the last day, the last lecture ends around 3 pm. From 3 to 5 pm on the last day, you are free to work on seminar computer exercises or head to the airport if you have an early flight.

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Course Outline

Day 1

- 9:00 *Lecture* – Case Study
9:30 *Lecture* – Calibration Concepts
- 11:00 *Computer Lab Session* – Sensitivity Analysis with Groundwater Vistas
- 12:00 *Lunch*
- 1:00 *Lecture* – Automated Sensitivity Analysis & Distributed Computing
2:00 *Lecture* – Using PEST For Model Calibration
- 3:00 *Computer Lab Session* – Zone-based Model Calibration
- 5:00 End for the Day

Day 2

- 8:30 *Lecture* – Using Pest with Pilot Points
- 10:00 *Computer Lab Session* – Pilot Points in Groundwater Vistas
- 12:00 *Lunch*
- 1:00 *Lecture* – Singular Value Decomposition (SVD) in PEST
2:00 *Lecture* – Running Parallel Pest
- 3:00 *Computer Lab Session* – PEST with SVD Assist
- 5:00 End for the Day

Day 3

8:30 *Lecture* – PEST Predictive Analyzer

9:45 *Lecture* – Calibration-Constrained Monte Carlo with PEST

10:30 *Computer Lab Session* – Uncertainty Analysis with PEST

12:00 *Lunch*

1:00 *Lecture* – Optimization Technology (MGO, SOMOS, GWM...)

2:30 *Computer Lab Session* – Using Optimization Models

5:00 END