

GEOL5250 Groundwater Modeling

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Overview

The objective of this course is to familiarize students with the concept and practice of mathematical and numerical modeling of saturated and unsaturated fluid flow and solute and reactive transport in the subsurface. By the end of this course, students will be able to:

- Understand and formulate mathematical representations of flow and transport
- Understand the art of groundwater modeling, the basic approach, and how to avoid common pitfalls.
- Understand the basics of how to use industry-standard modeling software such as MODFLOW, MT3D, SEWAT, SUTRA, and PHT3D and associated GUIs.
- Know what modeling tools are available and which types are appropriate in particular situations.
- Construct and use a groundwater flow and solute transport model to answer a question or understand a process.
- Read and understand other modeling studies critically and evaluate them.

The final goal is not expertise in particular software, rather the ability to pick up a modeling tool and figure out how to use it. The course will be largely hands-on conceptualizing, constructing, running, post-processing, and analyzing groundwater models.

Recommended Textbooks

Applied Groundwater Modeling, by M.P. Anderson and W.W. Woessner, Academic Press, 2002
Modeling Groundwater Flow and Contaminant Transport, by J. Bear and A.H-D. Cheng Singer, 2010
Applied Contaminant Transport Modeling, by C. Zheng and G.D. Bennett, John Wiley and Sons, 2002

Email

Any email that you send to me must have GEOL5250 at the beginning of the subject line. Any email that you receive from me will have GEOL5250 in the subject line.

Course Requirements

In-class Exercises

One or more modeling exercises may be conducted during any class period. These will be given credit in approximate proportion to the effort required through participation, completing, and in some cases, deliverables (such as graphs, simulation results, or short write-ups).

Assignments

Out of class assignments will be assigned periodically. These will be due in class on the due date.

Course Project

Students will be required to complete a course project involving the development and application of a groundwater model. The specific topic is optional. A project that contributes to ongoing thesis research is encouraged. A 1-page proposal for the final project will be due early in the semester. Project ideas must be approved by your professor prior to submission. The proposal should contain the following: a clear justification of the project and what issue or question it will address, 2) a description of the modeling methods that will be used, 3) discussion of what you might learn or accomplish (anticipated results). A

final report is due at the end of the semester along with an in-class presentation. This is a class assignment (not a formal research project); the goal is to explore an idea and generate some preliminary results that you can build on later. More details will follow.

Readings

Required readings will be handed out and discussed in class.

Required background

A course in Hydrogeology or equivalent and Calculus are required. I assume familiarity with calculus, matrices, and basic programming skills. Familiarity with MATLAB or Python is recommended.

Grading

Participating and in-class exercises	20%
Assignments	45%
Final Project	35%
Total:	100%

*Grades are rounded to the nearest tenth.

Percentage	Letter Grade
>92	A
90 – 92	A-
88 – 89	B+
83 – 87	B
80 – 82	B-
78 - 79	C+
73 – 77	C
70 - 72	C-
68 – 69	D+
60 – 67	D
<60	F