1-2014

GEO 585.01: Topics - Hydrogeologic Modeling

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GEO585: Hydrologic Modeling
Spring 2014
University of Montana
Instructor: Marco Maneta
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Class meetings: Tuesday-Thursday 02:10pm-03:30pm

Overarching goals:

- Advanced topics in forward computer modeling and model analysis.
- Inverse modeling, calibration, and sensitivity analysis using advanced research tools

Ancillary goals: Along with the overarching goals, in this course we will revisit some linear algebra and optimization concepts necessary to understand the contents of the course and to understand the scientific literature. We we will get familiar with some data pre- and post-processing tools.

Prerequisites: Interest in quantitative modeling of environmental processes along with comfort with computers, calculus, physics and algebra.

Office hours: Office hours will be the next hour after class.

Grades: 40% Individual project; 40% class activities; 20% Final exam.

Recommended books:

- General Hydrology books:
  - Dingman, L. Physical Hydrology. 2nd edition. Waveland Press, 2008
  - Chow, VT, Maidment, DR, and Mays, LW. Applied Hydrology. McGraw-Hill, 1998
- Ecohydrology
  - Bonan, G. Ecological Climatology. Cambridge University Press, 2008
- Optimization and linear algebra:
  - Arora, J. Introduction to Optimum Design. 3rd edition. 2012.
    - The 2nd edition of this book is available online at the UM Mansfield library (free of charge)
    - There is an number of errata in the 2nd edition. Make sure you also get the document with the list of corrections in the publisher's webpage
  - Aster, RC, Brochers, B, Thurber, CH. Parameter estimtion and inverse problems. Elsevier, 2nd ed, 2012
  - Noble and Daniel. Applied linear algebra. 2nd edition

Date	Topic	Activity
01/28	Overview	
01/30	Intro to DOS and other tools	DOS practice
02/04	Conceptual models	
02/06	Intro to PCRaster	PCR map algebra
02/11	Physics based models	
02/13	Ascii and Binary information	Fix binary climate file
02/18	Physics based ecohydrologic models	
02/20	Intro to Python	

02/25	Plotting with Python	Plotting Tutorial
02/27	Retrieve CUAHSI-HIS data	Python HIS
03/04	Ech2o,Rhessys, CLM	
03/06	Ech2o tutorial	Echo Tutorial
03/11	Physics of Ech2o	
03/13	Ech2o tutorial (spin up and stuff)	Echo Tutorial
03/18	Intro to Optimization	
03/20	Type of search algorithms	
03/25	No class	
03/27	Review of basic calculus	Problem set
04/08	Steepest-descent	
04/10	Newton's method	Problem set
04/15	Levenberg-Marquardt	
04/17	Intro to PEST	Pest demo problem
04/22	Interpretation of PEST information	
04/24	Connecting PEST to ech2o	
04/29	Statistical aspects of least squares	
05/01	Sensitivity analysis, uncertainty	
05/06	Student project presentation	
05/08	Student project presentation	