GEO585: Hydrologic Modeling
Spring 2020
University of Montana
Instructor: Marco Maneta
Email: marco.maneta@umontana.edu
Office: CHCB 348
Phone: 406-243-2454
Class meetings: Monday-Wednesday 10:10pm-11:30pm

Note: This Course has a Moodle Site. Additional reading material, problems sets and other information will be posted there with frequent updates, so check the site often.

Overarching goals:
In this course, students will

- identify types of hydrologic models used in practice (analog, statistical, conceptual, physics-based, etc) and understand the strengths and weaknesses of each type and their most adequate application.
- Solve surface and subsurface flow models of some common models used in environmental and earth sciences.
- Use Python and version control systems (GIT) for collaborative scientific model development and administration.
- Apply models to explore solutions to environmental problems.

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

Prerequisites: Calculus, Physics and Algebra. Familiarity of the fundamental principles of hydrology is also desirable (e.g. GEO421 or GEO422)

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

Grades: 60% Individual project; 40% class activities

Text books: No specific text book is used in this course. The necessary reading materials will be uploaded to Moodle. However, the following books are recommended for reference:

- Hydrology:
  - Dingman, SL. Physical Hydorlogy. 3rd edition. 2014.

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<tr>
<th>Date</th>
<th>Topic</th>
<th>Activity</th>
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<tbody>
<tr>
<td>01/13/20</td>
<td>Overview and Intro to Modeling</td>
<td>Python Practice Set</td>
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<tr>
<td>01/15/20</td>
<td>Conceptual Hydrologic Models</td>
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<td>01/20/20</td>
<td>No class, MLK</td>
<td>Problem set</td>
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<tr>
<td>01/22/20</td>
<td>Conceptual Hydrologic Models</td>
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<td>01/27/20</td>
<td>Physically based Hydrologic models</td>
<td>Problem set</td>
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<tr>
<td>01/29/20</td>
<td>Manning’s equation, kinematic wave</td>
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<tr>
<td>02/03/20</td>
<td>Manning’s equation, kinematic wave</td>
<td>Problem set</td>
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<td>02/05/20</td>
<td>Object orientated programming</td>
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<td>02/10/20</td>
<td>Energy balance model</td>
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<td>02/12/20</td>
<td>Energy balance model</td>
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<td>02/17/20</td>
<td>No class, Presidents day</td>
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<td>02/19/20</td>
<td>Energy balance model</td>
<td>Group problem set</td>
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02/24/20 Richards equation model  
02/26/20 Richards equation model  
03/02/20 No class  
03/04/20 No class  
03/09/20 Richards equation model  
03/11/20 Spring break  
03/16/20 Spring break  
03/18/20 Ecohydrologic models ? Ech2o  
03/23/20 Ecohydrologic models ? Ech2o  
03/25/20 Error propagation in models  
03/30/20 Error propagation in models  
04/01/20 Intro to inverse modeling  
04/06/20 Intro to inverse modeling  
04/08/20 Gradient Based Search  
04/13/20 Levenberg-Marquardt  
04/15/20 Global Search  
04/20/20 Markov Chain Monte Carlo  
04/22/20 Student project presentation  
04/27/20 Student project presentation  
04/29/20 Student project presentation  

POLICIES

Emailing  We may occasionally conduct email correspondence with class members and we will use official UM email addresses. All email sent to us must originate from your official UM email address (email originating from non-UM addresses will not be read or responded to). Sorry, but this is the law we are required to follow.

Attendance  No formal attendance will be taken. However, the format of this course requires class attendance for success. Substantial course content (i.e., graded in-class exercises and discussions) and information transfer will only occur in class. We cannot accommodate individual make-ups for missed classes. This is not a good course for you if it is not possible for you to always attend class sessions.

Due dates  All assignments are due at the start of class on designated due date.

Disabilities  The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students. If you think you may have a disability adversely affecting your academic performance, and you have not already registered with Disability Services, please contact Disability Services in Lommasson Center 154 or 406.243.2243. I will work with you and Disability Services to provide an appropriate modification.

Conduct Code  All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code. The Code is available for review online at: http://www.umt.edu/vpsa/policies/student_conduct.php