CIVE 581A9: Morphodynamic Modeling
Spring 2015 Syllabus

Instructor information

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Office hours: 10-11 TR or by appointment

Course information

Lecture time: 11:00 am – 12:15 pm TR
Classroom: Engineering B4
Class website: canvas.colostate.edu (We will use CSU's new Canvas interface to post assignments, lecture notes, additional instructional material, announcements, etc.)
Course Prerequisite: CIVE 401 (Hydraulic Engineering) or permission of course instructor

Overview

The goal of this course is to cover the basic principles of morphodynamic modeling, with a primary focus on river morphodynamics. Morphodynamic modeling involves three interacting components: the flow field, the sediment transport field, and bed evolution. In this course, we will cover basic principles underlying each of these components, and how they can be combined to make a model capable of simulating river channel evolution.

Learning objectives

Upon completion of this course, a successful student will be able to:

- Describe modeling tools available for solving morphodynamic problems
- Describe the theory behind the practice of physical, numerical, and analytical morphodynamic models
- Develop physical and numerical morphodynamic models
- Describe what types of information can be obtained from physical and numerical morphodynamic models
- Quantify morphodynamic evolution with numerical models
- Describe, understand, and use numerical modeling software available for 1D and 2D simulation of flow, sediment transport, and channel evolution of rivers.

Text

There is no formal textbook for this course. We will instead draw upon articles published in the scientific literature, book chapters, software manuals, and other electronic resources.

Assignments

Homework will be assigned every 2-3 weeks; these will range from somewhat traditional problem sets, to more involved modeling exercises using either existing software or your own programming.

Final Project

In lieu of a final exam, there will be a final project. This project can take one of two forms, a) a case study / literature review, or b) an independent research project. More information will be provided later in the semester, but below is a brief overview of these options:

Case study/literature review:

For this option, you will choose a topic relevant to morphodynamics and find a variety of studies in the published literature that have addressed that topic. The written and oral presentations will summarize the different studies: what methods were used? What were the results? How do the studies compare?

Independent research project:

For this option, you will use morphodynamic tools (such as those we learn to use in this course) to address a problem relevant to your own research.

A tentative topic (for either option) will be due the week before spring break; for this you will turn in 1-2 paragraphs stating your chosen option, the topic, and what you anticipate you will do. For the case study/lit review option, provide at least 3-5 references you expect to use.

The projects will have a final written report and an oral presentation during the last week of class. The final written report must be 12 pages or less (12 point single spaced), including figures and references, and will be due at the date and time of the otherwise-scheduled final exam (May 13 at 6:20 pm). Oral presentations will take place during the last week of class, and as in most major academic conferences, you will have 12 minutes to present your material. Further information on the format and content of the written reports and oral presentations will be provided later in the semester.

Course evaluation

- Homework assignments: 70%
- Final project: 25%
    - (Written report: 15%; Oral presentation: 10%)
- Class participation: 5%

Grading will be assigned according to a fixed grade scale and use the +/- grade system as described in the CSU catalog.

Academic Integrity

This course will adhere to the CSU Academic Integrity Policy as found in the General Catalog (http://www.catalog.colostate.edu/FrontPDF/1.6POLICIES1112f.pdf) and the Student Conduct Code (http://www.conflictresolution.colostate.edu/conduct-code). At a minimum, violations will result in a grading penalty in this course and a report to the Office of Conflict Resolution and Student Conduct Services.

The overarching rule for academic integrity in this class (and in your future careers) is the following: do not misrepresent anyone else's work as your own! That means that, while you are allowed to talk or work with others on assignments, what you turn in must be your work alone. For reports or other written work, you must not plagiarize others' work – use citations appropriately.

Tentative **schedule of topics:**

Week 1: Introduction; conservation of bed sediment
Week 2: Review of hydraulics; bedload transport of gravel mixtures
Week 3: Equal/selective/partial mobility
Week 4: 1D morphodynamics: introduction, discretization schemes
Week 5: Sediment supply and armoring (1D modeling)
Week 6: Hydrographs and stratigraphy (1D modeling)
Week 7: 2D modeling of bars in straight and meandering channels
Week 8: Linear stability analysis; bar theory/bend theory/resonance
Week 9: 2D modeling with sediment mixtures
Week 10: Models of meandering and lateral migration
Week 11: Bedrock erosion and morphodynamic modeling
Week 12: Discrete element and rules-based morphodynamic models
Week 13: Flume experiment design (scaling/methods)
Week 14: Morphodynamics of tidal channels
Week 15: In-class presentations of final projects