CE/OC 635

Applied Modeling of Nearshore Processes (4 credits)

Spring 2011

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Class time: T Th 10:00 – 11:20am at Kearney 205
W 10:00 – 11:50am at Owen 241

Office hours: DFH or HTO: M 10-12 or by appointment

Important dates: Last day to add/drop a class – April 8
No class on April 19

Course description:

Analytical or mathematical methods applied to nearshore hydrodynamics are necessarily limited to cases of simple geometry and boundary / initial conditions. These simple solutions, while illuminating from a physical process point of view, often find limited applicability to real field conditions. The complex coastlines, bathymetry, and forcing conditions encountered in the field require the application of numerical models. This course will introduce students to state-of-the-art open source models of wave, tide, and surge processes. As a preliminary, the topics of nearshore data, vertical datum adjustments, and gridding will be covered. Students will then receive hands-on instruction in the use and theory of the SWAN and ADCIRC models. Multiple case study sites will be considered, including both the west and east coasts of the United States. A prior course in nearshore processes is suggested. Experience with Matlab and the Unix environment will be useful but are not required.

Class objectives:

The objectives are to familiarize the student with models relevant to coastal engineering/nearshore oceanography by providing an understanding of

- The theoretical basis of each model
- The underlying assumptions, advantages/shortcomings of each model
- The model equations
- The solution methods employed
- The operation of the software (including input requirements)
- The interpretation of the results

Platforms:

Unix-based platform → SWAN / ADCIRC
Windows-based platform → ADCIRC / grid generation (SMS)

Lecture Format:

T Th Lectures:

- A combination of whiteboard + powerpoint presentation + web demonstration
- Notes handed out when necessary

W Computer Labs:

- Downloading and manipulating input data
- Model execution
- Visualization of model output

Assignments and grading:

- The course grade will be based on small assignments (30% total) and reports on SWAN and ADCIRC (35% each). There will be no in-class examinations.
- In class we will work our way through a modeling exercise for several sites, representing both the east and west coasts of the USA.

Expectation of students:

- You may discuss your assignments with others and work through common issues in a group, but you must hand in your own original work.

Text:

- There is no textbook for the course. The user's manuals of the programs we will use will be provided to you in electronic format in the form of pdf files. However, a few good resources that may be useful during the course are:
  - Water Wave Mechanics for Engineers and Scientists, Dean and Dalrymple
  - Coastal Processes with Engineering Applications, Dean and Dalrymple
  - Beach Processes and Sedimentation, Komar
  - Tides, Surges, and Mean Sea Level, Pugh (free .pdf at http://eprints.soton.ac.uk/19157/)

Tentative class and computer lab schedule: Özkan-Haller, Hill, Özkan-Haller&Hill

Week	Date	General Topic	Class	Lab	Class	Assignments
1	**28-Mar**	Intro	Intro to modeling	Tools (Matlab)	Review Tides	Matlab
2	**4-Apr**	Intro	Review waves		Levels of wave modeling	
3	**11-Apr**	Intro	Bathymetry sources	Data sources	Bathymetry processing	Lab homework
4	**18-Apr**	Waves	No class	Lecture/lab: Wave spectra	Wave action balance	Spectra homework
5	**25-Apr**	Waves	STWAVE solution	STWAVE	Applications, caveats → SWAN	
6	**2-May**	Waves	SWAN solution	SWAN	SWAN applications	SWAN report
7	**9-May**	Tides	Introduction to ADCIRC, capabilities and file I/O	ADCIRC test runs – idealized channel	Sources of input data – tides, rivers, and winds	Boundary condition data assignment
8	**16-May**	Tides	Introduction to SMS, unstructured mesh criteria	Grid Generation	Harmonic analysis – time series vs. harmonic constant datum method	Grid Generation
9	**23-May**	Tides	Velocity fields – flow pathlines, streamlines, and residual velocity		Special topics	ADCIRC report
10	**30-May**	Wrap-up	Coupled modeling		Summary	