MARS 4100/6100 - Physical Processes of the Ocean
Spring Semester 2015

11:00-12:15am Tuesday and Thursday
MAR. SCI. BLDG. Room 239

Course Objectives:
In this course we will learn about the physical forces on Earth that cause ocean motion and the geological forces that determine the ocean basin and coastal morphologies. This course will provide the student with the necessary skills to carry out mathematical calculations while understanding their limitations, and thus giving a physical interpretation of the solutions obtained. Students will use real-time observed data obtained from a number of sources to examine a specific feature of interest and present their results to the class and in a project report.

We will examine the ocean and atmosphere as a coupled system driven by energy from the Sun and how atmospheric circulation creates the global ocean wind-driven surface currents. Coupled atmosphere-ocean processes create anomalies like El Nino that cause alterations in meteorological conditions around the world. Deep ocean currents, driven by density and the meridional overturning circulation, further regulate climate on Earth. We will also discover how waves are a mechanism that transports energy from one point to another point on Earth. We will then examine how the Earth/Moon/Sun system causes large bodies of water to rise and fall as tides.

We will discuss origins and movement of marine sediments, and once we understand the modern ocean, we use this knowledge on basic principles of marine geology to infer ocean and climate changes over geologic time. We will address how sediments can serve as archives of past climatic conditions, the causes of ice ages, how plate movement influences ocean circulation and climate, explore long-term planetary evolution, and discuss the impacts of human activities on future oceans and climate.

Instructors: Dr. Daniela Di Iorio
Marine Science Bldg., Rm. 250
Office phone: 542-7020
email: daniela@uga.edu
Office hours: open door policy or by appointment

Dr. Christof Meile
Marine Science Bldg., Rm. 110G
Office phone: 542-6549
email: cmeile@uga.edu
Office hours: open door/by appointment

Primary Textbooks:
OC: Ocean Circulation, The Open University
OB: The ocean basins: Their structure and evolution, The Open University
WTS: Waves, Tides and Shallow Water Processes, The Open University

Books are available online as new or used and are also on Reserve (24-hr use only) at the Science Library. There will be approximately 20 pages of reading required each week. Reading these assignments BEFORE lecture will significantly improve your comprehension of lecture material and better prepare you for homework and exams.

eLC: All lecture notes, assignments, reading materials and data sets will be posted on the E Learning Commons web site https://uga.view.usg.edu. You must have an UGA-myid account. For complete information on the use of eLC, go to the Student Help link and you will see what you need to access eLC, how to configure your web browser and numerous frequently asked questions. Once you log into eLC you will find all the courses you are authorized to use. If you do not see MARS4100/6100 then you must make sure you are registered for the course. Click on the course link and you will see a link for Assignments and Class Notes in the Course Content. All files will be in PDF format and you need to have the Adobe Acrobat Reader installed on your computer (http://www.adobe.com/products/acrobat/readstep.html). If you have problems please let us know.

Grading:

Midterm Exam	25%
Monitoring Project report (20%) and presentation (5%)	25%
Assignments (5 total) plus in class hand ins	25%
Final Exam (2nd half of course only)	25%

A(90-100%,4), A-(85-90%,3.7), B+(80-85%,3.3), B(75-80%,3), B-(70-75%,2.7), C+(65-70%,2.3), C(60-65%,2.0), C-(55-60%,1.7), D(50-55%,1)

There will be no curving made to the assignments, exams and final grade distribution.

Incompletes: The grade of Incomplete (I) is given to students who, for reason of accident or illness, were unable to complete a segment of the course. In no case will an Incomplete be given as a means of avoiding a failing grade.
WF: The grade of Withdrawal with Failure (WF) will be given to students who fail to come to class and hand in course material when expected and who have not withdrawn from the course prior to the Midpoint Withdrawal Deadline of Mar 19, 2015.

Final Exam: Thur Apr 30, 12-3pm (second half of course only); the Final report is also due.

Homework: You may use any word processor (LaTex, Word, etc) or computational software (MATLAB, Excel, etc) to help with your assignments. Hand written and plotted is just fine provided it is neat and legible. You must show your work and discuss your result for full credit. Due dates for homework assignments are noted in the course schedule provided below. Turning in homework late, without an excuse, will result in 1 point per day deduction.

Physical and Geological Oceanographic Data Analysis Project: The goal of this project is to familiarize students with the process of collecting and interpreting scientific data that is available as part of the Ocean Observatories Initiative. You will focus on a topic of your choice, acquiring physical or geological data from an oceanographic web site and carrying out an analysis of that data. Your project will culminate in a 10-12 min presentation at the end of the semester and a 5-8 page report. The presentation and report should include both a description of the scientific data

as well as an interpretation and analysis of that data. The student should use peer-reviewed journal articles to help understand the phenomena and the paper should include at least 3 peer-reviewed references. To help guide you in preparing your report and presentation, you will be required to submit a brief summary of your chosen data analysis project by Mar 17 and an outline of your report by Apr 14 (MARS 6100 students see below).

Some possible sources of data are listed below. If you have other data in mind that is of interest to you then please contact either Dr. Di Iorio or Dr. Meile to check availability and accessibility.

NOAA Deepwater Horizon Archive: Access to a wide range of data related to the BP April 2010 Oil Spill in the Gulf of Mexico (http://www.noaa.gov/deepwaterhorizon/)

Equatorial and El Nino dynamics: Realtime buoy data taken from Tropical Atmosphere Ocean Project in the equatorial Pacific Ocean (http://www.pmel.noaa.gov/tao).

Tides and Currents monitoring: Tide, current, water level and other coastal oceanographic products for coastal sites throughout the United States from the NOAA Center for Operational Oceanographic Products and Services web page (http://www.co-ops.nos.noaa.gov/).

Surface waves and meteorological conditions: Wind speed and direction, barometric pressure, air temperature, wave heights and direction, water temperature, and other parameters from the NOAA National Data Buoy Center (http://www.ndbc.noaa.gov/).

Gulf Stream: Flow velocities from the Delft Institute for Earth-Oriented Space Research (DEOS, http://rads.tudelft.nl/gulfstream/).

Global drifters: Satellite-tracked surface drifting buoy observations for currents, sea surface temperature, atmospheric pressure, winds and salinity. (http://www.aoml.noaa.gov/phod/dac/index.php)

Deep Ocean Seismicity and Ambient sound from Hydroacoustic Monitoring: Regional seismic/volcanic activity from mid ocean ridges in the Pacific and Atlantic and ambient sounds (http://www.pmel.noaa.gov/acoustics/index.html).

Follow an ARGO integrated global observation buoy: robotic floats that are used to profile through the water column for temperature (heat) and salinity (freshwater) measurements (http://www.coriolis.eu.org/Data-Products/Data-Delivery/Data-selection)

Georgia Coastal Ecosystems LTER: monitoring of freshwater output, meteorological conditions, estuarine temperature and salinity in Sapelo Island GA domain (http://www.gce-lter.marsci.uga.edu/portal/monitoring.htm).

Academic Honesty: All students are responsible for maintaining the highest standards of honesty and integrity in every phase of their academic careers. The penalties of academic dishonesties are severe and ignorance is not an acceptable defense. Documents for academic honesty and standards, like "A Culture of Honesty", may be found at the web site for the University of Georgia Office of Vice President for Instruction, http://www.uga.edu/honesty/.

Plagiarism ("take ideas, writings, etc. from another and pass them off as one's own", Webster's New World Dictionary) will not be tolerated. There are several forms of plagiarism, ranging from outsourcing your work to somebody else, to slight rewording of a published text or summarizing a text without citing it. If you are in doubt consult with the instructor ***before*** you hand something in.

MARS 6100: Students are required to produce a more detailed and expanded data analysis project (8-10 pages) with at least 5 peer reviewed references. It is highly encouraged that you start early in the semester to find the data you wish to discuss. Please see the instructors to help guide your progress throughout the semester.

Class Schedule: The course syllabus is a general plan for the course; deviations from the syllabus when necessary will be announced by the instructor in class. Students who miss class are responsible for all announcements and assignments given in lecture.
Italics: lectures by C. Meile

Week	**Date**	**Lecture Topic**	**Textbook Reading**	
Week 1	6-Jan	Orientation/Solar input	OC: Ch 6	
	8-Jan	Heat fluxes/heat balance	OC: Ch 1	
Week 2	13-Jan	Earth's Rotation/Coriolis Force	OC: Ch 1,2	
	15-Jan	Atmospheric Processes	OC: Ch 2	
Week 3	20-Jan	Wind driven circulation I	OC: Ch 3	Assign 1 due
	22-Jan	Wind driven circulation II	OC: Ch 4	
Week 4	27-Jan	El Nino	OC: Ch 5	
	29-Jan	Thermohaline Circulation	OC: Ch 6	
Week 5	3-Feb	Waves I	WTS: Ch 1	Assign 2 due
	5-Feb	Waves II	WTS: Ch 1, OC: Ch 6	
Week 6	10-Feb	Tides I	WTS: Ch 2	
	12-Feb	Tides II	WTS: Ch 2	
Week 7	17-Feb	Coastal dynamics	WTS: Ch 6, supplements	Assign 3 due
	19-Feb	**Midterm exam**		
Week 8	24-Feb	*Water and salt budget of the ocean*	Supplements	
	26-Feb	*Marine Sediments: transport*	WTS: Ch3, 4, Supplements	

Week 9	3-Mar	*Marine Sediments: sources and sinks*	WTS: Ch4, Supplements	
	5-Mar	*Rocks and the rock record* *Geologic time*	Supplements	Assign 4 due
Week 10	10-Mar	Spring Break		
	12-Mar	Spring Break		
Week 11	17-Mar	*Ice Ages and the Ocean*	Supplements	
	19-Mar	*Causes of ice ages*	Supplements	Project summary
Week 12	24-Mar	*Plate tectonics - the data*	OB: Ch 2, 4	
	26-Mar	*Plate tectonics – the theory*	OB: Ch 4	
Week 13	31-Mar	*Sea level changes*	OB: Ch 6	
	2-Apr	*Plates, Circulation, & Climate*	Supplements	Assign 5 due
Week 14	7-Apr	*Climate Cycles*	Supplements	
	9-Apr	*Planetary Evolution*	Supplements	
Week 15	14-Apr	*Links to global carbon cycle*	OB: Ch 7	Report outline
	16-Apr	*Box models of the carbon cycle*	Supplements	
Week 16	21-Apr	**10-12 min Presentations**		
	23-Apr	**10-12 min Presentations**		
	30-Apr	**Final exam** **(12-3pm, Room 239)**		Final Report Due