MARS 4100 - Physical Processes of the Ocean
Spring Semester 2017

9:30-10:45am Tuesday and Thursday
MAR. SCI. BLDG. Room 239 & 261

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 specific features of interest.

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 serve as archives of past climatic conditions, discuss causes of variations in climate. We will discuss current day topics on sediment transport, and will make use of existing data collection efforts to address a range of scientific questions.

Instructors:

Dr. Daniela Di Iorio
Marine Science Bldg., Rm. 212
Office phone: 542-2820
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 or by appointment

Primary Textbooks:
OC: Ocean Circulation, The Open University (An online book accessible through Galileo at http://site.ebrary.com.proxy-remote.galib.uga.edu/lib/ugalib/detail.action?docID=10190755)
OB: The ocean basins: Their structure and evolution, The Open University (An online book accessible through Galileo at http://site.ebrary.com.proxy-remote.galib.uga.edu/lib/ugalib/detail.action?docID=10206656)
WTS: Waves, Tides and Shallow Water Processes, The Open University

Books not available for download or viewing online are available new or used and are also at the Science Library. The textbooks contain suggested reading materials but are not required.

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	30%
Assignments	35%
Final Exam (2^{nd} half of course)	30%
Participation	5%

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. 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.

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.

Academic Honesty: As a University of Georgia student, you have agreed to abide by the University's academic honesty policy, "A Culture of Honesty," and the Student Honor Code. All academic work must meet the standards described in "A Culture of Honesty" found at: https://ovpi.uga.edu/academic-honesty/academic-honesty-policy. Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation. Questions related to course assignments and the academic honesty policy should be directed to the instructor.

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.

Tentative Class Schedule: Students who miss class are responsible for all announcements and assignments given in lecture. *Italics: lectures by C. Meile,* others by D. Di Iorio**.** This outline is a general plan for the course; deviations may be necessary.

	Th Jan 5	Class introduction / Solar input (room 261)	
Wk 1	T Jan 10	Heat Fluxes (room 239)	
	Th Jan 12	Heat Balance / Earth's rotation (room 239)	
Wk 2	T Jan 17	*Snowball Earth (room 261)*	
	Th Jan 19	Atmospheric processes / Global wind field (room 239)	
Wk 3	T Jan 24	Ekman Transport / Sverdrup Transport (room 239)	Assign 1 due
	Th Jan 26	Wind driven surface currents – subtropic/subpolar region (room 239)	
Wk 4	T Jan 31	Wind driven surface currents – The Gulf Stream (conservation of potential vorticity)	
	Th Feb 2	Equatorial currents	
	Th Feb 2 6-7:15pm	El Nino	Assign 2 due
Wk 5	Feb 7/9	GOMRI Conference attendance – no classes	
Wk 6	T Feb 14	Water masses	
	Th Feb 16	*Human activity and ocean circulation: Observations (room 261)*	
	Th Feb 16 6-7:15pm	*Past ocean circulation: Plate movement (room 261) – see OB: Ch 2,4 (Plates)*	
Wk 7	T Feb 21	Meridional Overturning circulation/Global ocean circulation (room 239)	
	Th Feb 23	Midterm Exam *(room 261)*	
Wk 8	T Feb 28	*Past ocean circulation, sealevel changes and Milankovitch cycles (room 261) – see OB: Ch 6 (SL)*	
	Th Mar 2	*Online marine data sources (room 261)*	*Assign 3 due*
Wk 9	Mar 7/9	**Spring Break**	
Wk 10	T Mar 14	*Marine Sediments: distribution, sources and sinks (room 261) – see WTS: Ch4*	
	Th Mar 16	*Marine Sediments as climate archives: Indicators of energetics of environment (grain size), chemical and biological tracers (room 261)*	
Wk 11	T Mar 21	*Paper discussion (Ice age and circulation) (room 261)*	
	Th Mar 23	*Challenges for climate proxies: sediment mixing and transport, tuning, early diagenetic alterations (room 261)*	
Wk 12	T Mar 28	Wind generated waves (room 239)	
	Th Mar 30	Inertial and Internal waves (room 239)	*Assign 4 due (data analysis)*
Wk 13	T Apr 4	Kelvin and Rossby waves (room 239)	
	Th Apr 6	Tides – Equilibrium model: Tide producing force (room 239)	
Wk 14	T Apr 11	Tides – Dynamical model (room 239)	
	Th Apr 13	*Marine Sediments: transport. Longshore transport, turbidites (room 261) – see WTS: Ch3,4*	
Wk 15	T Apr 18	*Paper discussion: sediment transport and contaminant transport (room 261)*	
	Th Apr 20	*Flow in Marine Sediments (room 261)*	
Wk 16	T Apr 25	*Paper discussion: Marsh stability and sediment budget; flow in the deep subsurface/vents; flow in surface sediments (room 261)*	*Assign 5 due*
May 2	8-11am	Final Exam (room 261)	

The course syllabus is a general plan for the course; deviations announced to the class by the instructor may be necessary.