SWS 5182: Earth System Analysis

Catalogue Description: Analysis of global-scale interdependences between climate, biogeochemical cycles and humans using a systems approach

Term	Fall
Meeting Time	Tuesday and Thursday Period 2 (8:30am – 9:20am)
Chat Session:	Thursday 7-8 pm (Online sections)
Enrollment Cap	25
Instructor	Stefan Gerber 3187 McCarty Hall Phone: 392 294 3174 sgerber@ufl.edu
Office hours	Thursdays 10 am to 12 noon or by appointment

Course Description: Earth System Science is the study of interactions between the physical climate – i.e. the circulation of the atmosphere and ocean, the marine and terrestrial life, and the solid Earth. We will explore these linkages from a system's perspective. In particular, we will address how climate, the carbon cycle, and nutrient dynamics interact in shaping global scale temperature, hydrology, primary productivity. An integral part will be to investigate how the Earth System responses to perturbation, such as current global change from large injections of fossil CO2. Throughout the course we will make use of simple mathematical/modeling concepts, and students will devise a simple box model to use for global change analysis. The course is a co-taught graduate/undergraduate course and is offered both online and on campus.

Course Objectives: By the end of the course the students will be able to

- characterize the physical, chemical and biological mechanisms that lead to exchange of energy and matter among the major components of the Earth System (atmosphere, ocean, biosphere and lithosphere)
- analyze interdependencies and feedbacks which operate within and among the components of the Earth System;
- quantify effects of ongoing environmental change using simple box models

Course Format: Lectures will be offered online and are for a module typically 2-3 lectures @ ~15 minutes length. For on campus students, meeting times will be used to discuss materials and homework and provide ample opportunity to address students' question. For online students a chat session provides similar opportunity to consolidate course materials.

***Class Attendance*:** Required for students enrolled in the on campus section. Chat session attendance is required for online students.

Prerequisites: Familiarity with data manipulation and arithmetic operations in Microsoft Excel or similar spreadsheet software is required. A minimal understanding of calculus is useful, though not a requirement (MAC 2233: Survey of Calculus 1; PHY 2048 Physics with Calculus 1, or similar).

Course text:

Required:
- Kump, Krasing and Crane,: 2010, The Earth System, Prentice Hall

- Selected scientific publications (pdfs provided through course reserves)

Optional
- Bloom A: 2010, Global Climate Change, Convergence of Disciplines, Sinauer
- Jacobson M.C. et al., 2000, Earth System Science from Biogeochemical Cycles to Global Change

Course outline

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W	***Topic***	***Reading***	***Assignments***
1	Learning objectives, introduction into system analysis	Crutzen and Stoermer, 2000 Chapter	System analysis of the global water cycle
2-3	Radiative balance of the Earth, greenhouse gases	Introduction, IPCC WG1 summary of policymakers Chapter 3 Crowley, 2000	Planetary energy balance Analysis of climate sensitivity from Data
3-4	Atmospheric Dynamics	Kottek et al., 2006 Chapter 4	Discuss Daily Weather Chart Global circulation and vegetation patterns
4-5	Ocean Circulation and Energy Budget	Rahmstorf et al., 2006, Chapter 5	Set up Earth system model Lag in the climate system
6	Past Climate Changes	Chapter 12 and 14	Presentation: Pick a paleo archive and discuss past climate
7-8	Ocean-atmosphere carbon balance	Chapter 15 Chapter 8 in Sarmiento and Gruber	Add ocean carbon cycle to your Earth system model Atmospheric CO2 in a Strangelove Ocean Greenhouse gas levels from emissions and after depletion of all fossil fuel
9-10	Terrestrial biogeochemistry	Luo et al., 2007	Account for land carbon cycle in your Earth System Model Climate mitigation potential of vegetation and soils
11-12	Earth System feedback analysis	Friedlingstein et al., 2006 Chapter 2	Quantify carbon cycle climate feedback in Earth system models

13 - 14	The fate of anthropogenic greenhouse gases	Archer et al., 2006, Revisit Chapter 15	Effect of Holocene coral reef buildup
14	Recap, Q&A		
15 - 16	Oral presentations		

Expectation and Evaluation: During the course, students will devise a simple Excel-based Earth System model that will gradually increase in complexity. Model development and application will be an integral part of assignments in which students write short reports on their progress in model developments and their findings. All reading homework and assignments are expected to be completed in a timely manner. All assignments will be graded and are a vital part of your final grade. Short quizzes will be on topics covered in the course and reading assignments. In addition students use the Earth system model they developed during the course and investigate a particular aspect. This could be a) scenario explorations b) parameter uncertainty quantification c) adding/refining a component, etc. Projects and assignments are expected to be completed in time and papers will not be accepted after 5:00 pm on the due date.

Grading System: See table for grade points - letter grade conversion. For information on current UF policies for assigning grade points, see *https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx*

A	**A-**	**B+**	**B**	**B-**	**C+**	**C**	**C-**	**D+**	**D**	**D-**	**E**
≥95	≥90	≥85	≥80	≥75	≥70	≥65	≥60	≥55	≥50	≥45	<45

Test Format	**Weight (%)**
Short Quizzes	20
Assignments	45
Project	25
Reflective Discussion	10

Class Demeanor and Etiquette: Students are expected to be considerate and respectful towards fellow students, teaching assistants, instructors, and guest lecturers. This includes a behavior that is not disruptive to class such as punctual attendance, the silencing of cell phones and similar electronic devices, and avoiding private conversations.

Online Course Evaluation Process

Student assessment of instruction is an important part of efforts to improve teaching and learning. At the end of the semester, students are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. These evaluations are conducted online at https://evaluations.ufl.edu. Evaluations are typically open for students to complete during the last two or three weeks of the semester; students will be notified of the specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results

Class Attendance

Class attendance is highly recommended. I understand, we are all busy and 100% may not always be possible. Omitting substantial portions (> 10%) of the class will hamper the student's ability to complete the required homework and project in a satisfactory manner and will thus affect the grade. It is the student's responsibility to maintain satisfactory academic performance and attendance. Neither the Instructor nor the TA are required to cover missed materials with a student if the absence is unexcused.

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Academic Honesty

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: "*We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity."* You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: *"On my honor, I have neither given nor received unauthorized aid in doing this assignment*."

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code.

Software Use

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

Campus Helping Resources

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575,
www.counseling.ufl.edu/cwc/
Counseling Services

Groups and Workshops
Outreach and Consultation
Self-Help Library
Wellness Coaching
U Matter We Care, http://www.umatter.ufl.edu
Career Resource Center, First Floor JWRU, 392-1601, www.crc.ufl.edu/

Students with Disabilities
The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation
0001 Reid Hall, 352-392-8565, www.dso.ufl.edu/drc/

University of Florida Complaints Policy
The University of Florida believes strongly in the ability of students to express concerns regarding their experiences at the University. The University encourages its students who wish to file a written complaint to submit that complaint directly to the department that manages that policy.
A student who is unsure as to the official responsible for handling his or her particular complaint may contact the Ombuds office or the Dean of Students Office. For complaints that are not satisfactorily resolved at the department level or which seem to be broader than one department, students are encouraged to submit those complaints to one of the following locations:

Ombuds: http://www.ombuds.ufl.edu/
31 Tigert Hall, 352-392-1308

The purpose of the Ombuds office is to assist students in resolving problems and conflicts that arise in the course of interacting with the University of Florida. By considering problems in an unbiased way, the Ombuds works to achieve a fair resolution and works to protect the rights of all parties involved.

Dean of Students Office: http://www.dso.ufl.edu/
202 Peabody Hall, 352-392-1261

The Dean of Students Office works with students, faculty, and families to address a broad range of complaints either through directly assisting the student involved to resolve the issue, working with the student to contact the appropriate personnel, or referring the student to resources or offices that can directly address the issue. Follow up is provided to the student until the situation is resolved.
Additionally, the University of Florida regulations provide a procedure for filing a formal grievance in Regulation 4.012: http://regulations.ufl.edu/regulations/uf-4-student-affairs/