

GEOS479/579: Introduction to Climate Dynamics

Fall Semester, 2012 MWF 10-11, GS 209

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Syllabus:

Goals: What you can expect from this course.

The main goal for this course is to understand the working of the climate system as a whole and its critical components (the atmosphere, ocean, sea ice, glaciers, land surface, etc), their complex interactions and feedbacks, and the mechanisms governing natural climate variability (e.g., ENSO) and the climate response to external perturbations (e.g., the increase in greenhouse-gas concentrations).

What we expect of you.

- 1. Textbook:** Online textbook (<http://stratus.astr.ucl.ac.be/textbook/>)
Introduction to Climate Dynamics and Climate Modeling by Goosse et al. (**required**)

Global Physical Climatology by Hartmann. Academic Press, 411 pp., 1994 (reference)
Physics of Climate by Peixoto and Oort, 520 pp., 1992. (reference)
Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Solomon, S. et al., 2007. (reference)
- 2. Attendance:** To perform well you need to come to every class and get the most out of the course.
- 3. Grades:** Undergraduates: Problem sets: 45% (9 sets, each 100 points); Exams: 45% (3 times, each 100 points); Final Paper and Presentation (optional); Participation: 10%.
Graduates: Problem sets: 36% (9 sets, each 100 points); Exams: 36% (3 times, each 100 points); Final Paper and Presentation: 18% (100 points), Participation: 10%.

* A = >89.5%
* B = 79.5% to 89.4%
* C = 69.5% to 79.4%
* D = 59.5% to 69.4%
* E = <59.5%

a) **Problem sets (45% undergraduates and 36% graduates):** There will be 9 problem sets during the semester. These will emphasize material that will be covered on the exams. Most of the exercises will be based on concepts from classes and readings. Many of the problem sets will require computations using spreadsheets (e.g., Excel), so you should know how to use Excel or an equivalent program.

b) **Exams (45% undergraduates and 36% graduates):** Three 100 point exams will be given during the semester, two mid-terms (**Sept. 26 and Oct. 26**) and a final (**Dec. 7**).

c) **Final Paper and Presentation (18%):** At the end of the semester, students will submit a final (approximately 8-15 pages) paper and make a 10-minute presentation followed by a 5-minute questions section on a topic related to climate dynamics. Proposals for topics must be received no later than **Nov. 9**. We will help you choose an appropriate topic and provide guidance on making an effective scientific presentation. Start planning for this early.

4. **Grade Reporting:** Grades will be available through D2L.

5. **Graded Work:** All graded material will be returned to you in class one week after they are due. You have one week make sure they were graded correctly -- bring to the instructor if not!

6. **Cheating:** Cheating is any attempt to represent someone else's work (on exams, quizzes, homework, extra credit exercises, etc.) as your own. It's great to work outside of class with friends, but material turned in must be your own thoughts and words. Do not include someone else's sentences or statements without appropriate reference. Identical work will be given a zero the first time. The second time, you will be referred to the Dean of Students, it will go on your academic record, and you may be expelled from the University. For more information, refer to the UA Code of Academic Integrity.

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Class Schedule – 2012
Instructor: Jianjun Yin

	Date	Lecture	Problem Sets
1	8/20/2012	Introduction	
2	8/22/2012	The atmosphere: Composition and Temperature	
3	8/24/2012	The atmosphere: General Circulation	
4	8/27/2012	The atmosphere: Precipitation	#1
5	8/29/2012	The Ocean: Composition and Properties	
6	8/31/2012	The Ocean: General Circulation	
7	9/3/2012	LABOR DAY HOLIDAY (no class)	
8	9/5/2012	The Ocean: Temperature and Salinity	#2
9	9/7/2012	The Cryosphere: Components and Properties	
10	9/10/2012	The Land Surface and Terrestrial Biosphere	
11	9/12/2012	The Energy Balance: Earth's Energy Budget	
12	9/14/2012	The Energy Balance: Earth's Energy Budget 2	#3
13	9/17/2012	The hydrological cycle	
14	9/19/2012	The hydrological cycle 2	
15	9/21/2012	The Carbon Cycle	
16	9/24/2012	The Carbon Cycle 2	#4
17	9/26/2012	Exam 1	
18	9/28/2012	Response of the Climate System: Natural Climate Forcing	
19	10/1/2012	Response of the Climate System: Anthropogenic Climate Forcing	
20	10/3/2012	Response of the Climate System: the Greenhouse Effect	
21	10/5/2012	Response of the Climate System: Physical Feedbacks	#5
22	10/8/2012	Response of the Climate System:: Geochem, Biogeochem	
23	10/10/2012	Modeling the Climate System: Introduction	
24	10/12/2012	Modeling the Climate System: Hierarchy of Climate Models	
25	10/15/2012	Modeling the Climate System: Components of Climate Models	
27	10/17/2012	Modeling the Climate System: Components of Climate Models 2	#6
28	10/19/2012	Modeling the Climate System: Numerical Resolution of Equations	
29	10/22/2012	Modeling the Climate System: Numerical Resolution of Equations 2	
30	10/24/2012	Modeling the Climate System: Testing the Validity of Models	#7
31	10/26/2012	Exam 2	

32	10/29/2012	Brief History of Climate: Introduction	
33	10/31/2012	Brief History of Climate: Internal Climate Variability	
34	11/2/2012	Brief History of Climate: Climate since the Earth's Formation	
35	11/5/2012	Brief History of Climate: Last Million Years	
36	11/7/2012	Brief History of Climate: The Holocene	
37	11/9/2012	Brief History of Climate: The Last 1000 Years and 100 Years	#8
38	11/12/2012	VETERANS DAY HOLIDAY (no class)	
39	11/14/2012	Future Climate Changes: Emission Scenarios	
40	11/16/2012	Future Climate Changes: Projections for the 21st Century	
41	11/19/2012	Future Climate Changes: Projections for the 21st Century 2	
42	11/21/2012	Future Climate Changes: Change beyond the 21st Century	
43	11/23/2012	THANKSGIVING HOLIDAY	
44	11/26/2012	Future Climate Changes: Sea Level Rise and Ice Sheet Stability	
45	11/28/2012	Future Climate Changes: Sea Level Rise and Ice Sheet Stability 2	#9
46	11/30/2012	Student Presentations	
47	12/3/2012	Student Presentations	
48	12/5/2012	Student Presentations	
49	12/7/2012	Final Exam	