EAS 48800/B8800/SUS7300 Climate & Climate Change
Spring 2020

Instructor: Prof. Johnny Luo, Office: MR-927, 212-650-8936, zluo@ccny.cuny.edu;
Time: M/W 2:00-3:15pm; **Location**: MR044;
Office hours: after class (3:15 - 4:15pm) or by appointment

General Description:

This class is intended introduce to students the modern study of Earth's climate system – Climate Science. Climate Science has evolved rapidly in the past decades and has become a "melting pot" of a number of disciplines including meteorology, climatology, oceanography, hydrology, etc. New observations and analysis tools have also been developed, the most notable of which are Earth-orbiting satellites and global climate models. In this class, students will first learn the fundamentals of the Earth's climate system and will then move on to learn how climate changes. Students will also learn to use Matlab to analyze gridded climate data.

Prerequisites:

EAS 10600 OR ENGR 10610, MATH 20200 OR 21200, PHYS 20400 OR PHYS 20800. Programming experience (e.g., Matlab) is highly desirable.

(Note: the prerequisite info on CUNYFirst is incorrect and is being updated).

Textbooks:

(Required) *Global Physical Climatology*, by Dennis L. Hartmann, Academic Press, 2nd Edition, 2016.

(Suggested) *Physics of Climate*, by Jose Peixoto and Abraham Oort, Springer, 1992.

(Suggested for Matlab) *Matlab Recipes for Earth Sciences*, M. H. Trauth, Springer, 2010

Grading:

	Undergrad	Graduate
Homework	10%	10%
In-class tests	30%	30%
Final Project	30% (presentation)	40% (presentation + term paper)
Final Exam	30%	20%

Learning Outcomes:

1. Describe different components of Earth's climate system
2. Describe factors affecting global energy balance; be able to use Matlab to calculate and plot solar insolation as a function of time and latitude.
3. Understand basics of solar and IR radiation transfer through the atmosphere; Apply the radiative transfer knowledge to calculate surface temperature under radiative-convective equilibrium using, for example, a 2-layer model.

4. Describe salient circulation features of the atmosphere (e.g., Hadley Cell) and the Ocean (e.g., Thermohaline circulation)
5. Understand climate sensitivity and climate feedback; be able to analyze different feedback mechanisms (e.g., water vapor feedback, ice albedo feedback, etc.)
6. Describe various natural (e.g., orbital variations) and anthropogenic climate forcing mechanisms (e.g., increasing greenhouse gasses); assess their importance in determining climate change.

Course Outlines: (Note: weekly plan may be subject to small changes)

Week	Dates	**EAS 488: Climate & Climate Change**	Notes
Week 1	Jan 27	Introduction to climate system	
	Jan 29	The Earth's energy balance I	
Week 2	Feb 3	The Earth's energy balance II	
	Feb 5	Lab 1: Use Matlab to access and plot gridded data	
Week 3	Feb 10	The Earth's energy balance III	
	Feb 12	No Class (Lincoln's Birthday)	
Week 4	Feb 17	No Class (Washington's Birthday)	
	Feb 19	Atmospheric radiation & climate I	
Week 5	Feb 24	Atmospheric radiation & climate II	
	Feb 26	Test 1	10 pts
Week 6	Mar 2	Surface energy balance I	
	Mar 4	Surface energy balance II	
Week 7	Mar 9	In-class Lab 2: Use Matlab to read IRI climate data	
	Mar 11	Atmospheric general circulation I	
Week 8	Mar 16	Atmospheric general circulation II	
	Mar 18	Atmospheric general circulation III	
Week 9	Mar 23	Ocean circulation	
	Mar 25	Test 2	10 pts
Week 10	Mar 30	Lab 3: Conduct basic analysis of climate data	
	Apr 1	Climate sensitivity & climate feedback I	
Week 11	Apr 6	Climate sensitivity & climate feedback II	
	Apr 7	Natural climate change I	
Week 12	Apr 13	No class (Spring Break)	
	Apr 15	No class (Spring Break)	
Week 13	Apr 20	Natural climate change II	
	Apr 22	Anthropogenic climate change I	
Week 14	Apr 27	Anthropogenic climate change II	
	Apr 29	Test 3	10 pts
Week 15	May 4	Preparation for final presentation	
	May 6	Student Presentation I	U: 30 pts; G: 40 pts
Week 16	May 11	Student Presentation II	
	May 13	Student Presentation III	