University of Nebraska–Lincoln

NRES 467\867 - Global Climate Change

Taglines - We Do The Heavy Lifting

Bulletin Listing:

NRES 467/867 -- "Global Climate Change "
467/867. Global Climate Change (METR 467/867), (3 cr, I) Lec. 3. Offered fall semester of even-numbered calender years.
Prereq: Junior standing, MATH 106, 5 hours of Physics, METR 251 and 252, METR 350, METR 453, or permission.

Elements of climate systems, including El Niño/La Niña cycle and monsoons. Natural variability of climate on interannual and interdecadal scales. Paleoclimate, and future climate with an emphasis on developed climate change scenarios and climate change impacts on natural resources and the environment. Introduction to climate modeling for advanced students registered for 867.

Instructor:

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Educational Objectives:

Students will:

1. increase their understanding of the earth climate, its present, past, and future conditions.
2. gain an understanding of the major elements of the climate system and their roles in climate change.
3. learn the natural variability of the climate system and develop the capability to identify climate change due to human induced effect.
4. gain knowledge of paleoclimates and predicted future climates.
5. learn how changes of climate will affect natural resources and environment.
6. gain an understanding of climate modeling principles and apply them to develop simple climate models (for graduate level students).

Methods:

The course will be primarily taught through lectures. An independent class project will be assigned to graduate students.

Prerequisites:

Prereq: Junior standing, MATH 106, 5 hours of Physics, METR 251 and 252, METR 350, METR 435, or permission.

Syllabus:

(Differentiation between undergraduate and graduate standings is that graduate students will be expected to do exercises of equation derivation and carry out a class project. A qualitative description of concepts with limited involvement of quantitative reasoning will apply to undergraduate students.)

Lecture No. (50 minutes lectures)	Topics
1	Introduction
	BASICS OF EARTH CLIMATE AND CLIMATE CHANGE
2	Energy budget at the earth surface and in the atmosphere (budget equations and methods of solution)
3	Atmospheric and ocean circulations (basic systems of equations of motion)
4	Climate and climate variations on different time scales (General Circulation study results)
5	Climatic forcing (radiative forcing of atmospheric aerosols and clouds--built on the energy budget concept)
6	Atmospheric trace gases and carbon dioxide, their sources and life cycles
7	Effects of greenhouse gases on radiation budget and climate (vertical profiles of CO2 and other gases in atmosphere and effect of their concentration on radiation transfer)
8	Land-cover change and surface forcing

9	Paleoclimatology, earth orbit change/oscillation and climate change
10	Overview on proxy studies of paleoclimate (methods and findings)
12	Droughts in paleoclimate
13	Climate change from paleo-perspective
14	Exam #1
	NATURAL VARIABILITY OF THE CLIMATE SYSTEM
15-17	Atmospheric waves and oscillation
18	Intraseasonal oscillations in the tropical atmosphere (observation and theories)
19	Intraseasonal oscillations in the mid-latitudes
20	Interannual variations of precipitation
21	Interannual variations of temperature
22-23	Interannual variations -- Ocean-atmosphere interactions and El Niño (observation)
24-25	Theories of El Niño development
26	Variations of El Niño over history
27	The Southern Oscillation and global climate
28-29	The North Atlantic Oscillation
30	Interdecadal variations of precipitation
31	Interdecadal variations of temperature
32	Exam #2
	CLIMATE CHANGE
33	Trend in the current surface temperature variation
34	Trend in the current precipitation variation
35	Change of occurrence frequency of severe events
36	Climate change predicted by climate models
37-38	Energy balance models
39-40	Global Climate models (GCMs)
41-43	Climate change scenarios and future climate – predictions of GCMs
44	Climate change impacts on environment
45	Final exam

Course Schedule: Monday, Wednesday, and Friday, 11:00-11:50AM (subject to change)

Texts:
Handouts will be taken from several books, including Introduction to Climatology, Trewartha, G. T., and Horn, L. H., Paleoclimatology, Crowley, T. J. and North, G. R., El Niño, La Niña, and the Southern Oscillation, Philander, S.G.H., and from published articles in atmospheric science and climate journals. Students will be required to read chapters of these selected books and specified journal articles.

Grading Method:

Undergraduate standing:		Graduate standing:	
Homework:	50%	Class project:	50%
Exam #1:	15%	Exam #1:	15%
Exam #2:	15%	Exam #2:	15%
Final exam:	20%	Final exam:	20%

Revised: August 2006