

Spring 2018

## ENVS 224 Climate Change

Session 004: TTh 11:30 AM – 12:45 PM, Crown Center 103

**Prerequisite:** ENVS 137 or UCSF 137

**Class Attribute:** Tier 2 Scientific Knowledge

**Instructor:** Ping Jing

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**Office Hours:** 1:00 – 3:00 PM, TTh (or by appointment)

### Note:

- **Materials from this course cannot be shared outside the class** without my written permission.
- Familiarize yourself with my class policies on Page 4. I will strictly apply these policies **in order to be fair to all students.**

### 1. Course description

This course is an introduction to the topic of climate and climate change that will address the core knowledge area *Scientific Literacy*. Basic principles and knowledge to explain climate change will be covered, thus meeting **COMPETENCY B: "DEMONSTRATE AN UNDERSTANDING OF THE FUNDAMENTAL PRINCIPLES, CONCEPTS, AND KNOWLEDGE OF THE SCIENCES"**. Students will learn about natural and anthropogenic causes of climate change, the interactions between earth-atmosphere-ocean systems, climate feedback mechanisms, and impacts of climate change on the natural physical environment. Students will also be introduced to global climate models and techniques for detecting climate change. In the class project, students will study climate change at the local scale in a city, including the impacts of climate change and mitigation/adaptation plans of the city.

### 2. Course objectives

A primary goal of this course is that students will gain an understanding of how the science of climate and climate change is developed in addition to basic knowledge on climate change. Another goal is that students will learn both cognitive and mathematical skills to draw valid, logical conclusions regarding various observed phenomena such as observed changes in the climate system and observed impacts of climate change. Students will reinforce their reading, writing, and public-speaking skills through the class project on climate change.

### 3. Textbooks

**Book 1 (required):** *Global Warming: Understanding the Forecast*, by David Archer, 2<sup>nd</sup> ed., 2012, Wiley, ISBN-13: 978-0-470-94341-0

The text-only PDF of this book is provided by the author at

[https://geosci.uchicago.edu/~archer/Forecast\\_2ed/text\\_2ed.textonly.pdf](https://geosci.uchicago.edu/~archer/Forecast_2ed/text_2ed.textonly.pdf).

The 1<sup>st</sup> edition of the book is available at

[https://maths.ucd.ie/met/cess/FoundClim/archer\\_global\\_warming.pdf](https://maths.ucd.ie/met/cess/FoundClim/archer_global_warming.pdf).

**Book 2 (recommended):** *Global Climate Change: Turning Knowledge into Action*, by Kitchen, 2014, Pearson Education, ISBN-13: 978-0-321-63412-2

**Book 3 (recommended):** *Dire Predictions: Understanding Climate Change, the Visual Guide to the Findings of the IPCC*, by Mann and Kump, 2<sup>nd</sup> ed., 2015, DK Publishing, ISBN-13: 978-0-1339-0977-7

### 4. Course outline (Sequence may vary; content basically maintained)

#### A. Introduction to the climate system

Atmospheric composition

Major components: nitrogen, oxygen, argon

Variable components: water vapor, carbon dioxide, methane, ozone, aerosols

Atmospheric temperature

Vertical structure of the atmosphere

Air pressure

Forces controlling air movement

Pressure gradient force, Coriolis force, and frictional force

Atmospheric humidity

Cloud formation and precipitation

**B. The global energy balance**

Heat and temperature

Sensible heat and latent heat

Heat transfer

Laws of radiation

Planck's law

Stefan-Boltzmann law

Wien's law

Energy balance of the earth

Heating and cooling of the earth

Solar inputs, energy exchange within the climate system

The greenhouse effect and the enhanced greenhouse effect

Radiative forcing

**C. Atmospheric general circulation and climate**

Cyclones and anticyclones

Pressure belts and planetary surface winds

The westerly winds and the jet streams

**D. Ocean-atmosphere interactions**

The oceans as heat storage and heat transporters

Surface ocean circulation

The El Nino-Southern Oscillation (ENSO)

**E. Climate feedback mechanisms**

Water vapor feedback

Ice albedo feedback

Cloud feedback

Biogeochemical feedback

**F. Changes in the climate system**

Concepts of climate change

Techniques for detecting climate change

Techniques for reconstructing past climate

Techniques for monitoring modern climate

The climate record

Historical climate change

Contemporary climate change

Causes of climate change

Natural causes and anthropogenic causes

Modeling of the climate system

Introduction to climate models

Future climate change

Applications of climate model results

**G. Impacts of climate change**

On water resources and severe weather events

**H. Solutions to climate change**

Mitigation methods

**5. Assessment**

	Points	% of Final Grade
Midterm exam	150	30%
Final exam	150	30%
Group project	65	13%
Exercises (10 pts each)	100	20%
Campus events	10	2%
Class attendance	25	5%
Total	500	100%

All points from assignments will be added at the end of the term, and a final grade will be determined according to the following scale. Grades will not be curved.

Grading scale: Letter Grade	% of Total Points	Total points
A	93–100%	464–500
A-	90–92%	448–463
B+	89%	443–447
B	80–88%	398–442
B-	79%	393–397
C+	77–78%	383–392
C	70–76%	348–382
C-	65–69%	323–347
D+	64%	318–322
D	50–63%	248–317
F	<50%	<247

## 6. Exams

Exams will be comprised of multiple-choice and short-answer questions. Exams will be given at appointed times. Make-up of exams will be permitted if an adequate explanation of the absence is presented before or within 24 hours after the scheduled exam. A grade of zero will be given for an unexcused missed exam. In general, exams must be made up before the next class period. Any questions about specific answers to exam questions will only be addressed by using the following protocol: Within one week of receiving your graded exam, you must submit, in writing, a thoughtful, well-reasoned argument as to why you believe your answer was correct. I will only consider changing grades when addressed in this manner. Warning: If I re-grade a question from an exam, your grade could go up or it could go down on the question at hand and on the exam in general.

## 7. Group Project

This is a group research project. Students will compare two U.S. states in terms of their energy consumption and greenhouse gas emissions. They will also compare the potential impacts of climate change on the two states. They will then make a climate change action plan for the two states to mitigate and adapt to climate change. They will report their research results in a PowerPoint presentation (50 pts). See the Appendix for guidance.

## 8. Campus Events

It's important for students to engage in campus events. I expect student to attend at least two campus events (5 pts each; 10 pts maximum) that I announce to the class or events that are relevant to environmental sustainability. In order to earn the 5 pts, you must present evidence of attendance (signature by the event organizer or a photograph) AND write a summary/reflection (>150 words) of the event.

## 9. Exercises

An exercise (10 pts each) is given in most classes. They typically require you to practice using Excel. They are due by the time the next class period starts. I will count your ten best exercise scores in your final grade. I encourage students to work in groups and help out each other. However, these assignments must be completed and submitted individually. Copying is not permitted and will result in a grade of zero for both parties involved.

## 10. Class attendance

Twenty-five points are offered to encourage students to attend classes. You will earn 1 pt for each class you attend (requiring a 70+ minutes presence in the classroom).

## 11. Missing classes

I expect students to attend all classes unless emergency circumstances prevent them from doing so. If missing a class, students are responsible for material that is presented in their absence. They should consult the notes of other students to find out what they missed before they return to class and clear up any questions with the instructor.

## **12. Special academic needs**

Students requiring special accommodations due to a diagnosed learning disability should speak to the instructor regarding these arrangements during the first week of the semester.

## **13. Academic integrity**

Clear expectations of academic integrity at Loyola University Chicago are provided at [http://www.luc.edu/academics/catalog/undergrad/reg\\_academicintegrity.shtml](http://www.luc.edu/academics/catalog/undergrad/reg_academicintegrity.shtml). These policies will be strictly enforced in this course. Academic dishonesty during a quiz or exam will result in a grade of zero for that quiz or exam. In addition, I am required to report any instances of academic dishonesty to the Chairperson of the Department of Environmental Science and the Dean of the College of Arts and Sciences.

## **14. Sakai**

Information about this course, syllabus, PowerPoint lectures, assignments, announcements, etc., will be posted on Sakai. Please login and familiarize yourself with this tool.

## **15. Important class policies**

Familiarize yourself with these policies. I will strictly apply these policies **in order to be fair to all students.**

- A. Materials from this course cannot be shared outside the class without my written permission.
- B. The maximum extension that I can offer to exams and quizzes is one week, even if you have a valid excuse. I typically give a two-day extension to students who have a valid excuse.
- C. When missing a quiz or an exam, students should contact me within 24 hours to request a makeup.
- D. Academic dishonesty during a quiz or exam will result in a grade of zero for that quiz or exam.
- E. If missing a class, students are responsible for material that is presented in their absence.

## **16. Policy for missed exams and assignments**

Students are expected to take exams on the scheduled dates and times. Makeup exams will be given only if one (or more) of the following conditions applies:

- A. Illness or hospitalization requiring physician's intervention.
- B. Death of a close family member.
- C. Unavoidable court date (including jury duty).
- D. Representing Loyola in an official capacity which requires your absence from class (i.e., debating team, model UN, intercollegiate athletics).
- E. Religious observance that prohibits normal work/school activities on that day.
- F. Off-campus interview for graduate or professional school.

Travel, unless it is travel for one of the reasons listed above, is not an approved reason for missing exams. In all cases, students must provide written, relevant, and verifiable documentation of the circumstances.

**Late assignments will receive no credit.** If the assignment is late due to one of the five reasons listed above, I will work with the student to determine an appropriate alternate assignment.

**Students who have an unexcused absence when group work is done will receive a zero for that assignment.**

### Tentative Schedule (Subject to Change)

Week	Topic
#1	Introduction to the atmosphere
#2	Heating the atmosphere and the energy budget
#3	Moisture, clouds, and precipitation
#4	Atmospheric circulation
#5	Atmospheric circulation cont'd
#6	Ocean-atmosphere interactions
#7	Ocean-atmosphere interactions cont'd <b>Tuesday of Week 7: Midterm exam</b>
#8	<b>Spring Break</b>
#9	Changes in the climate system: detection techniques and evidence
#10	Changes in the climate system: causes and diagnosis
#11	Feedback mechanisms in the climate system
#12	Modeling of the climate system
#13	Solving climate change <b>Thursday of Week 13: progress report of the project due</b>
#14	Solving climate change cont'd
#15	<b>PPT presentations</b>
Final Exam Week	<b>Check the final exam schedule at</b> <a href="http://www.luc.edu/academics/schedules/spring/exam_schedule.shtml">http://www.luc.edu/academics/schedules/spring/exam_schedule.shtml</a>

## Appendix A. Guidelines for the Group Project (65 pts)

**Strictly follow these instructions. Failure to do so will result in lower grades.**

1. This is a group assignment (2 members per group).
2. Each group will choose two U.S. states by themselves to study climate change in the two states.
3. Use the following references in your research:
  - For energy and greenhouse emissions, visit the U.S. Energy Information Administration website: <https://www.eia.gov>.
  - For climate change impacts, visit the 2014 National Climate Assessment (<http://nca2014.globalchange.gov/report>) and the 2017 National Climate Assessment (<https://science2017.globalchange.gov>).
4. You will report your research results in a PowerPoint (PPT) presentation. The PPT presentation should contain the following sections:
  - Title page (one slide): the title of your presentation and your names
  - Outline (one slide): the outline of your presentation
  - Comparisons of the energy consumption (types of energy sources, amounts, and trends).
  - Comparisons of the greenhouse gas emissions (amounts and trends)
  - Comparisons of potential climate change impacts
  - Climate action plans for the two states (compare and discuss)
  - Summary (one slide): remind the audience of the most important take-home information.
  - Discussions (one to two slides): ask the audience questions to prompt follow-up discussions.
  - References (one to two slides): list your references; no required format.
5. Each group submits a one-page, single-spaced **progress report (10 pts)** on their project **by Thursday of Week 13**. The progress report should include the following:
  - what is your original plan for the project, including expected outcomes, tasks and the timeline (4 pts)
  - what you have accomplished so far, including major findings and if you are on schedule (4 pts)
  - what you plan to do next in order to complete the project on time successfully (2 pts)
6. Each group presents their **PPT presentation (50 pts)** on the designated day. The PPT file must be submitted to the instructor by email before the presentation starts.
  - Each group is given 15 minutes.
  - Each student should present 5-6 minutes (10 to 12 minutes total for the group).
  - The group uses the rest of the time (3-5 minutes) to answer questions or ask the audience questions and lead the follow-up discussion.
7. Grading method for the PPT presentation (50 pts): (Each student of the same group will be evaluated separately.)

Criteria	Outstanding	Acceptable	Unacceptable
<b>Slide appearance</b> (8 points)	<b>(7–8 pts)</b> Limited text shows key points. No unnecessary words. Spelling, grammar, and punctuation are correct. Font is clearly readable from back of the room. Pictures help focus attention and clarify information.	<b>(3–6 pts)</b> A little wordy. Some spelling, grammar, or punctuation errors. Font is a little small to be easily seen from back of room. Pictures are few or poor quality or do not help clarify info.	<b>(0–2 pts)</b> Slides are covered with text. Text is too small or wrong colored to be easily read. Pictures absent or very poor quality or do not help audience understand the info.
<b>Speaking</b> (10 points)	<b>(9–10 pts)</b> The presenter speaks clearly and is familiar with the presentation. He/she does not just read note cards.	<b>(6–8 pts)</b> The presenter is a little hard to hear and understand; he/she is not very familiar with his/her slides.	<b>(0–5 pts)</b> The presenter mumbles over words. No planning of what he/she is saying is evident.
<b>Content</b> (30 points)	<b>(27–30 pts)</b> All points on topic outline are well covered. No required content is missing. Ideas are well-developed and clear. Important points are emphasized and related to each other. Supporting details are included.	<b>(18–26 pts)</b> Some points in topic outline are missing. Some required content is not adequately addressed. Ideas not well developed or not well organized. Not enough supporting details. You are left wondering what the important info is.	<b>(0–17 pts)</b> Many points in topic outline are missing. A significant amount of required content is missing. Topic poorly covered. Ideas disorganized and poorly developed. He/she does not seem to understand his/her topic.
<b>References</b> (2 points)	<b>(2 pts)</b> All material on slides including illustrations is referenced.	<b>(1 pt)</b> Some material is not referenced.	<b>(0 pts)</b> Few or no references are listed on slides.

### 8. Your grading of other students' PPT presentations (5 pts)

You are required to attend and grade other students' presentations.

- 5 pts: You provide well-thought-out comments to all other students' presentations.
- 3–4 pts: You provide comments to most other students' presentations.
- 1–2 pts: Your comments are too brief or you miss more than two groups' presentations.
- 0 pts: You provide no comments to any presentations.