Instructor: Sonali McDermid is a climate scientist and Assistant Professor in the Dept. of Environmental Studies here at NYU. A description of her research is available at http://environment.as.nyu.edu/object/environment.faculty.sonalimcdermid
To make an appointment for Office Hours, click Here

Brief Course Description:

Climate change is among the most complex and challenging problems that we have confronted as a civilization, and the responses and impacts will vary largely across space and the global population. This course is designed to give you an overview of the scientific basis of climatic change, and will expose you to multiple facets of a very interdisciplinary and encompassing field. You will be introduced to the physical science of our climate system, the contributing system components, and the basic mechanisms that govern how the climate system responds to drivers of change. We'll then explore climate change from multiple perspectives: paleoclimatic change, recent historical variability and change, and then future climate projections. The course will be guided by the prescribed textbook, and also by the Intergovernmental Panel on Climate Change, Assessment Report 5 (AR5). AR5 summarizes the global scientific consensus on the problem, and serves as the basis for a vast majority of impacts assessments and policy decisions. Readings and assignments will be supplemented with major peer-reviewed scientific papers and reports.

Grading:

This class counts as 4.0 credits. Your grade will be based on regular homework assignments, one mid-term exam, and a final exam

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Contribution to Grade (%)</th>
<th>Deadline</th>
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<tbody>
<tr>
<td>Homework Assignments</td>
<td>40</td>
<td>Friday at 5pm a week from issue</td>
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<tr>
<td>Midterm Exam</td>
<td>30</td>
<td>Wednesday, March 11th</td>
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<tr>
<td>Final Exam</td>
<td>30</td>
<td>Monday, May 11th</td>
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Assignments:
There will be regular homework assignments throughout the course, which will each require short answers to approximately 4-6 questions (some may be quantitative). One short answer midterm exam will be given in class on Weds, March 11th.

When assigned, you will have approximately one (1) week to complete each assignment. These will comprise of numerous (~4-10) questions designed to test your comprehension and critical thinking of the assigned readings and issues discussed in class. The responses will either be written in short-answer form and will test your comprehension in understanding future projected changes and uncertainties, or they will be quantitative reasoning questions relating to basic interactions in our climate system.

The assignments will generally be posted Fridays directly following the week’s classes, and are due by 5:00 pm the following Friday. Assignments, along with all class correspondence, will be posted using the NYU Classes system. Assignments are expected to be typed using 12 pt font and 1.5 line spacing (double spacing is NOT acceptable). Assignments should either be emailed to me or uploaded via the NYU Classes webpage. Please DO NOT submit a GoogleDoc.

Please note: all assignments MUST have your last name in the filename. Assignments that do not have a name in the filename will automatically be deducted 10 points. Late homework will NOT be accepted, without a documented excuse.

If you have difficulty in complying with the above, or any other questions, please contact me as soon as possible.

**Quizzes and Exams:**

Short multiple choice quizzes will be periodically given at the beginning of lecture (first 5 minutes). Points earned on quizzes across the semester can contribute up to 4% extra credit to the final grade. These quizzes are thus an opportunity to bump (from a B to a B+, e.g.). There are no make-up quizzes, so if you miss class or are late you will not have an opportunity to earn those extra credit points. No other extra credit will be offered!

Exams will be short answer and comprise of roughly 8-10 questions, to be completed in class without notes or aides. Please see instructor for other accommodations. Should you need to miss an exam, please alert instructor in advance if possible to schedule a makeup. If an exam is missed due to illness, a makeup exam will be scheduled after the receipt of a doctor’s note.

**Required Text and Readings:**

*Our Changing Climate: Introduction to Climate Science 1st Ed, Chad M. Kaufman, from AMS EduBooks. ISBN: 978-1-935704-82-9*

You may either rent or buy just the Ebook version:
Rent: https://edubooks.ametsoc.org/CLTX-Ed1
Buy: https://edubooks.ametsoc.org/CLTX-Ed1-N

This course will also be supplemented by readings from the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR5), along with peer-reviewed scientific articles. IPCC AR5 freely available document at: https://www.ipcc.ch/report/ar5/, but I will also make the relevant chapters available via NYUClasses - Resources.

Please note: This field is dynamic and rapidly changing. The scientific literature is therefore constantly being updated, and each semester there will be new findings. As such, please pay close attention to NYUClasses for an updated list of readings. The readings below will serve as a guide, but I may choose to update/replace these based on the latest material. All additional readings will be posted in .pdf format on NYUClasses-Resources as well, and it is your responsibility to regularly check the course webpage to find your readings, assignments, and materials.

Student Expectations:

*It is NYU policy that all work is expected to be your own. Plagiarism of any kind will result in a failing grade for the class, and referral to an academic dean. Plagiarism includes: copying sentences or fragments from any source without quotes or references; not citing every source used in your papers; citing internet information without proper citation; presenting someone else’s work as your own; or copying verbatim from any source. You are subject to CAS’s guidelines for Academic Integrity: http://cas.nyu.edu/page/ug.academicintegrity*

You will be expected to attend every class, as the readings will cover *some* of the topics we discuss in class in more detail, but not all topics. Your active listening in class will help you to create a more thorough response to some of the homework prompts, and those responses that receive full marks will incorporate this. This is college, and so I also expect that you will take initiative to look further into terms and topics you are unfamiliar with in the readings (this includes asking me). Active participation will be encouraged – it can behoove you to be a visible contributor in class. There will be many opportunities to do so, as an individual and as discussions questions posed to groups of students in class, so please be ready to take advantage of these opportunities.

**Academic Integrity, Plagiarism, and Cheating (adapted from the website of the College of Arts & Science, [https://cas.nyu.edu/content/nyu-as/cas/academic-integrity.html](https://cas.nyu.edu/content/nyu-as/cas/academic-integrity.html]):**

Academic integrity means that the work you submit is original. Obviously, bringing answers into an examination or copying all or part of a paper straight from a book, the Internet, or a fellow student is a violation of this principle. But there are other forms of cheating or plagiarizing which are just as serious — for example, presenting an oral report drawn without attribution from other sources (oral or written); writing a sentence or paragraph which, despite being in different words, expresses someone else’s idea(s)
without a reference to the source of the idea(s); or submitting essentially the same paper in two different courses (unless both instructors have given their permission in advance). Receiving or giving help on a take-home paper, examination, or quiz is also cheating, unless expressly permitted by the instructor (as in collaborative projects).

**Disability Disclosure Statement:**

Academic accommodations are available to any student with a chronic, psychological, visual, mobility, learning disability, or who is deaf or hard of hearing. Students should please register with the Moses Center for Students with Disabilities at 212-998-4980.

NYU’s Henry and Lucy Moses Center for Students with Disabilities  
726 Broadway, 2nd Floor  
New York, NY 10003-6675  
Telephone: 212-998-4980  
Voice/TTY Fax: 212-995-4114  
Web site: http://www.nyu.edu/csd
Climate Change Syllabus – Spring 2020

Readings highlighted in Green are provided on NYUClasses. You are responsible for obtaining any additional readings prescribed.

Week 1 (1/27) - Introduction:
- A primer on systems thinking
- The Anthropocene: Increased population, development, and per capita consumption have initiated what is being termed a new geological period: the “Anthropocene”
- Setting the stage: the stakes of climate change in 2020

Readings:
- Kaufman, Chapter 1 from “Importance of the Climate System” to end of chapter
- Review: https://www.ourchildrenstrust.org/us/federal-lawsuit/

Week 2 (2/3) – Fundamentals of Earth’s Climate/Biogeophysical/Biogeochemical Systems

Readings:
- Kaufman, Chapter 4 All

Week 3 (2/10) – Fundamentals of Earth’s Climate/Biogeophysical/Biogeochemical Systems con’t
- Hydrological cycle: How does water impact Earth’s climate?

Readings:
- Kaufman, Chapter 5, “Properties of Water” and “Atmospheric Stability”
- Kaufman, Chapter 6, “Forces that Act on Atmospheric Circulation”, “Synergistic


**Week 4 (2/17) – Fundamentals of Earth’s Climate/Biogeophysical/Biogeochemical Systems con’t**

No class 2/17

- *Forcings and Feedbacks in the Climate System:* Radiative forcings: changes in Earth’s orbit, greenhouse gases, and solar luminosity. Positive and negative feedbacks.
- *The Earth’s Climate System:* Short and long term carbon cycles, plate tectonics.

**Readings:**

- Kaufman, Chapter 7, everything EXCEPT “Other oscillations between Atmosphere and Ocean”, and “Changing Ocean in a Changing Climate”
- Kaufman, Chapter 8, “Feedbacks”, and “Biogeochemical Cycles”
- Kaufman, Chapter 10, “Climate Sensitivity”

**Week 5 (2/24) - Climate Change in the Geological Record:**

**Guest Lecture 2/26: Dr. Linda Sohl, Paleoclimatologist, Columbia University**

- *Paleoclimatic reconstructions:* Climate variation across time scales. The faint young Sun and evolution of the atmosphere. The role of weathering and long-term carbon cycles – impact to regional and global climates. The Earth’s orbital cycles as “pacemaker” of ice ages (Milankovic theory). Evidence from marine sediments and glacial ice cores. Historical periods of climate change in human history.

**Readings:**

- Kaufman, Chapter 8, “Natural Drivers of Climate Change”
- Kaufman, Chapter 9, Everything EXCEPT “Heinrich Events”, and “Climates of the Holocene”
- [IPCC AR5, WG1, Chapter 5](#), Executive Summary, Section 5.1, Section 5.2, Section 5.3, Section 5.5, and Section 5.6

**Week 6 (3/2) - Climate Change in the Historical Record, Anthropogenic Climate Change:**

- *Observed Historical Changes:* The temperature/CO₂ record, measurements of ocean heat content, melting of polar ice and glaciers, increased frequency of
drought and extreme weather events, and other “symptoms”. Evidence that fossil fuel combustion is the principal cause. Limitations to data collection.

- **Fossil fuels**: Origins and historic use of fossil fuels; current usage and trends

**Readings:**
- Kaufman, Chapter 8, “Current State of the Climate System from the Instrumental Record”
- Kaufman, Chapter 12, “The Energy-CO2 Connection – Fossil Fuels”
- IPCC AR5, WG1, *Summary for Policymakers*

**Week 7 (3/9) – Review Lecture and Q&A; Mid-term Exam**

**Week 8 (3/16) – Spring Break, No Class**

**Week 9 (3/23) - Anthropogenic Climate Change/Impacts of Anthropogenic Climate Change:**
- **Climate Data, Tools, Models and Projections**: Earth systems models and computer simulations, their applications and uncertainties. The importance of multi-model climate projections for a range of future emissions scenarios.
- **Scenarios of change and their development**: how do we “project” future conditions and how do we treat uncertainty?
- **Detection and Attribution**: How do we know its us? What constitutes “dangerous anthropogenic interference”? Testimony by Dr. James Hansen
- **The implications of “climate change commitment” and “business as usual”**: extreme storms; sea level rise, interactions with human ecosystems and the built environment. The case of the “missing heat”.

**Readings:**
- RCP Guide, “Part 1” and “Part 3”
- IPCC AR5, WG1, Chapter 10, Detection and Attribution, Executive Summary Only
- IPCC AR5, WG1, Chapter 12. Section 12.5 including inset boxes

**Week 10 (3/30) – Impacts of Anthropogenic Climate Change:**
- **Water and Food**: Climate implications for water and food availability and distribution
- **Natural ecosystems**: Shifts in climate zones; disruption of natural ecosystem functionality; pests and diseases; examples of observed changes to date and outstanding concerns; sea level rise; extreme storms

**Readings:**
- Kaufman, Chapter 11, “Human Vulnerabilities – Agriculture”, “Vulnerabilities in
the Biosphere – Ecosystem Limitations”, “Vulnerabilities in the Biosphere – Species Migrations”

- IPCC AR5, WG 2, Chapter 4, Executive Summary, Section 4.3
- IPCC AR5, WG 2, Chapter 7, Executive Summary, Section 7.2, Section 7.4
- IPCC AR5, WG 2, Chapter 6, Executive Summary, Section 6.2, Section 6.3.1, Section 6.3.2, Section 6.3.6, Section 6.4.1

Week 11 (4/6) - Impacts of Anthropogenic Climate Change:

Guest Lecture Dr. Benjamin Cook on 4/6, Climate Scientist and Drought Expert, NASA Goddard Institute for Space Studies

Readings:
- Watch Chasing Ice: https://chasingice.com/
  - Available where you stream movies or through NYULibraries

Week 12 (4/13) - Impacts of Anthropogenic Climate Change; Adaptation and Mitigation:

- Climate Emergencies: Coral Reefs and Ice
- Defining adaptation: Overview of adaptation; needs, timeframes, and barriers to adaptation

Readings:
- Kaufman, Chapter 7, “Changing Ocean in a Changing Climate”
- Kaufman, Chapter 11, “Ocean and Cryosphere Vulnerabilities”
- Kaufman, Chapter 12: Adaptation and Resiliency
- Kaufman, Chapter 13: Policy lessons from stratospheric ozone, Adaptation,
- IPCC AR5, WG2, Chapter 14, Executive Summary, Section 14.2, Section 14.3, Section 14.5, Section 14.6

Week 13 (4/20) - Adaptation and Mitigation con’t

- Regional Case studies of Adaptation and Vulnerability
- Global warming of 1.5°C – what are key terms of report, how is it different, and what does it mean that we have “~10 years left to act”?

Readings:
- IPCC AR5, WG2, Chapter 16, Executive Summary, Section 16.3, Section 16.4
- IPCC AR5, WG2, Chapter 29, Executive Summary, Section 29.1, 29.3, 29.4, 29.6
• IPCC Special Report on Global Warming of 1.5°C Summary for Policymakers -
   All text that is bolded in dark blue and figures

Week 14 (4/27) – Adaptation and Mitigation con’t Global Warming of 1.5°C

Guest lecture by Miranda Massie on 4/29– Director the Climate Museum

• Mitigation global climate change: Possibilities and barriers to mitigation, the role and possibilities of climate engineering, alternative energies solutions and increasing need for mitigation

Readings:
• Kaufman, Chapter 12, “The Energy-CO2 Connection – Carbon Capture and Storage”, “Geoengineering the Climate System”
• Kaufman, Chapter 13, “Mitigation”
• IPCC AR5, WG3, Summary for Policymakers on Mitigation

Week 15 (5/5): Mitigation continued and wrap-up to tie odds and ends; Final Exam review and Q&A

Week 16 (5/11): Final Exam