

# SYLLABUS – EARTH/SUST201 – Climate Change

Department of Earth Science

Fall 2023

**Instructors:** Ken Rubin, Chip Fletcher, Sloan Coats

Contact information: [krubin@hawaii.edu](mailto:krubin@hawaii.edu), [fletcher@soest.hawaii.edu](mailto:fletcher@soest.hawaii.edu), [scoats@hawaii.edu](mailto:scoats@hawaii.edu)

Office locations and Office hours *TBD*

## I. Course description

Course catalog: Introduction to the science of climate change with a focus on changing climate over Earth's past, present and future, the causes, consequences, and record of past changes, future projections, mitigation, and adaptation. Open to both science and non-science majors.

Additional details: This course will examine the coupled systematics of the atmospheric, terrestrial, marine, and ecological systems as they respond to the forces and processes that impact Earth's climate over a range of space and time scales. It will also focus on the associated human dimensions of climate change (consequences and solutions). We will examine the magnitude and tempo of climate related phenomena, such as solar and terrestrial geophysical activity, extra-terrestrial impacts, Earth's major ecological transitions, Pleistocene and Holocene climate patterns, the climate-altering activities of humankind, and the overlapping global crises of climate/pandemics/biodiversity loss/and human inequality. The course will include learning modules in which students explore mitigation and adaptation strategies for future climate and sea level change specific to Hawai'i.

## II. Course Content and Learning Objectives

### Calendar\*

Week	Topic
1	Introduction to climate and climate change
2	Overview of the climate system including atmosphere and ocean circulation and energy balance
3	Climate variability including monsoons, ENSO, volcanism, etc.
4	The carbon cycle and ecological factors
5	Modeling the climate system
6	Proxy records and archives
7	Paleoclimate – deep time perspective
8	Quaternary paleoclimate and paleo sea level
9	Anthropogenic climate change – driving forces
10	Anthropogenic climate change – UNFCCC targets and COPS
11	Anthropogenic climate change – tipping points and socio-economic responses
12	Projected changes in the climate system
13	Climate change impacts and adaptation in Hawai'i
14	Solutions to climate change: viability, history, and local challenges in Hawai'i
15	Overlapping global crises: climate change-biodiversity loss-pandemics-human displacement and inequity

*\*Course calendar and content are subject to change.*

### ● Course Content Details

Learning modules on:

*Earth's Climate System*

- Basic atmospheric physics and chemistry
- External and internal processes
- The natural carbon cycle and its ecological controls.

- Climate variability including marine (e.g., the oceanic overturning circulation), atmospheric (e.g., jet stream), and geologic (e.g., volcanism) processes, and coupled marine-atmospheric-geologic processes (e.g., ENSO).
- The coupled systematics of atmospheric, terrestrial, marine, and ecological parameters on Earth as responses to the forces and processes that impact Earth's climate over a range of temporal and spatial scales.
- Earth's changing climate over the geological past including the causes, consequences, and record of past changes, with emphasis on
  - the Cenozoic and Quaternary records
  - earlier major climate-driving events related to the origin and evolution of life on the planet
  - the plate tectonic cycle
  - planetary impacts
  - solar irradiance shifts
  - changes to Earth's magnetic field.
- Geologically modern but pre-anthropogenic climate variations on Earth, including geographical components of climate expression.
- Types of marine and terrestrial climate records and archives, and their uncertainties (e.g., sediments, ice core, pollen).
- The magnitude and tempo of climate-sensitive phenomena, including "tipping points" such as ocean circulation, the Amazon, permafrost, ice sheets, reefs, and other global bio-physical systems that are in peril.

#### *Climate Models and Forecasts*

- Anthropogenic climate change causes, consequences, and solutions – human activities and feedbacks, including behavioral, social and economic factors.
- Climate change in Hawai'i and the Pacific region, in a global context.
- Climate models of modern, paleo and future climate; Coupled Model Intercomparison Project (CMIP) scenarios, and projections.

#### *Human Dimensions and Adaptation*

- Warming trajectories and impacts to humans, including community displacement and socio-economic consequences globally and in Hawai'i.
- Climate politics including the United Nations Framework Convention on Climate Change (UNFCCC), Paris pledges, Intergovernmental Panel on Climate Change (IPCC) and World Meteorological Organization (WMO) reports, and national policies.
- Future climate change and associated uncertainties, including mitigation strategies for future climate and sea level change.
- **Institutional Learning Objectives (undergraduate, see [https://manoa.hawaii.edu/ovcaa/institutional-learning-objectives/\\_undergrad\\_ilo/](https://manoa.hawaii.edu/ovcaa/institutional-learning-objectives/_undergrad_ilo/))**

##### *1. Breadth and Depth of Knowledge*

- Students develop their understanding of the world with emphasis on Hawai'i, Asia and the Pacific by integrating:
  - Broad knowledge of the cultural, social, physical, and natural world,
  - specialized knowledge in an academic field

##### *2. Intellectual and Practical Skills*

- Students demonstrate skills needed to succeed in a complex world to: Think Critically and Creatively, Communicate and Report, consider Personal and Social Responsibility
- 3. *Students pursue excellence, integrity, and engagement through:*
  - Continuous Learning and Personal Growth, Respect for People and Cultures, in Particular Hawai'i an Culture, Stewardship of the Natural Environment
- **Program/Course Learning Objectives** (<https://drive.google.com/file/d/1FzXbgbl1SVIIRt7xEO-D6AGygMWtawQI/view> )
  1. Students can explain the relevance of earth science to human needs, including those appropriate to Hawai'i, and be able to discuss issues related to geology and its impact on society and planet Earth.
  2. Students can apply technical knowledge of relevant computer applications, laboratory methods, field methods, and the supporting disciplines (math, physics, chemistry, biology) to solve real-world problems in earth science.
  3. Students use the scientific method to define, critically analyze, and solve a problem in earth science.
  4. Students can reconstruct, clearly and ethically, geological knowledge in both oral presentations and written reports.
  5. Students can evaluate, interpret, and summarize the basic principles of earth science, including the fundamental tenets of the sub-disciplines, and their context in relationship to other core sciences, to explain complex phenomena.

### III. Course Information, Policies and Resources

1. **Course Structure:** This will be a hybrid learning experience, with pre-recorded learning modules by the instructors and other climate experts delivered by video on your schedule. Learning outcomes will mostly be tested on-line via laulima, coupled with in-person activities (discussions and demonstrations) in a classroom setting. One or two climate-relevant field excursions (coastal zone geology) will also be included, with alternate participation modes for individuals with accessibility challenges. The basic breakdown of activities each week is 1 to 2 hours independent online learning, 1-2 hour in-class activities and discussions, not to exceed 3 hours of content delivery per week.
2. **Attendance policy:** Regular attendance in class and the accomplishment of online learning modules on a predetermined schedule are required. Students who are enrolled in this course, but never attend will be flagged by the course instructor for non-participation as per UH policy. Flagged students will be administratively dropped by the Office of the Registrar. Any changes to a student's enrollment status may affect financial aid eligibility and can result in the return of some or all of federal student financial aid.
3. **Use of Technology:** Internet, mobile devices, and social media are allowed and encouraged for structured class activities. This course uses Laulima. If you are new to Laulima, you can follow this link to the Laulima Support for Student help page ([https://www.hawaii.edu/talent/laulima\\_students.htm#:~:text=Laulima%20is%20the%20course%20management,to%20their%20course%20and%20FAQ.](https://www.hawaii.edu/talent/laulima_students.htm#:~:text=Laulima%20is%20the%20course%20management,to%20their%20course%20and%20FAQ.)). During the semester, if technology questions arise, call the Information Technology Services (ITS) at (808) 956-8883 or Toll Free (800)-558-2669. You can also click on the "Help" button in the Laulima course shell and it will connect you to helpful resources to get you through just about any issue. Because we will only communicate using Laulima and email, you will need to use your UH student email.

4. **Statement on Disability: KOKUA Program:** If you have a disability and related access needs, please contact the KOKUA Program (Office for Students with Disabilities) at 956-7511, [KOKUA@hawaii.edu](mailto:KOKUA@hawaii.edu), or go to Room 013 in the Queen Lili'uokalani Center for Student Services. Please know that I will work with you and KOKUA to meet your access needs based on disability documentation. Kokuu's services are confidential and offered free of charge.
5. **Academic Integrity and Ethical Behavior: Office of Student Conduct:** Cheating, plagiarism, or other forms of academic dishonesty are not permitted within this course and are prohibited within the System-wide Student Conduct Code (EP 7.208). Examples include: fabrication, facilitation, cheating, plagiarism, and use of improper materials. Any incident of suspected academic dishonesty will be reported to the Office of Student Conduct for review and possible adjudication. Additionally, the instructor may take action in regards to the grade for the deliverable or course as they see fit.
6. **Office of Title IX:** (808) 956-2299 / [t9uhm@hawaii.edu](mailto:t9uhm@hawaii.edu) / <https://manoa.hawaii.edu/titleix/>
7. **Department of Public Safety:** (808)956-6911 (Emergency) / (808)956-8211 (Non-Emergency) <http://manoa.hawaii.edu/dps/>
8. **UH System Basic Needs** (*text to be used*) include food and housing, childcare, mental health, financial resources and transportation, among others. Student basic needs security is critical for ensuring strong academic performance, persistence and graduation and overall student well-being. If you or someone you know are experiencing basic needs insecurity, please see the following resources: [UH System Basic Needs](#)

#### IV. Required Readings

Required reading will be from publically available resources, such as IPCC report (Intergovernmental Panel on Climate Change) summaries for policy makers and sector-specific reports including:

1. Global warming of 1.5C: <https://www.ipcc.ch/sr15/>
2. Climate Change and Land: <https://www.ipcc.ch/srcl/>
3. The Ocean and Cryosphere in a Changing Climate: <https://www.ipcc.ch/srocc/>
4. SPM AR6 Working Group I:  
[https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC\\_AR6\\_WGI\\_SPM\\_final.pdf](https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf)
5. SPM AR6 Working Group II:  
[https://report.ipcc.ch/ar6wg2/pdf/IPCC\\_AR6\\_WGII\\_SummaryForPolicymakers.pdf](https://report.ipcc.ch/ar6wg2/pdf/IPCC_AR6_WGII_SummaryForPolicymakers.pdf)

Additional Learning Materials developed by the instructors.

#### VIII. Class participation:

- Be sure to always read the Lulima announcements to enhance your participation and stay current.
- **Students are expected to watch the presentations on Lulima, read the assigned readings, and complete all assignments on time.**
- Students are expected to read the assigned sections in the provided reading sources.
- Students are expected to pay attention to announcements and course documents posted on Lulima, and to ask relevant questions before assignments are due.
- **You must use your UH email account or make sure to forward messages to other accounts if you use them. The instructor takes no responsibility for missed communications if you fail to check your UH email account.**
- Students enrolled in this class are expected to keep up with all assignments on a timely basis.

## V. Course Assignments, Evaluation and Grading

### 1. Types of Required Assignments

- Weekly Video lectures and learning modules, including *completion of the online assignments based on them*
- Weekly Assigned Readings
- Weekly Quizzes based on the module topics
- Participation in In-class assignments, exercises and discussion
- Mid-term exams (2 of them covering the first 2/3 of the course)
- Non-comprehensive final exam (covering the last 1/3 of the course)

2. Assessment of work (course instructors will grade assignments using standard objective measures of correctness and completeness of answers using the standard grading system model). the course grade will be based on the aggregate score of all assignments, with a value of 0 given for all missed assignments). You do not need to complete all assignments in order to receive a passing grade.

3. Attendance/Participation expectation: regular attendance is required for completion of in-class activities

4. Grading (*letter grade, credit/no credit CR/NC, incomplete I, as applicable*)

Final grades will be based on the total number of points received from weekly assignments, quizzes, and exams. To grade assignments, I must be able to read and understand them. Spelling, rules of English composition and legibility will count in grading. **Note: plagiarism and/or cheating will result in an F grade for the test or assignment. Repeated offenses will result in an F grade for the course.**

5. Grading Scale: A=90-100%, B=80-89.99%, C=70-79.99%, D=60-69.99%, F=Less than 60%

6. XII: Audit Policy: There are no requirements for auditing this class and you may decide to change from a graded option to auditing after the beginning of the semester as per UH policy.

7. XIII: Plagiarism and cheating policy:

As per university policy, academic integrity is a basic principle that requires all students to take credit for the ideas and efforts that are their own. Cheating, plagiarism, and other forms of academic dishonesty are defined as the submission of materials in assignments, exams, or other academic work that is based on sources prohibited by the instructor. Academic dishonesty is defined further in the "Student Code of Conduct." In addition to any adverse academic action, which may result from the academically dishonest behavior, the University specifically reserves the right to address and sanction the conduct involved through student judicial review procedures and the Academic Dispute Resolution Procedure specified in the University catalog.