GEOL 441/541: CLIMATE VARIABILITY AND CLIMATE CHANGE

Professor: Dr. Susan Kaspari
Class meets: Monday, Wednesday, Thursday 10:00-10:50 AM Science 2, room 207
Lab meets: Tuesday 2:00-4:50 PM Science 2, room 207 or computer lab. Lab location will be announced before class.
Text: *Climatology* by Hidore, Oliver, Snow and Snow (Third Edition). We will also utilize reports from the Intergovernmental Panel on Climate Change http://www.ipcc.ch/index.html and the recently released National Climate Assessment Report https://nca2018.globalchange.gov
Email/phone: kaspari@geology.cwu.edu (509) 963-2738 (email is the best way to contact me)
Office Hours: Science 2, room 329, Monday 2:00-2:50 pm and Thursday from 11-11:50 AM

Course Description: In this course students will gain an understanding of how the Earth's climate varies naturally, how human activities are contributing to climate change, how much more climate is projected to change this century, and what the impacts of this change will be. Lab sessions will be spent doing case studies or working with real climate data to address topics such as the earth's radiative balance, ocean-atmosphere interactions, and how climate change will affect the living and physical (glaciers, the ocean) world. A major component of the course will consist of students working in groups to conduct a quarter long community based research project (described below).

Course goals. In addition to the outcomes listed in the course description, students should:

- improve their ability to deal with uncertainty and complexity and to think critically
- evaluate the impacts of current and future climate change
- gain an improved self awareness of how their individual choices may contribute to climate change

Course Components:
Labs/Case Studies/Reading Assignments: Details will be provided in class.
Exams: There will be three exams (two mid-term exams plus a cumulative final exam). Exams will cover the material covered during class, in lab, and in the text. Midterm exams will be held during class on January 28 and February 20, and will consist of individual (~75%) and collaborative group (~25%) sections. The final exam will be held Wednesday March 13 from 2-4 pm.
Community Based Inquiry Research Project and Presentation
Students will work in groups (3 students per group) to conduct a quarter long research project aimed at answering: ***How will projected changes in climate affect Kittitas County*** (or potentially another region of Washington)? Through this research project students will gain an improved understanding of how current and projected changes in climate affect our region, with an emphasis on local impacts. Each group will develop their own research question, write a research proposal, **conduct original research that includes quantitative analysis**, write a final research paper, write a 2-page stakeholder memo, and present their findings in an oral presentation to the class and stakeholders from the community. The final paper will be fully referenced (references should mostly be from the peer reviewed scientific literature rather than government reports or the popular media) ~2500 words long; include at least 4 figures, and follow the format of *Science.* Each student will peer evaluate group member contributions at the end of the course, which will be calculated into each student's final course grade. Additional details will be provided in class. Writing help is available through CWU's University Writing Center, which offers free, one-on-one sessions to all CWU students: http://www.cwu.edu/learning-commons/university-writing-center

Inquiry Based Research Project Deadlines

Item	Due Date	Description	% Grade
4 Individual Research Questions	1/8	Each student will submit 4 research questions, from which their group will select 1 question that will guide their research project	5
Draft Research Proposal	1/17	**Detailed** research proposal, including research question, interested stakeholders, planned research, methods, anticipated results, and 6 references from the peer reviewed literature	5
Final Research Proposal	1/31	Revised final research proposal incorporating feedback from the draft research proposal.	5
Research Paper Draft Due	2/21	Complete draft of the paper. I expect a fully developed paper. The more effort put in by this point, the more feedback you will receive and thus improve your chances of doing well on the research project. The paper should be fully referenced and include figures.	10
Draft Stakeholder Memo	2/28		5
Revised Stakeholder Memo	3/5		5
Project Presentations	3/5	Each group will have 45 minutes to present their research to the class and stakeholder. Plan on a 35-40 minute presentation, plus follow up time for questions.	20
Final Research Paper	3/5		40
Peer Evaluation	3/6		5

Course Assessment
20% mid term exams
15% final exam
35% research project/presentation
25% labs/case studies/assignments
5% participation
Final grades will be based on the % of total points: A=>93%; A-=90 to <93%; B+=87 to <90%; B=83 to <87%; B-=80 to <83%; C+=77 to <80%; C=73 to <77%; C-= 70 to <73%; D+=67 to <70%; D=63 to <67%; D-=60 to <63%; F=<60%

Important Notes:

- ***Commitment to Diversity*** CWU is committed to diversity, and expects every member of the university community to contribute to an inclusive and respectful culture for all in its classrooms, work environments, and at campus events.
- ***Students with Disabilities*** – Central Washington University is committed to creating a learning environment that meets the needs of its diverse student body. If you anticipate or experience any obstacles to learning, contact me and the Office of Disability Services to discuss a range of available options. Student Disability Services is located in Hogue 126. Call (509) 963-2214 or email ds@cwu.edu for more information. http://www.cwu.edu/disability-support/requesting-student-accommodations
- CWU holds its students to the highest standard of academic integrity and honesty. Plagiarism is defined in this section as "the appropriation of any other person's work and the unacknowledged incorporation of that work in one's own work offered for credit". Plagiarism may range from an entire paper to a phrase within a sentence. When you are paraphrasing an idea that is not your own and is not common knowledge, **you need to cite the source**. Copying the work of other students on exams or assignments is also considered academically dishonest. The CWU academic code of conduct is defined here: http://apps.leg.wa.gov/WAC/default.aspx?cite=106-120-027

- If something happens during the quarter that prevents you, or is likely to prevent you, from completing a requirement for the course, contact me as soon as possible and inform me of the situation. Class cancellations due to weather are posted at http://www.cwu.edu/~web/closures.php .
- *Please- no cell phones or texting during class.*

Course Schedule: Note that the order and content of lectures are subject to change. Additional reading may be assigned. Reading is due **before** the date that it is assigned.

Week	Day	Date	Topic	Reading	Research
1	R	Jan. 3	Introduction		
2	M	Jan. 7	Heat Transport and Intro to Earth's Radiation Budget	Clim. Ch. 2 Miles et al., 2010 (sections 1 and 3)	
2	T	Jan. 8	Lab: Global Temperature and Earth's Radiation Budget		4 individual research questions due Form research groups
2	W	Jan. 9	Earth's Radiation Budget II	Clim. Ch. 3	
2	R	Jan. 10	Earth's Radiation Budget III, and Global Temperature		
3	M	Jan. 14	Ocean and Atmosphere Circulation I	Clim. Ch. 5, 6	
3	T	Jan. 15	Lab: Albedo and Ocean-Atmosphere Interactions		
3	W	Jan. 16	Ocean and Atmosphere Circulation II	Clim. Ch. 5, 6	
3	R	Jan. 17	Reconstructing Climate	Clim. Ch. 10; IPCCWGI.5	Research Proposal Due with 6 references from peer reviewed literature
4	M	Jan. 21	***No Class: Martin Luther King Jr Day***		
4	T	Jan. 22	Lab: visit paleoclimate laboratories		
4	W	Jan. 23	Human influence on Climate I: Greenhouse Gases and Aerosols	Clim. Ch. 11	
4	R	Jan. 24	Human influence on Climate III: Albedo	Clim. Ch. 14	
5	M	Jan. 28	**Exam 1**		
5	T	Jan. 29	Lab		
5	W	Jan. 30	Observations: Atmosphere	Clim. Ch. 13 IPCCWGI.2	
5	R	Jan. 31	Observations: Ocean	Clim. Ch. 12 IPCCWGI.3	Final Research Proposal Due
6	M	Feb. 4	Observations: The Natural World	Clim. Ch 13	
6	T	Feb. 5	GETSI: Melting Ice and Changing Sea Level	Clim. Ch. 12 IPCCWGI.4	
6	W	Feb. 6	GETSI continued		
6	R	Feb. 7	GETSI continued		
7	M	Feb. 11	GETSI continued		
7	T	Feb. 12	GETSI continued		
7	W	Feb. 13	GETSI continued		
7	R	Feb. 14	GETSI continued		
8	M	Feb. 18	***No Class: President's Day***		
8	T	Feb. 19	Lab		
8	W	Feb. 20	**Exam 2**		

8	R	Feb. 21	Climate Change Projections	IPCCWGI.11 and 12	Research Paper draft due
9	M	Feb. 25	Climate Change Projections	IPCCWGI.11 and 12	
9	T	Feb. 26	Lab		
9	W	Feb. 27	Climate Policy		
9	R	Feb. 28	Impacts, Adaptation and Vulnerability I	IPCCWGII.1 1 and 12	Draft Stakeholder Memo Due
10	M	Mar. 4	Impacts, Adaptation and Vulnerability II	IPCCWGII.1 1 and 12	
10	T	Mar. 5	Lab: Presentation of Research		Final Research Paper and Stakeholder Memo Due Research Presentations
10	W	Mar. 6	Mitigation	IPCCWGIII	Peer Evaluations Due
10	R	Mar. 7	Mitigation	IPCCWGIII	
11	W	Mar. 13	**FINAL Exam 2-4 *pm*** *(note- final exam period may differ from what is posted by the registrar. Please let me know if you have a conflict).*		