USC Dornsife
Dana and David Dornsife
College of Letters, Arts and Sciences

GEOL 412 Oceans, Climate & Environment

4 Units
Spring 2019
MW 2-3.20pm
Location: ZHS 200
This class requires substantial independent literature-based research equivalent to 1 of the 4 credits.
NEW Climate sustainability theme.

Instructor: Dr. Sarah Feakins
Office: ZHS 223F
Office Hours: Wed 11am-12 or by appointment
Contact Info: feakins@usc.edu (email preferred)
Secondary method: 213 740 7168 (office phone if needed)
Dr. Feakins replies to emails within hours or certainly 2 work days.

IT Help: John Yu
Hours of Service: 10-4
Contact Info: ZHS 130 johnyu@usc.edu

Library research help: In person and by phone, chat and email at Ask a Librarian, through research guides and FAQs by contacting science librarian, zunno@usc.edu (Dr. Zoe Pettaway Unno).

Course Description

Fundamentals of climate including atmosphere and ocean. Topics include radiative energy balance, ocean-atmosphere linkages and approaches to study climate while building quantitative and qualitative skills.

Course Objectives and Outcomes:

This course is intended to provide a foundation for understanding the Earth's climate and ocean system and is geared towards undergraduate majors and minors in Earth Sciences and Environmental Studies. Undergraduates from other disciplines and graduate students seeking a foundation in climate science are also welcome. We will learn about the fundamental properties of the ocean and atmosphere. We discover the key factors that control climate and how these have varied through time. We will explore approaches to climate, ocean and environmental science including an overview of modern observations and modeling and 'proxy' climate records that can extend our knowledge beyond the short instrumental period. We will learn about how the climate system works, and how it varies and consider how climatic and environmental variability influences societies in the past, present and future. You will develop your scientific skills though assignments building towards individual research projects that also hone a range of presentation skills.

Who should take this class?

This class is one of the electives for the Earth Science and for the Environmental Studies undergraduate major and minor degree tracks. Past students have included those in Engineering degree tracks, Applied Math, Physical Sciences and Political Economy.

Recommended Preparation: A GE course in Earth Science especially: GEOL 107Lg/150Lg/160Lg. Registration stated corequisite: MATH 125 and 1 from (CHEM 105A or CHEM 103) *ask Cindy Waite waite@usc.edu if you need clearance for registration*.

Learning Objectives (LO)

Learning objectives for the course are an adapted subset from those of the Department of Earth Sciences:

1. Students will learn from lectures, classroom discussions and textbook reading about fundamental principles of climate science and accumulated knowledge.
2. Students will perform calculations to explain and predict climate, building quantitative skills.
3. Students will sketch diagrams and use estimation to demonstrate conceptual and quantitative skill.
4. Students will graph climate data.
5. Students will develop observational, critical reasoning and data description skills.
6. Students will participate in classroom discussions, reflective self-assessment and peer-evaluation. These active methods aid learning, observation and communication skills are needed to develop professional skills for scientific careers, team-work environments and personal development.
7. Students will learn where to access scientific information, graphical and written for future graduate research, scientific careers and lifelong-learning beyond the class as knowledge is not static and science progresses fast, especially with climate change. Students will use the USC library and online databases to locate and retrieve publications relevant to a research question or project, to formulate and evaluate research questions and to accurately report on and draw conclusions from careful readings of works of research literature.
8. Students will demonstrate the ability to accurately and ethically incorporate and cite a variety of scholarly sources in their written reports and oral presentations, and will evaluate the relative reliability of sources of information (peer-review, journal/publisher, online publishing etc.).
9. Students will demonstrate the ability to acquire and communicate scientific data, ideas, and interpretations through written, oral, and visual means in short and long format.
10. Students will produce written and oral reports that clearly and accurately describe and illustrate the background, methods, data, and interpretations.

Learning will be achieved via guided, lecture- and discussion-based learning inside the classroom, as well as via independent literature-based learning outside of the classroom. Learning will be assessed via a variety of homework assignments and examinations, written reports and oral presentations.

***NEW* Climate sustainability theme**

Motivation: Climate change and its societal implications are becoming increasingly apparent across the world, the United States, California and Los Angeles. Climate scientists are making clear statements about the state of climate and the mitigation steps that could be made to reduce the magnitude of climate change in the future. This class has always provided climate science training to develop climate skills, but the urgency of our situation requires a focused response. We have readings, carbon calculations and climate science actionable information towards California's climate initiatives. With this effort GEOL 412 seeks to train scientists ready to use climate science to inform management of a sustainable climate future.

Learning Objective: The ability to identify the key aspects of climate science associated with anthropogenic greenhouse gas emissions and associated climate change is a critical objective for GEOL 412. Observation and thinking skills are key to prepare climate-educated students armed not just with today's knowledge but also with training to learn from and respond to new data emerging in our changing world. This class will help students to seek scientific sources of information on the current and evolving state of the climate and climate science. The class will train students for civic engagement in climate and societal issues with an awareness of individual and institutional responsibility and actions. Students will be asked to:

A. Calculate carbon emissions for an individual, as part of preparations for in-class discussions of individual and institutional responsibility.
    a. Individual https://coolclimate.berkeley.edu/calculator
    b. University https://stars.aashe.org/
B. Explore and read sections of the US Fourth National Climate Assessment (NCA4) issued in 2018. https://nca2018.globalchange.gov/
C. Read the Second State of the Carbon Cycle Report (SOCCR2) issued in 2018. https://carbon2018.globalchange.gov/
D. Read the key graphs from the IPCC Special Report issued in 2018 on carbon emissions trajectories needed to stay <1.5˚C. http://www.ipcc.ch/report/sr15/index_background.shtml
E. Identify and respond to California's Cap and Trade funded climate initiatives. http://www.caclimateinvestments.ca.gov/
F. The State of Calfiornia is leading the way on climate action. Independent research topics will be arranged to achieve class coverage of a range of climate topics - topics will be elected and traded via a consensus approach to achieve broad coverage for civic engagement in Californian climate issues.

Teaching Philosophy

Learning via incorporating feedback during the semester towards a larger goal.

All too often homework is attempted, graded and the cycle is complete. Beyond the classroom, this is not how most products are delivered, instead many products only appear after being improved through the incorporation of feedback. As part of this course, many of the individual homework assignments will build towards the research project, this allows learning and the adoption of a growth-mindset, known to be important to success in many aspects of life. This class includes an in-depth involvement in researching a topic of your choosing. In the course of the semester, you will perform a variety of assignments that will hone your skills in a variety of presentation formats, while allowing you to incorporate feedback and contribute to development of ideas that supports you in developing a polished and in-depth final product. *I encourage you to make use of the feedback on your graded assignments during the semester toward your research project talk and final paper.*

Learning through independent research projects.

The USC Earth Science department considers that individual research projects are: "effective learning tools that require students to apply what they have learned and synthesize a body of knowledge, without having a proscribed "correct" answer. They have been effective in inspiring some students to continue on to do directed research projects or acquire a part time job with faculty engaged in funded research projects." More broadly they allow you the skills to direct your own learning, which is very good preparation for graduate degree programs and more broadly offers lifelong benefits in terms of your personal fulfillment and career development.

Optional: JEP Service Learning
For those students interested in a career in science teaching, the Joint Education Project service learning opportunity is available. You may apply for a service learning opportunity through the USC Joint Education Project (JEP): https://dornsife.usc.edu/joint-educational-project/ at the start of the semester JEP places USC students in classrooms to enrich education at local schools. This involves an 8 week effort in local areas schools. Your lesson plans would be developed around class materials and topics. To be affiliated with this class, you would be teaching climate concepts in local area schools, informed by the climate literature and Next Generation Science Standards. This effort could be used as the independent study component of the semester, and you literature-based research may include science education publications. You would report upon your teaching efforts in the oral pitch, powerpoint presentation and written term paper including an example teaching module. Further information will be available from the JEP co-ordinator, and from the professor, in week 1 of classes.

Technology

Technology Use: This course is web and technology-enhanced. Class materials and some readings will be posted on blackboard. Technology-enhanced learning strategies will be used, including powerpoint presentations by students, for class peer review.

Technological Proficiency and Hardware/Software Required: You will need access to a computer and to standard Microsoft Office software: Word, Excel and Powerpoint. Students can download the MS Office package free through USC if they don't already have it: https://itservices.usc.edu/officestudents/

IT Help: John Yu **Hours of Service:** 10-4 **Contact Info:** ZHS 130 johnyu@usc.edu

Required Readings and Supplementary Materials

Textbook (required): Global Physical Climatology 2nd edition, by Dennis L. Hartmann, ISBN 0-12-328530-5, Academic Press, London. Available in USC bookstore, or to rent or buy from Amazon.
Additional readings will be provided and/or located by students using database software via USC libraries.

Library research help: Need to do research but don't know where to start? Searching for a book, article, or data to support your argument? Not sure how to cite a source in your bibliography? Ask a librarian! Research help is available: In person and by phone, chat and email at Ask a Librarian, through research guides and FAQs by contacting science librarian, zunno@usc.edu (Dr. Zoe Pettaway Unno).

Description and Assessment of Assignments

Homework assignments: There are 6 assignments (2 numerical, 3 written, 1 spoken) counted at 10pt each (30% of total). See schedule for components, additional instructions in class.

Midterm examination: 40 pts. 20% of total. Open-book, take-home examination that tests your ability to summarize and distill the concepts in the class, comprehend new scientific data in graphical form, and undertake calculations similar to that used in the first half of the course.

Individual Powerpoint Presentation: 20pts. 10% of total. Use the skills needed for academic or industry technical presentations. Detailed instructions to be given in class.

Research paper: 40 pts. 20% of total. An in-depth project researched from the literature written as a essay including, use of figures, referencing etc. Detailed instructions to be given in class.

Final examination: 40 pts. 20% of total. Closed-book, summative, cumulative assessment. This examination primarily tests your ability to articulate a coherent argument, and an organized framework of the key points on a topic along with examples and facts to support that argument – in essay style answers. Short answer questions will ask you to summarize and distill the concepts in the class, comprehend new scientific data in graphical form, and undertake calculations similar to that used in the first half of the course.

Activities teach the various writing, reading, graphing, communication, presentation and research learning objectives – and the evaluated activities and rubrics assesses the degree to which students have met the learning objectives.

Examinations evaluate student comprehension of the lecture and readings (textbook and assigned readings); they will emphasize material covered in lecture. They will include calculations, diagrams, short and long answer questions and will emphasize comprehension of the concepts, rather than rote memorization.

Grading Breakdown

Grading will be based on your performance on numerical, graphical and written assignments and presentations.

Assignment	**Points**	**%**
Homework assignments (6 assignments)	60	30
Midterm examination	40	20
Research talk (powerpoint)	20	10
Term paper	40	20
Final examination	40	20
TOTAL	200	100

Grading Scale

Course final grades will be determined using the following scale

A 95-100	C 73-76
A- 90-94	C- 70-72
B+ 87-89	D+ 67-69
B 83-86	D 63-66
B- 80-82	D- 60-62
C+ 77-79	F 59 and below

Assignment Rubrics

A: Independently identifies important scientific research questions or if topic assigned, frames the topic well; uses coherent, clear, compelling, excellent argumentation; demonstrates a qualitative and quantitative grasp of concepts; uses appropriate examples or data to support the argument; appropriate display and reporting of data.
A-: As for A, but some minor weaknesses in one or two categories.
B+: As above but minor weaknesses in more than 2 categories.
B: Good quality work, but may suffer in terms of organization, such as may reveal minor gaps in comprehension, articulation and/or presentation of ideas.
B-: As above but with minor weaknesses in all areas, or major in one.
C: Passing work, with +/- as appropriate; minimum standard for a geoscientist.
D: Not-passing work for major credit; does not meet minimum standards for a geoscientist.
F: Failing work.

Assignment Submission Policy

Due dates for all assignments are noted on the weekly breakdown.
Assignments due in class should be delivered in hard copy to the professor in the classroom at the start of class (unless noted otherwise). Electronically submitted documents should be submitted as Microsoft Office documents attached to an e-mail to feakins@usc.edu (unless noted otherwise). Please use the following format for naming your files: 'Last name_First name_Assignment number'.

Grading Timeline

Assignments completed by the due date will be returned in class, one week after the due date.

Additional Policies

Phones etc. Text messaging, email, social media use, or web-browsing, is not permitted in class except where required for in-class work. Turning your cell phone off and taking notes only with a notebook, may be good strategies, if you find this hard advice to follow. Students are encouraged to use a paper notebook for notes for best learning experience and to reduce the powerful distraction, unless otherwise arranged with the instructor.

Attendance: Students are expected to attend all class sessions, please send an email with a reason if you have to miss class due to an unavoidable issue, e.g. family emergency or ill-health.

Late policy: Late work will not be accepted after graded assignments have been returned. Prior to that late assignments will receive one grade increment lower per day late, i.e. from A- to B+, or –5% per day (including weekend days). Under some special circumstances e.g. due to a medical emergency, university approved athletic absence, or religious holiday observance, short extensions may be granted – *if you let the professor know in advance.*

Course Schedule: A Weekly Breakdown

Wk	Prep.	Class	Follow up
1	*GPC chapter 1*	**Introduction to Climate and Ocean Science** *Introduction to the climate system: the atmosphere as an efficient communicator, the ocean as a heat storage and transport slower communicator. LO: 1.*	
	GPC 2.1-2.6 and 3.1-3.4 and 4.1, 4.4	**Planetary Scale Energy Budgets** *Climate at the planetary scale. Solar emissions: Plank, Wien and Stephan Boltzman laws of blackbody radiation. Insolation received at the Earth. Temperature of emission of the Earth. Energy Budget of the Planet. Consideration of other planets in our solar system; and of other solar systems. Earth 2? LO: 1-3.*	*Assignment 1: energy balance problem set, due Wed week 2 at 2pm in class. LO: 1. select appropriate principles, 2. employ quantitative skills.*
2	*Reading: GPC 2.5, 3.5, 3.8; Petit et al., 1999.*	**Atmosphere – Greenhouse Effect** *Climate at the planetary scale: Role of Greenhouse Gases. Principals of absorption and emission in gases. Temperature at the surface of the Earth. Planetary Energy Balance for a planet with an atmosphere. Construction of a 1D model of earth's climate considering a 1 layer atmosphere. Climate sensitivity to GHGs. LO: 1-3.*	
	Reading: GPC 2.7-2.9, 4.7-4.9, 6.1, 6.3, 6.5	**Atmosphere – Latitudinal Variations** *Insolation variations with latitude. Obliquity of the Earth's axis and seasonality. Latitudinal variations in energy budgets. Ocean and atmospheric heat transport. General circulation of the atmosphere, Trade Winds, ITCZ, Westerlies. Coriolis Effect. LO: 1-3.*	*Assignment 2: – global temperatures, due Wed week 3 at 2pm in class. LO: 1. know concepts, 3. data description, including graphical and writing skills.*
3	*IR reading*	**MLK day no class** *Independent research project (IR): identify a problem, read introductory material, literature search, gather prior work on the problem. IR Worksheet due Wed wk 3. LO: 7.*	
	GPC 3.9, 3.10, 3.12	**Atmosphere – Moisture in the Atmosphere** *We start with watching a simulation of water vapor and precipitation during the course of the year for the planet, make and discuss observations. Detection of moisture in the atmosphere (visible, IR). Moisture convection and lateral transport and latent heat flux. The fundamental rule governing moisture in the atmosphere: Claussius-Clapeyron Relation, water vapor as key feedback on warming. LO: 1-4.*	*Assignment 3: – moisture in the atmosphere, due Wed week 4 at 2pm in class. LO: 1-5, understanding graphical data, quantitative skills.*
4	*GPC 5 NCA4_chpt 25 – SW and FAQs*	**Atmosphere – Hydrological Cycle** *Fundamentals of the global hydrological cycle, quantification of components, fluxes. Global and precipitation and evaporation patterns. Consideration of regional precipitation and potential evaporation seasonality and implications for water availability. Case study California's water: importance of snowpack, climate change. LO: 1-4.*	
	GPC 6.5	**Atmosphere – Monsoons** *Seasonality, land-sea temperature contrasts, sea breezes, monsoons, ITCZ migration. Examples: Asian Monsoon and societal issues; West African Monsoon; North American Monsoon. Santa Ana Winds as an example of an episodic reversal of prevailing winds – with fire consequences. LO: 1-3.*	*Assignment 4: prepare pitch for Wed week 5, instructions given in class. LO: 9-10 presentation skills, concise summarization and framing of problems.*

5	*Assigned journal articles*	**Remote Sensing of the Hydrological Cycle: Evapotranspiration** *Remote sensing is transforming our observational data collections on land surface processes within the hydrological cycle, hence I have invited a g**uest speaker, Josh Fisher**, Science Lead, ECOSTRESS Mission, **NASA JPL – who will visit on Feb 4th.** JPL has a new instrument on the International Space Station to study how effectively plants use water. The ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station (ECOSTRESS) will offer clues about how Earth's water and carbon cycles affect plant growth and how ecosystems adapt to changes in climate by measuring evapotranspiration (the loss of water from leaves and soil). LO: 1, 5.*	
	IR reading CA climate initiative Cap &Trade	**"Pitch perfect":** *in Wed class brief oral "pitch" of your independent study topic (Assignment 4). LO: 9.* *In class peer review. LO: 6, reflective self-assessment and peer-evaluation.*	*Study for the midterm examination. LO: 1, acquire knowledge of fundamental principles of climate science.*
7	*Assigned journal articles*	**Ocean Temperatures** *We will look at temperature data as collected by observations and collated into global maps. You will study the availability of data across spatial and temporal scales, to find what is known well and what is known less well. You will also learn how to access climate data to see evolving trends. LO: 1, 4, 5.*	*Assignment 5: Real climate data exercise – begin in class, due in class on Wednesday. LO: 5-10, esp 5: observation, critical reasoning and data description skills.*
	GPC 7.2	**Ocean Properties** *Dissolved solids, salinity units, means of measurement, differences in riverine inputs of freshwater between ocean basins, salinity as a conservative tracer of deep water masses. Temperature and potential temperature. Controls on density. Density stratification in the oceans. Dissolved gases and air-sea gas exchange – deoxygenation, acidification LO: 1, 3, 5.*	
6		**President's Day no class** Study for the midterm examination	
		MIDTERM EXAM **Wed, Feb 20th** *take home, open book, due 3.20pm. LO: 1-5, 9.* ***Mid-semester reflective feedback for student & instructor***	
8	*IR reading*	**Atmosphere – Lapse Rate Games** *Climate calculations using lapse rates, using simple graphing techniques with an emphasis on back of the envelope estimates, with discussions of the magnitude of uncertainties in various assumptions. Instability and stability in the atmosphere. Katabatic winds and polynyas. Temperature inversions. Orographic precipitation. Monsoon circulation. Discussions LO: 1-5.*	*IR: read 1 publication on your research topic, worksheet due Wed wk 6 at 2pm in class for in class review, LO: 6-10.*
	Assigned journal articles NCA4_chpt 19_SE	**Hurricanes** *Necessary conditions for hurricane formation. Limitations on modeling hurricanes: scale issues, hurricane genesis, hurricane size and strength, hurricane tracks. Consideration of what can and can't be well resolved in existing models. Model skill. Scope for improvement in seasonal predictions. Changing hurricane risk, societal issues. LO: 1, 3, 5.*	

9	*GPC 7.1, 7.4-7.6, 7.8*	**Ocean Dynamics** *Surface: Major ocean currents, and features. Controls on ocean circulation: atmospheric circulation, Coriolis effect, boundary effects. Winds, wind drag and Ekman transport, direction and speed of ocean currents. Gyre circulation, boundary currents, ocean dynamic topography, geostrophic flow. Eddies. Gulf Stream, California Current.* *Deep: T, S in the deep ocean, identification of major water masses. The Thermohaline circulation. How has ocean circulation changed in the past including during glacial times and in deep time, including greenhouse climates? LO: 1, 3, 5.*	
	Assigned journal article, SOCCR2_ report in brief	**Influence of ocean life on climate** *Marine biological uptake of carbon dioxide and sequestration in sediments is a major component of the global carbon cycle and climate. Hence the questions of productivity, species, interactions are important: Where is life, what is it doing, how does uptake change over time? Modern observations and modeling of processes (and future change) include challenges of problems of scale being tackled at USC, thus for this topic, we have a* ***guest speaker Prof. Naomi Levine, Marine Environmental Biology.*** *LO: 1, 5.*	*IR: Guided response; summarize key points from assigned journal article. LO: 5,7-9.*
10		****March 11-15 SPRING BREAK****	
11	GPC 8, esp. 8.3	**El Niño Southern Oscillation ENSO** *History of ENSO observations, ocean SST, SSTa, thermocline; SLP and Southern Oscillation, Bjerknes feedback and delayed oscillator, teleconnections and impacts, ENSO and paleoclimate, and future trends. LO: 1, 5.*	
	GPC 12.1-12.4	**Natural climate variability: Sunspots, Volcanoes** *We consider 2 means of altering climate with different temporal characteristics. 1.The Sun and its variations in radiative fluxes through time. 2. Volcanic aerosols, past reconstructions. Historical, satellite and proxy evidence for past variations and implications for climate. Geoengineering. LO: 1, 5.*	*Assignment 6: research from the scientific literature assignment due next Monday. LO: 5, 7-10.*
12	GPC 13 IPCC 1.5 or *Thread reader*	**Anthropogenic climate change** *Human induced climate changes, greenhouse gases, aerosols, climate feedbacks. Signs of climate change: temperature, ice and sea level. LO: 1, 2, 5.*	*Calculate carbon emissions.*
	GPC 12.5-12.6	**Orbital pacing of climate change** *Discovery of glacial interglacial cycles, oceanography and oxygen isotopes, variations in the Earth's orbit. Pleistocene paleoclimate and paleoceanography. Deglaciations. LO: 1.*	*IR prepare ppt for wk 13/14. LO: 5, 7-10.*
13	*IR reading*	**Student Presentations:** *Powerpoint presentation of your independent study project (LO: 5, 7-10), peer review (LO: 6).*	
	IR reading	**Student Presentations:** *Powerpoint presentation of your independent study project (LO: 5, 7-10), peer review (LO: 6).*	*IR reminder to* ***write*** *your term paper, 3 wks left*
14	*IR reading*	**Student Presentations:** *Powerpoint presentation of your independent study project (LO: 5, 7-10), peer review (LO: 6).*	
	IR reading	**Student Presentations:** *Powerpoint presentation of your independent study project (LO: 5, 7-10), peer review (LO: 6).*	*IR reminder to completel* ***draft*** *term paper, 2 wks left*

15	GPC 9	**Past Climate Change: Marine Proxies** *Ocean sediments; geochemical approaches to reconstructing past conditions including oxygen isotopes, Mg/Ca, biomarkers; variations in deep sea and sea surface temperature, ice volume and other questions. The geological time component of carbon burial in ocean sediments today and in past oceans and the long timescale variations in the carbon cycle. What can geological archives tell us about past climate and future analogs. LO: 1, 5.*	
	GPC 9	**Past Climate Change: Terrestrial Proxies** *Continental proxies and archives: tree rings, pollen, biomarkers, lake cores, ice cores, speleothems, geomorphology. How can we reconstruct climate and ecosystems in the past and at what resolutions. What can geological archives tell us about past climate and future analogs. LO: 1, 5.*	*IR reminder to **edit** your term paper (1 week left). Due last class, Wed 24th April at 2pm.*
16	GPC 10 NCA4 IPCC1.5	**Mechanisms 1: Climate Sensitivity & Feedback Mechanisms** *Forcings, non-linear responses, equilibrium states, positive and negative feedbacks, tipping points. Discuss managing climate future with emissions/geoengineering. LO: 1, 5, 6.*	
	GPC 11	**Mechanisms 2: Climate models** *Why do we need models? Testing cause and effect. Hierarchy of model type. How to use models to answer climate science questions. Example applications. Projections for emissions scenarios – summative discussion. LO: 1, 5, 6.*	***Submit** term paper on your independent research project. **Due last class, Wed 24th April at 2pm.** LO: 5, 7-10.*
Study week		*Study from your notes on the class topics, textbook readings and assigned homeworks. Prepare to answer long (essay) and short format questions including calculations and diagrams. LO: 1-5,9. Study material across the entire semester.*	
Final Exam		*Closed book, cumulative, handwritten. LO: 1-5,9* **Monday, May 6th 2-4pm in ZHS 200**	

About the Instructor:

Dr. Sarah Feakins is an Associate Professor of Earth Sciences at USC, where she has been a member of faculty since 2009. Previously, she was a NOAA Climate and Global Change Postdoctoral Fellow at the California Institute of Technology from 2006-2008 working on proxy calibration in isotope biogeochemistry. She obtained her PhD (Geology) in from Columbia University's Department of Earth and Environmental Sciences at Lamont-Doherty Earth Observatory in 2006 with a thesis reconstructing paleoenvironments of northeast Africa during the Neogene and related to human origins. She obtained a first-class degree and was top of her year in Geography at the University of Oxford (1998-2001). At USC since 2009, she has taught 107, 412, 566 and 575, while running a research program from the Leaf Wax Lab in SHS 460, funded by the US National Science Foundation, American Chemical Society and other sources with a team of graduate and undergraduate students earth.usc.edu/feakins/people/. She has a passion for engaging students in large-scale thinking about the Earth and in honing expertize in biogeochemistry needed to push forward analytical frontiers to uncover evidence for past environments to reach a deeper understanding of the climate system, the evolution of our species and our future trajectory. While some build models, mostly trained in the modern to predict the future, my research approach makes detailed measurements about the past to see how the climate system has operated at warm times in the past to provide a geological window into our future. How do precipitation patterns and ecosystems respond as the climate shifts? Earth history provides real-world realizations that constrain a wider realm of what's possible. We need to bring all our powers of reasoning to bear on understanding our place in the climate system. This upper-division climate course seeks to provide the inspiration and the fundamentals to take you there: as ocean/atmosphere trained earth scientists, ready for advanced study and research, environmental risk and consultancy, governance and other careers.

My research webpage is here: http://earth.usc.edu/feakins/

My publications can be found here: Google Scholar.

I post research/climate news articles of interest here: https://twitter.com/SFeakins

To contact me: feakins@usc.edu I will reply within hours if I can, or if not within 2 business days.

Statement on Academic Conduct and Support Systems

Academic Conduct:
Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Support Systems:
Student Health Counseling Services - (213) 740-7711 – 24/7 on call engemannshc.usc.edu/counseling
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call suicidepreventionlifeline.org
Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 – 24/7 on call engemannshc.usc.edu/rsvp
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) | Title IX - (213) 740-5086 equity.usc.edu, titleix.usc.edu
Information about how to get help or help a survivor of harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following protected characteristics: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations.

Bias Assessment Response and Support - (213) 740-2421
studentaffairs.usc.edu/bias-assessment-response-support
Avenue to report incidents of bias, hate crimes, and microaggressions for appropriate investigation and response.

The Office of Disability Services and Programs - (213) 740-0776 dsp.usc.edu
Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Support and Advocacy - (213) 821-4710
studentaffairs.usc.edu/ssa Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101 diversity.usc.edu
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
dps.usc.edu, emergency.usc.edu
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call
dps.usc.edu Non-emergency assistance or information.