

# EARTH SCIENCES 2009-10

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## UNIVERSITY OF CALIFORNIA, SANTA CRUZ

### THE EARTH SCIENCES MAJOR

The study of Earth sciences encompasses a broad range of fields. Research and courses in this department include the study of planetary interiors and surfaces, the atmosphere, oceans, and biosphere, stretching from the birth of the solar system, to the present, to predictions about the future. Undergraduate courses integrate these subdisciplines and applications, with a focus on modern frontiers and career opportunities in the field.

### STUDY AND RESEARCH OPPORTUNITIES

- ◆ B.S. standard degree (see *Course Work* section) or with optional concentrations in environmental geology, ocean sciences, planetary sciences, or science education; minor degree; M.S.; Ph.D. with optional concentrations in geochemistry, geology, geophysics, and planetary science
- ◆ Combined B.A. degrees are available in Earth sciences/anthropology and environmental studies/Earth sciences.
- ◆ An internship program provides opportunities for undergraduate students to gain practical work experience, which may prove beneficial in the industrial, academic, or governmental job markets.
- ◆ Earth sciences students may gain up to seven units of teaching experience through Earth Sciences 196A-C, *Teaching Apprenticeship*.

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### HIGH SCHOOL PREPARATION

High school students planning to major in Earth sciences at UC Santa Cruz should take the standard courses required for UC admission. In addition, they should have a strong background in high school mathematics, including algebra (two years), Euclidean geometry, trigonometry, and analytic (coordinate) geometry, as well as some background in high school chemistry, biology, environmental science, or physics.

### TRANSFER PREPARATION

Transfer students are encouraged to contact the Physical and Biological Sciences Undergraduate Affairs adviser for information on courses they should complete before arrival at UC Santa Cruz. Students and their college advisers are strongly recommended to examine the degree requirements at [undergrad.pbsci.ucsc.edu/programs/eps](http://undergrad.pbsci.ucsc.edu/programs/eps) for the student's intended major. It is important that students have completed an introductory course in physical geology and as many as possible of the chemistry, mathematics, and calculus-based physics courses required. Prospective transfer students should visit the Physical and Biological Sciences Undergraduate Affairs web site at [undergrad.pbsci.ucsc.edu](http://undergrad.pbsci.ucsc.edu) for further information (see the *For More Information* section).

Students planning to major in the sciences and engineering are not well served by completing the Intersegmental General Education Transfer Curriculum (IGETC) due to the extensive lower-division major preparation course load and related prerequisite course requirements. Students interested in these high-unit majors are encouraged to complete courses equivalent to the specific program's lower-division major requirements first and the university's broader general education equivalents second. Please see [www.assist.org](http://www.assist.org) to identify these course equivalents. Also, please see the *Course Work* section for more information.

### CAREERS

An Earth sciences degree opens up a broad and exciting range of career opportunities. Students obtaining a good background in geology and related disciplines will be prepared for a wide variety of employment opportunities in teaching, research, and work in government, consulting firms, and industrial institutions. Many upper-division Earth sciences courses involve intensive written work, which most students find helpful in developing skills useful in the job market. In addition, there is a requirement to take at least two upper-division courses that provide hands-on experience with data acquisition and analysis, which is particularly valuable training for the job market and for graduate research. (See next page for specific examples of Earth sciences fields.)

Atmospheric science	Oceanography
Climate change and impacts	Paleoclimatology
Coastal geology	Paleomagnetism
Energy resources	Paleontology/paleoecology
Engineering geology	Petrology/mineralogy
Environmental assessment and remediation	Planetary science
Geochemistry	Sedimentology/stratigraphy
Geomorphology	Seismology
Geophysics	Structural geology
Glaciology	Teaching and research
Hydrogeology/groundwater	Tectonics
Hydrology	Volcanology
Land management and restoration	<i>These are only samples of the field's many possibilities.</i>
Marine geology	
Mineral resources/economic geology	

## COURSE WORK

The various degrees offered by the Earth and Planetary Sciences Department may require lower-division preparation in anthropology, astronomy, biology, chemistry, education, environmental studies, math, and physics. These courses are taken in conjunction with some or all of the Earth sciences foundation series and other upper-division requirements. For example, following is the required course work for the Earth sciences standard B.S. degree:

- Earth Sciences 5/L, *California Geology with Laboratory* or 10/L, *Geologic Principles with Laboratory* or 20/L, *Environmental Geology with Laboratory* (introductory geology course)
- Chemistry 1A, 1B/M, and 1C/N, *General Chemistry* (three quarters)
- Mathematics 11A-B, *Calculus with Applications* (two quarters) or 19A-B, *Calculus for Science, Engineering, and Mathematics* (two quarters) and 22, *Introduction to Calculus of Several Variables* or 23A, *Multivariable Calculus*, or Earth Sciences 111, *Mathematical Methods for Earth Scientists*
- Physics 6A/L-B/M-C/N, *Introductory Physics* (series of 3). Chemistry 108A/L or 112A/L, *Organic Chemistry*, may substitute for Physics 6C/N
- Earth Sciences 110A/L, *Evolution of the Earth with Laboratory*, 110B/M, *Earth as a Chemical System with Laboratory*, and 110C/N, *The Dynamic Earth with Laboratory* (foundation series of 3)
- Earth Sciences 190, *Earth Sciences Mentorship* (1 unit optional mentorship seminar)
- Four upper-division electives (of which 2 must be lab- or field-intensive)
- Senior comprehensive: Senior field internship (Earth Sciences 188A-B) or senior thesis (Earth Sciences 195) or pre-approved graduate level course

## FACILITIES

On-campus research facilities at UC Santa Cruz include laboratories in seismology (the W. M. Keck Seismological Laboratory), crustal imaging/remote sensing, paleomagnetism, high-pressure and -temperature mineral physics, surface

processes, high performance computing for climate modeling and planetary sciences, isotope geochemistry, electron microscopy, and a wide variety of chemical analysis facilities for rock and water samples (XRF, ICP, and XRD spectrometry). Earth and Planetary Sciences at UC Santa Cruz is also associated with the Institute of Marine Sciences, a group of physical, biological, and chemical oceanographers with a graduate program of their own. Students often have opportunities to engage in seagoing research aboard a coastal research vessel, and occasionally on the larger research vessels of the nearby U.S. Geological Survey, Monterey Bay Aquarium Research Institute, or other oceanographic institutions. The Institute of Geophysics and Planetary Physics (IGPP), a multicampus research institute, is located at UC Santa Cruz. Research scientists associated with IGPP greatly intensify tectonic investigation, adding significantly to the intellectual and teaching resources available in Earth and Planetary Sciences at UC Santa Cruz. For more information on IGPP activities, see the following web site:

[igpp.ucsc.edu](http://igpp.ucsc.edu)

## EDUCATION ABROAD PROGRAM (EAP)

The Education Abroad Program (EAP) offers undergraduate students the opportunity to study at more than 100 host universities and colleges in 34 countries as part of their regular UC academic program. Students receiving financial aid can apply their award to a program abroad. Science majors are encouraged to plan carefully and check the degree requirements that may be completed abroad.

## ACADEMIC ADVISING

Academic advising is available from Physical and Biological Sciences Undergraduate Affairs. Undergraduate Affairs publishes the web site [undergrad.pbsci.ucsc.edu](http://undergrad.pbsci.ucsc.edu), which contains detailed information about the degree programs, sample schedules, transferring credit, placement exams, faculty research, and opportunities in the Physical and Biological Sciences majors.

## FOR MORE INFORMATION

For further information about the Earth sciences major, see: [reg.ucsc.edu/catalog/html/programs\\_courses/earthPS.html](http://reg.ucsc.edu/catalog/html/programs_courses/earthPS.html)

Information about the Earth sciences major can be found at: [undergrad.pbsci.ucsc.edu/programs/eps](http://undergrad.pbsci.ucsc.edu/programs/eps) or by e-mailing [epsadvising@ucsc.edu](mailto:epsadvising@ucsc.edu).

For specific information regarding Earth and Planetary Sciences faculty and research, see the department web site at: [www.es.ucsc.edu](http://www.es.ucsc.edu)

If you have other questions, contact:  
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