Earth System Science (EARTHSS)

Courses

EARTHSS 1. Introduction to Earth System Science. 4 Units.
Covers the origin and evolution of the Earth, its atmosphere, and oceans, from the perspective of biogeochemical cycles, energy use, and human impacts on the Earth system.

(II and VA).

EARTHSS 3. Oceanography. 4 Units.
Examines circulation of the world oceans and ocean chemistry as it relates to river, hydrothermal vent, and atmospheric inputs. Geological features, the wide variety of biological organisms, and global climate changes, such as greenhouse warming, are also studied.

(II, Va)

EARTHSS 5. The Atmosphere. 4 Units.
The composition and circulation of the atmosphere with a focus on explaining the fundamentals of weather and climate. Topics include solar and terrestrial radiation, clouds, and weather patterns.

(II, Va)

EARTHSS 7. Physical Geology. 4 Units.
Introduction to Earth materials and processes. Topics include rocks and minerals, plate tectonics, volcanoes, earthquakes, Earth surface processes, Earth resources, geologic time, and Earth history. Laboratory work involves hands-on study of geologic materials, maps, and exercises pertaining to geologic processes. Materials fee.

(II, Va)

EARTHSS 15. Introduction to Global Climate Change. 4 Units.
Introduction of scientific, technological, environmental, economic, and social aspects underlying the threat and understanding of global climate change. Human and natural drivers of climate. Impacts of climate on natural, managed, and human systems, including their vulnerability and ability to adapt.

(II and (VA or VIII)).

EARTHSS 17. Hurricanes, Tsunamis, and Other Catastrophes. 4 Units.
Introduction to the basic science and state of predictability of various natural catastrophic events including earthquakes, volcanic eruptions, tsunamis, landslides, floods, hurricanes, fires, and asteroid impacts and their interactions and implications with human society in the U.S. and globally.

Overlaps with PUBHLTH 90.

(II and (VA or VIII)).

EARTHSS 19. Introduction to Modeling the Earth System. 4 Units.
Simulate the Earth's system using computer models. Covers the interaction of the air, land, and ocean, and explores how changes to one part of the environment affect the complete Earth system. Utilizes technological tools to understand scientific principles.

(II, Vb)

EARTHSS 21. On Thin Ice: Climate Change and the Cryosphere. 4 Units.
Introduction of the basic science that governs the cryosphere and its interaction with the climate system. Covers some of the significant economic, sociological, and political consequences of the recent melting of the cryosphere driven by anthropogenic climate change.

(II and (VA or VIII)).

EARTHSS 23. Air Pollution: From Urban Smog to Global Change . 4 Units.
Air pollution occurs on regional to global scales. A wide range of air pollution sources and physical, chemical, and meteorological sciences behind air pollution are introduced. The consequences of air pollution to our society are also discussed.

(II and (VA or VIII)).
EARTHSS 27. The Sustainable Ocean. 4 Units.
An introduction to sustainability as it relates to marine resources and conservation. Topics include the scientific basis of our understanding of marine ecosystems, and the political, social, and cultural principles that govern resource protection.
(Ii and VIII).

EARTHSS H30B. Environmental Issues Affecting the Sustainability of Societies I. 4 Units.
Focuses on several environmental challenges facing the world today, and explores the problem, possible solutions, and their scientific, technical, and social constraints. Models for systems, their assumptions, predictive uncertainty, and interpretation, play a large role.
Prerequisite: CHEM H30A. CHEM H30A with a grade of C or better
Overlaps with EARTHSS 15.
Restriction: Campuswide Honors Program students only.
(Ii and Vb).

EARTHSS H30C. Environmental Issues Affecting the Sustainability of Societies II. 4 Units.
Focuses on how we can use Earth's resources, e.g., food and water, in a more sustainable way, exploring their scientific, technical, and social constraints.
Prerequisite: EARTHSS H30B. EARTHSS H30B with a grade of C or better
Restriction: Campuswide Honors Program students only.
(III)

EARTHSS 45. New Student Seminar. 1 Unit.
Weekly meetings led by faculty, current students, and staff, to provide information on the Department of Earth System Science, campus resources, and special programs and opportunities. Designed for students who recently joined the Earth System Science and Environmental Science majors.
Grading Option: Pass/no pass only.
Restriction: Environmental Science Majors have first consideration for enrollment. Earth System Science Majors have first consideration for enrollment. New students only (freshman, transfer, and change of major).

EARTHSS 51. Land Interactions. 4 Units.
The role of terrestrial processes in the Earth system. Provides an introduction to ecosystem processes that regulate the cycling of energy, water, carbon, and nutrients. Analysis of the impact of human activities. Materials fee.
Corequisite: CHEM 1C
Restriction: Environmental Science Majors have first consideration for enrollment. Earth System Science Majors have first consideration for enrollment.

EARTHSS 53. Ocean Biogeochemistry. 4 Units.
Overview of oceanography for those interested in Earth System Science. Focus is on physical, chemical, and biological processes that drive biogeochemical cycling in the oceans. Coastal systems are also reviewed, with an emphasis on California waters.
Prerequisite: CHEM 1C
Restriction: Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment.

EARTHSS 55. Earth’s Atmosphere. 4 Units.
Composition, physics, and circulation of Earth’s atmosphere with an emphasis on explaining the role of atmospheric processes in shaping the climate system. Topics include atmospheric composition, the global energy balance, radiative transfer and climate, atmospheric circulation, and climate sensitivity.
Prerequisite: (MATH 2B or MATH 5B or AP Calculus BC) and (PHYSICS 3B or PHYSICS 7C or AP Physics C Part II). AP Calculus BC with a minimum score of 4. AP Physics C Part II with a minimum score of 5
Restriction: Environmental Science Majors have first consideration for enrollment. Earth System Science Majors have first consideration for enrollment.
EARTHSS 60A. Fundamental Processes in Earth and Environmental Studies. 4 Units.
An introduction to the physical environment, biological systems, and human-environment interactions. Explores physical principles such as fluid transport and reaction rates using environmental examples as well as principles of populations, ecosystems, carrying capacity, and sustainable use of resources.
Prerequisite: CHEM 1B
Restriction: Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment.

EARTHSS 60B. Local and Regional Environmental Issues. 4 Units.
An introduction to common environmental issues using case studies from Orange County and California. Studies natural hazards as well as human-caused problems with air quality, water quality, coastal pollution, ecosystem degradation, and urban climate.
Prerequisite: EARTHSS 60A and (CHEM 1B or CHEM H2B)
Restriction: Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment.

EARTHSS 60C. Global Environmental Issues. 4 Units.
An overview of global environmental changes including climate change, sea level rise, biodiversity loss, land and ocean degradation, and resource depletion. Discusses scientific, cultural, historical, and policy dimensions of these issues as well as possible solutions.
Prerequisite: EARTHSS 60A and (CHEM 1B or CHEM H2B)

EARTHSS 101. Paleoclimatology. 4 Units.
Explores past changes in Earth's climate. Topics include tools and techniques used to reconstruct past climate from natural archives; records and mechanisms of past climate changes throughout Earth history; and lessons learned from the paleo-record for prediction of future climate.
Prerequisite: (EARTHSS 60A and EARTHSS 60B and EARTHSS 60C) or (EARTHSS 51 and EARTHSS 53 and EARTHSS 55)
Restriction: Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment. Concurrent with EARTHSS 201.

EARTHSS 110. Environmental Controversies. 4 Units.
Examines the roles and strategies of advocacy groups, scientists, lobbyists, celebrities, pundits, politicians, and other opinion-makers in creating and shaping public opinion on controversial environmental issues. Use and misuse of science to influence public opinion is elicited.
Prerequisite: (EARTHSS 60A and EARTHSS 60B and EARTHSS 60C) or EARTHSS 51 or EARTHSS 53 or EARTHSS 55
Restriction: Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment.

EARTHSS 112. Global Climate Change and Impacts. 4 Units.
Observations over the 20th century show extensive changes in atmospheric composition, climate and weather, and biological systems that have paralleled industrial growth. Evidence of globally driven changes in these biogeochemical systems is studied, including projected impacts over the 21st century.
Prerequisite: (EARTHSS 51 and EARTHSS 53 and EARTHSS 55) or (EARTHSS 60A and EARTHSS 60B and EARTHSS 60C)
Restriction: Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment. Concurrent with EARTHSS 222.

EARTHSS 114. Earth System Science Laboratory and Field Methods. 4 Units.
Introduction to methods used to measure exchange of gases and energy between the atmosphere and terrestrial ecosystems. Laboratories include data acquisition and isotopic and chromatographic analysis. Field measurements at UCI's Marsh Reserve include microclimate, hydrology, trace-gas exchange, and plant growth. Materials fee.
Prerequisite: (EARTHSS 51 and EARTHSS 53 and EARTHSS 55) or (EARTHSS 60A and EARTHSS 60B and EARTHSS 60C)
Restriction: Environmental Science Majors have first consideration for enrollment. Earth System Science Majors have first consideration for enrollment.

EARTHSS 115. Aquatic Field Methods. 4 Units.
Students design sampling plans, conduct field research techniques, and carry out data analyses that are relevant to aquatic field research. Aquatic field sites covered in the course include marine, estuarine, and fluvial systems. Materials fee.
Prerequisite: (EARTHSS 51 and EARTHSS 53 and EARTHSS 55) or (EARTHSS 60A and EARTHSS 60B and EARTHSS 60C)
Restriction: Environmental Science Majors have first consideration for enrollment. Earth System Science Majors have first consideration for enrollment.
EARTHSS 116. Data Analysis for Earth Sciences. 4 Units.
Analysis and interpretation of geophysical data, including functional fitting, probability density functions, and multidimensional time-series methods, with applications in atmospheric, oceanic, and biogeochemical sciences.
Prerequisite: (EARTHSS 51 and EARTHSS 53 and EARTHSS 55) or (EARTHSS 60A and EARTHSS 60B and EARTHSS 60C)
Restriction: Environmental Science Majors have first consideration for enrollment. Earth System Science Majors have first consideration for enrollment.

EARTHSS 118. Advanced Data Analysis and Modeling. 4 Units.
Covers advanced data analysis and modeling techniques for applications within Earth System Science. These applications will come from a variety of Earth science problems. Students will gain programming proficiency by implementing computational methods in python.
Prerequisite: EARTHSS 116 or IN4MATX 41 or I&C SCI 31
Restriction: Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment.

EARTHSS 124. Weather Analysis. 4 Units.
Provides an overview of weather systems in midlatitudes and tropics. The fundamental dynamics possible for these weather systems are described. Elementary weather analysis and forecasting techniques are introduced.
Prerequisite: EARTHSS 55 or EARTHSS 60A
Restriction: Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment.

EARTHSS 130. Physical Oceanography. 4 Units.
Physical processes that determine the distribution of water properties such as salt and temperature. Fluid-dynamical underpinnings of physical oceanography. Wave motions. The wind-driven and thermohaline circulation. Similarities and differences between ocean and atmosphere dynamics.
Prerequisite: MATH 2D and PHYSICS 7C and (EARTHSS 53 or EARTHSS 60A)
Restriction: Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment.

EARTHSS 132. Terrestrial Hydrology. 4 Units.
Comprehensive treatment of modern conceptual and methodological approaches to hydrological science. Combines qualitative understanding of hydrological processes with quantitative representation, approaches to measurement, and treatment of uncertainty. Components of the hydrological cycle and their linkages within the coupled Earth system.
Prerequisite: EARTHSS 60A or (EARTHSS 51 and EARTHSS 55)
Restriction: Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment.
Concurrent with EARTHSS 232.

EARTHSS 134. Fundamentals of GIS for Environmental Science. 4 Units.
Introduction to Geographic Information Systems (GIS). Topics include fundamentals of cartography, creating/editing GIS data, linking spatial and tabular data, georeferencing, map projections, geospatial analysis, spatial statistics, and the development of GIS models. Examples from hydrology, ecology, and geology.
Prerequisite: (EARTHSS 60A and EARTHSS 60B) or (EARTHSS 51 and EARTHSS 53)
Overlaps with CRM/LAW C148.
Restriction: Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment.

EARTHSS 138. Satellite Remote Sensing for Earth System Science. 4 Units.
Satellite remote sensing data are increasingly used to study the Earth system. Provides an overview of the principles behind remote sensing, and the types of satellite data available for study of the oceans, land, and atmosphere.
Prerequisite: EARTHSS 51 or EARTHSS 53 or EARTHSS 60A or EARTHSS 60C
Restriction: Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment.
Concurrent with EARTHSS 238.
EARTHSS 140. Advanced Geology. 4 Units.
Introduces students to the geological processes which have formed and continue to shape the Earth. Topics will include geological time, minerals and the rock cycle, plate tectonics and associated geological hazards, earth resources, and earth surface processes. Materials fee.
Prerequisite: EARTHSS 51 or EARTHSS 60A
Overlaps with EARTHSS 7.
Restriction: Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment.

EARTHSS 142. Atmospheric Chemistry. 4 Units.
Chemistry of the troposphere and stratosphere. Topics include processes controlling the lifetime and reaction pathways of chemicals in the atmosphere, the role of the atmosphere in biogeochemical cycles, and interactions between atmospheric chemistry and the physical climate system.
Prerequisite: (CHEM 1C or CHEM H2C) and (MATH 2B or MATH 5B or AP Calculus BC. AP Calculus BC with a minimum score of 4
Restriction: Environmental Science Majors have first consideration for enrollment. Earth System Science Majors have first consideration for enrollment.

EARTHSS 144. Marine Geochemistry and Biogeochemistry. 4 Units.
Processes controlling the major and minor element composition of seawater and element distributions in the ocean. Gas exchange, carbon dioxide system, stable isotopes, radionuclides as tracers and chronometers, particle fluxes, organic geochemistry, sediment geochemistry, global cycles of biogeochemically important elements.
Prerequisite: (EARTHSS 53 or EARTHSS 60A) and (CHEM 1C or CHEM H2C or CHEM M3C)
Restriction: Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment.

EARTHSS 146. Consequences of Air Pollution. 4 Units.
From public health to the global climate system this course will explore the impacts of air pollution from the beginning of human history to current and emerging issues. Scientific concepts behind air pollution and solutions will be discussed.
Prerequisite: (EARTHSS 60A and EARTHSS 60B and EARTHSS 60C) or (EARTHSS 51 and EARTHSS 53 and EARTHSS 55)
Restriction: Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment.

EARTHSS 148. Marine Ecosystems and Global Change. 4 Units.
Presents an overview of marine ecosystem structure, diversity, and processes in the context of global change, including the impacts of climate warming, ocean acidification, marine fisheries, and anthropogenic additions of nutrients and pollutants.
Prerequisite: EARTHSS 53 or (EARTHSS 60A and EARTHSS 60C)
Restriction: Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment.
Concurrent with EARTHSS 248.

EARTHSS 152. Environmental Isotope Geochemistry. 4 Units.
Topics include the fundamentals of stable, radioactive, and radiogenic isotope variability in the Earth System. Focuses on theory, measurement techniques, biogeochemistry, hydrology, ecology, and climate related applications.
Prerequisite: (EARTHSS 51 and EARTHSS 53 and EARTHSS 55) or (EARTHSS 60A and EARTHSS 60B and EARTHSS 60C)
Restriction: Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment.
Concurrent with EARTHSS 252.

EARTHSS 158. Research Methods for Sustainable Systems Analysis. 4 Units.
Develops students’ analytical skills that are necessary to engage and assess the sustainability of coupled human and natural systems and effectively communicate their findings.
Prerequisite: Satisfactory completion of the Lower-Division Writing requirement.
Restriction: Upper-division students only. Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment. Global Sustainability Minors have first consideration for enrollment.
EARTHSS 162. The Impact of Climate Change on California's Landscape. 4 Units.
Overview of anticipated impacts of climate change on California's landscape. Includes projections of future climate; anticipated impacts on ecology, hydrology, wildfire, coastal environment, and agriculture; and efforts to reduce greenhouse gas emissions or adapt to climate change through land management.

Prerequisite: (EARTHSS 51 and EARTHSS 53 and EARTHSS 55) or (EARTHSS 60A and EARTHSS 60B and EARTHSS 60C)
Restriction: Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment.

EARTHSS 164. Ecosystem Ecology. 4 Units.
A mechanistic perspective on ecosystem processes. Covers ecosystem development, element cycling, and interactions with plants and microbes. The role of ecosystems in environmental change is also addressed.

Prerequisite: BIO SCI E106 or EARTHSS 51 or EARTHSS 60A or CHEM 51C
Same as BIO SCI E118.
Restriction: Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment. Ecology and Evolutionary Biol Majors have first consideration for enrollment.
Concurrent with EARTHSS 264.

EARTHSS 168. Physiological Plant Ecology. 4 Units.
An examination of the interactions between plants and their environment. Emphasis on the underlying physiological mechanisms of plant function, adaptations and responses to stress, and the basis of the distribution of plants and plant assemblages across the landscape.

Prerequisite: (EARTHSS 51) or (EARTHSS 60A and EARTHSS 60C) or (BIO SCI E106)
Same as BIO SCI E127.
Restriction: Biological Sciences Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment. Earth System Science Majors have first consideration for enrollment. Earth System Science and Environmental Science and Biological Sciences majors have first consideration for enrollment.

EARTHSS 170. Environmental Microbiology. 4 Units.
Establishes a fundamental understanding of microbes living in the environment, including their distribution, diversity, and biochemistry, and discusses how they attribute to global biogeochemical cycles.

Prerequisite: (EARTHSS 53) or (EARTHSS 60A and EARTHSS 60C) or (BIO SCI E106 and BIO SCI M122)
Same as BIO SCI E163.
Concurrent with EARTHSS 270.

EARTHSS 172. Science Communication and Outreach. 2 Units.
Students learn and practice effective science communication skills useful in public and educational outreach. Topics include research explication, language scaffolding, educational psychology, oral presentation techniques, K-12 science standards, and effective writing styles for op-eds, blogs, and Web sites.

Prerequisite: EARTHSS 51 or EARTHSS 60A
Grading Option: Pass/no pass only.
Repeatability: May be taken for credit 3 times.
Restriction: Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment.
Concurrent with EARTHSS 272.
EARTHSS 174. Ice in the Climate System. 4 Units.
Examines the major components of the Earth's cryosphere. Characteristics, volume, extent, remote sensing observations, long-term trends, mass balance, key physical processes, relevance and importance to the climate system, responses and feedbacks, future evolution, and key uncertainties will be discussed.
Prerequisite: (EARTHSS 60A and EARTHSS 60B and EARTHSS 60C) or (EARTHSS 51 and EARTHSS 53 and EARTHSS 55)
Restriction: Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment.
Concurrent with EARTHSS 274.

EARTHSS 176W. Marine Conservation, Policy, and Society. 4 Units.
Conservation of marine ecosystems is important yet challenging due to competing physical, ecological, social, and regulatory issues. Students explore the principles of marine conservation, the scientific basics of marine ecosystems, and political and social processes involved with resource protection.
Prerequisite: (EARTHSS 51 and EARTHSS 53 and EARTHSS 55) or (EARTHSS 60A and EARTHSS 60B and EARTHSS 60C). Satisfactory completion of the Lower-Division Writing requirement.
Restriction: Upper-division students only. Environmental Science Majors have first consideration for enrollment. Earth System Science Majors have first consideration for enrollment.

EARTHSS 178. Solving the Energy-Carbon-Climate Problem. 4 Units.
Why is climate change such a difficult problem? What can we do about it? The course will introduce the global politics of energy and climate, assess options for decreasing energy demand, generating low-carbon energy, sequestering carbon, geoengineering, and adaptation.
Prerequisite: (EARTHSS 60A and EARTHSS 60B and EARTHSS 60C) or (EARTHSS 51 and EARTHSS 53 and EARTHSS 55)
Restriction: Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment.

EARTHSS 180. Environmental Sustainability I. 4 Units.
Provides an introduction to sustainability from different points of view; historical, scientific, political, ethical, and economic.
Same as PP&D 131.
Restriction: Urban Studies Majors have first consideration for enrollment. Social Ecology Majors have first consideration for enrollment.

EARTHSS 182. Environmental Sustainability II. 4 Units.
Investigates how sustainability can be implemented in a variety of contexts including water, energy, non-renewable resources, biodiversity, and urban policy, and also how it could be measured.
Same as PP&D 132.
Restriction: Urban Studies Majors have first consideration for enrollment. Social Ecology Majors have first consideration for enrollment. Earth System Science Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment.

EARTHSS 190A. Senior Seminar on Global Sustainability I. 2 Units.
Students attend weekly seminar to discuss current issues in global sustainability. Weekly attendance at Global Sustainability Forum is also required. Seminar utilized to analyze forum presentations. Prepare bibliography.
Same as BIO SCI 191A, SOCECOL 186A.
Restriction: Seniors only. Global Sustainability Minors have first consideration for enrollment.

EARTHSS 190B. Senior Seminar on Global Sustainability II. 2 Units.
Students attend weekly seminar to discuss current issues in global sustainability. Weekly attendance at Global Sustainability Forum is also required. Seminar utilized to analyze forum presentations. Prepare research proposal.
Prerequisite: BIO SCI 191A or SOCECOL 186A or EARTHSS 190A
Same as BIO SCI 191B, SOCECOL 186B.
Restriction: Seniors only.
EARTHSS 190CW. Writing/Senior Seminar on Global Sustainability III. 4 Units.
Students attend weekly seminar to discuss current issues in global sustainability. Weekly attendance at Global Sustainability Forum also is required.
Seminar utilized to analyze Forum presentations and to prepare senior research paper. Prepare/write research paper under direction of faculty member.
Prerequisite: BIO SCI 191B or EARTHSS 190B or SOCECOL 186B. BIO SCI 191B or EARTHSS 190B or SOCECOL 186B. Satisfactory completion of the Lower-Division Writing requirement.
Same as BIO SCI 191CW, SOCECOL 186CW.
Restriction: Seniors only.

EARTHSS 191. Introduction to Research in Earth System Science. 1 Unit.
Weekly presentations by Earth System Science faculty describing ongoing research in their laboratories. Students are introduced to the range of research topics and methods in Earth System Science and to the research opportunities available within the Department.
Prerequisite: (EARTHSS 60A and EARTHSS 60B) or (EARTHSS 51 and EARTHSS 53) Grading Option: Pass/no pass only.
Restriction: Earth & Atmospheric Sciences Minors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment. Earth System Science Majors have first consideration for enrollment.

EARTHSS 192. Careers in Earth System Science. 1 Unit.
A weekly seminar course designed to help students transition to post-graduation career paths. Topics include designing effective resumes, applying to graduate school, and seeking employment. Also includes presentations by faculty, business, and government leaders describing potential environmental science career trajectories.
Grading Option: Pass/no pass only.
Restriction: Environmental Science Majors have first consideration for enrollment. Earth System Science Majors have first consideration for enrollment.

EARTHSS 197. Independent Study in Earth System Science. 0.5-4 Units.
Field study, educational outreach, or other independent projects under faculty direction. Interested students should arrange with an ESS faculty member to supervise and support an independent study project. A written summary is required at the end of each quarter.
Grading Option: Pass/no pass only.
Repeatability: May be taken for credit for 12 units.

EARTHSS 198W. Senior Thesis in Earth System Science. 4 Units.
Students receive guidance on the effective oral and written communication of research results. Students prepare and present a seminar, a poster, and a written thesis describing their research in Earth System Science.
Prerequisite: Two quarters of EARTHSS 199. Satisfactory completion of the Lower-Division Writing requirement.
Overlaps with EARTHSS H198.

EARTHSS H198. Honors Thesis in Earth System Science. 4 Units.
Students receive guidance on effective written and oral communication of research results. Students prepare and present a seminar, poster, and written thesis describing their honors research in Earth System Science. Submission of the thesis and successful completion of this course will also satisfy the UCI upper-division writing requirement.
Prerequisite: ESS 199A and ESS 199B
Restriction: Consent of instructor to enroll and Prerequisite required

EARTHSS 199. Undergraduate Research. 1-4 Units.
For undergraduates with majors in science or engineering. Interested students should arrange with an ESS faculty member to supervise and support a research project. A written summary is required at the end of each quarter.
Repeatability: May be taken for credit for 12 units.
EARTHSS H199A. Honors Research in Earth System Science. 4 Units.
Undergraduate honors research in Earth System Science. A student commitment of 10-15 hours a week is expected, and a written report is required at the end of the quarter.

 Restriction: Earth System Science Honors students only. Campuswide Honors Program students only.

EARTHSS H199B. Honors Research in Earth System Science. 4 Units.
Undergraduate honors research in Earth System Science. A student commitment of 10-15 hours a week is expected, and a written report is required at the end of the quarter.

 Restriction: Earth System Science Honors students only. Campuswide Honors Program students only.

EARTHSS H199C. Honors Research in Earth System Science. 4 Units.
Undergraduate honors research in Earth System Science. A student commitment of 10-15 hours a week is expected, and a written report is required at the end of the quarter.

 Restriction: Earth System Science Honors students only. Campuswide Honors Program students only.

EARTHSS 200. Global Physical Climatology. 4 Units.
A descriptive overview of Earth's climate system and energy budget. Large-scale circulations, key physical processes, and climate sensitivity of the atmosphere, ocean, land surface, and cryosphere.

 Restriction: Graduate students only.

EARTHSS 201. Paleoclimatology. 4 Units.
Explores past changes in Earth's climate. Topics include tools and techniques used to reconstruct past climate from natural archives; records and mechanisms of past climate changes throughout Earth history; and lessons learned from the paleo-record for predication of future climate.

 Restriction: Graduate students only.
Concurrent with EARTHSS 101.

EARTHSS 202. Climate Change. 4 Units.
Explores past, present, and projected changes in Earth's climate. Topics include paleoclimate records and mechanisms of natural climate variability at a range of timescales (orbital to seasonal); General Circulation Models; and IPCC observations and projections of future climate change.

 Restriction: Graduate students only.

EARTHSS 212. Geoscience Modeling and Data Analysis. 4 Units.
Computer-based course. Fundamental statistical techniques needed to analyze Earth system data and models. Basic numerical techniques to solve Earth system models. Focuses on linear and non-linear ordinary differential equations, as well as simple partial differential equations.

 Restriction: Graduate students only.

EARTHSS 222. Global Climate Change and Impacts. 4 Units.
Observations over the 20th century show extensive changes in atmospheric composition, climate and weather, and biological systems that have paralleled industrial growth. Evidence of globally driven changes in these biogeochemical systems is studied, including projected impacts over the 21st century.

 Concurrent with EARTHSS 112.

EARTHSS 224. Ocean Processes. 4 Units.
Introduction to the physics, chemistry, and biology of the oceans. Offers a mechanistic perspective of the structure and functioning of marine ecosystems, nutrient cycles, and role of ecosystem dynamics in local and global biogeochemistry.

 Restriction: Graduate students only.

EARTHSS 226. Land Surface Processes. 4 Units.
A mechanistic perspective of the structure and functioning of terrestrial ecosystems. Includes processes such as nutrient cycling, biogeochemical cycling, mass balance, energetics, terrestrial hydrology, and water cycle.

 Restriction: Graduate students only.
EARTHSS 228. Geophysical Fluid Dynamics. 4 Units.
Introduces fluid dynamical processes that determine the large-scale flow of the atmosphere and ocean, with particular emphasis on the interactions between the stable density stratification and the Coriolis force associated with Earth's rotation.

Restriction: Graduate students only.

EARTHSS 232. Terrestrial Hydrology. 4 Units.
Comprehensive treatment of modern conceptual and methodological approaches to hydrological science. Combines qualitative understanding of hydrological processes with quantitative representation, approaches to measurement, and treatment of uncertainty. Components of the hydrological cycle and their linkages within the coupled Earth system.

Prerequisite: EARTHSS 60A or EARTHSS 51 Concurrent with EARTHSS 132.

EARTHSS 238. Satellite Remote Sensing for Earth System Science. 4 Units.
Satellite remote sensing data are increasingly used to study the Earth system. Provides an overview of the principles behind remote sensing, and the types of satellite data available for study of the oceans, land, and atmosphere.

Concurrent with EARTHSS 138.

EARTHSS 240. Atmospheric Chemistry and Physics. 4 Units.
Examines the physical/chemical processes which determine the structure and composition of Earth's atmosphere and its role in the climate system.

Restriction: Graduate students only.

EARTHSS 248. Marine Ecosystems and Global Change. 4 Units.
Presents an overview of marine ecosystem structure, diversity, and processes in the context of global change, including the impacts of climate warming, ocean acidification, marine fisheries, and anthropogenic additions of nutrients and pollutants.

Prerequisite: EARTHSS 224
Restriction: Graduate students only.
Concurrent with EARTHSS 148.

EARTHSS 250. Laboratory Methods in Earth System Science. 4 Units.
Introduction to analytical methods used in Earth science research. Lectures cover theory and applications of each method. Laboratories cover sample preparation, experimental design, standardization and calibration, operation of analytical instruments (mass spectrometers, gas chromatographs, and spectrophotometers), and analysis of data.

Concurrent with EARTHSS 150.

EARTHSS 252. Environmental Isotope Geochemistry. 4 Units.
Covers the fundamentals of stable, radioactive, and radiogenic isotope variability in the Earth System. Focuses on theory, measurement techniques, biogeochemistry, hydrology, ecology, and climate related applications.

Restriction: Graduate students only.
Concurrent with EARTHSS 152.

EARTHSS 264. Ecosystem Ecology. 4 Units.
A mechanistic perspective on ecosystem processes. Covers ecosystem development, element cycling, and interactions with plants and microbes. The role of ecosystems in environmental change is also addressed.

Prerequisite: CHEM 51C
Concurrent with EARTHSS 164 and BIO SCI E118.

EARTHSS 266. Global Biogeochemical Cycles. 4 Units.
Global biogeochemical cycling of the elements. Topics include global cycling of carbon, nitrogen, oxygen, and sulfur; impact of human activities on biogeochemical processes.

Restriction: Graduate students only.
EARTHSS 270. Environmental Microbiology. 4 Units.
Establishes a fundamental understanding of microbes living in the environment, including their distribution, diversity, and biochemistry, and discusses how they attribute to global biogeochemical cycles.

Prerequisite: (EARTHSS 53 or EARTHSS 60A) and (EARTHSS 60C or BIO SCI E106)

Concurrent with EARTHSS 170 and BIO SCI E163.

EARTHSS 272. Science Communication and Outreach. 2 Units.
Students learn and practice effective science communication skills useful in public and educational outreach. Topics include research explication, language scaffolding, educational psychology, oral presentation techniques, K-12 science standards, and effective writing styles for op-eds, blogs, and Web sites.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be taken for credit 3 times.

Concurrent with EARTHSS 172.

EARTHSS 274. Ice in the Climate System. 4 Units.
Examines the major components of the Earth’s cryosphere. Characteristics, volume, extent, remote sensing observations, long-term trends, mass balance, key physical processes, relevance and importance to the climate system, responses and feedbacks, future evolution, and key uncertainties will be discussed.

Concurrent with EARTHSS 174.

EARTHSS 280A. Special Topics in Earth System Science. 1-4 Units.
Each quarter is devoted to current topics in the field of Earth System Science. Topics addressed vary each quarter.

Repeatability: Unlimited as topics vary.

EARTHSS 280B. Special Topics in Earth System Science. 1-4 Units.
Each quarter is devoted to current topics in the field of Earth System Science. Topics addressed vary each quarter.

Prerequisite: EARTHSS 280A

Repeatability: Unlimited as topics vary.

EARTHSS 280C. Special Topics in Earth System Science. 1-4 Units.
Each quarter is devoted to current topics in the field of Earth System Science. Topics addressed vary each quarter.

Prerequisite: EARTHSS 280B

Repeatability: Unlimited as topics vary.

EARTHSS 282A. Special Topics in Climate. 1-4 Units.
Each quarter is devoted to in-depth analysis of an important and rapidly developing area in the field of climate dynamics. Topics addressed vary each quarter.

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only.

EARTHSS 282B. Special Topics in Climate. 1-4 Units.
Each quarter is devoted to in-depth analysis of an important and rapidly developing area in the field of climate dynamics. Topics addressed vary each quarter.

Prerequisite: EARTHSS 282A

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only.
EARTHSS 282C. Special Topics in Climate. 1-4 Units.
Each quarter is devoted to in-depth analysis of an important and rapidly developing area in the field of climate dynamics. Topics addressed vary each quarter.

Prerequisite: EARTHSS 282B
Repeatability: Unlimited as topics vary.
Restriction: Graduate students only.

EARTHSS 284A. Special Topics in Atmospheric Chemistry. 1-4 Units.
Each quarter is devoted to current topics in the field of Atmospheric Chemistry. Topics addressed vary each quarter.

Repeatability: Unlimited as topics vary.

EARTHSS 284B. Special Topics in Atmospheric Chemistry. 1-4 Units.
Each quarter is devoted to current topics in the field of Atmospheric Chemistry. Topics addressed vary each quarter.

Prerequisite: EARTHSS 284A
Repeatability: Unlimited as topics vary.

EARTHSS 284C. Special Topics in Atmospheric Chemistry. 1-4 Units.
Each quarter is devoted to current topics in the field of Atmospheric Chemistry. Topics addressed vary each quarter.

Prerequisite: EARTHSS 284B
Repeatability: Unlimited as topics vary.

EARTHSS 286A. Special Topics in Biogeochemistry. 1-4 Units.
Each quarter is devoted to in-depth analysis of a subarea in biogeochemistry which is undergoing rapid development. Topics addressed vary each quarter.

Repeatability: Unlimited as topics vary.
Restriction: Graduate students only.

EARTHSS 286B. Special Topics in Biogeochemistry. 1-4 Units.
Each quarter is devoted to in-depth analysis of a subarea in biogeochemistry which is undergoing rapid development. Topics addressed vary each quarter.

Prerequisite: EARTHSS 286A
Repeatability: Unlimited as topics vary.
Restriction: Graduate students only.

EARTHSS 286C. Special Topics in Biogeochemistry. 1-4 Units.
Each quarter is devoted to in-depth analysis of a subarea in biogeochemistry which is undergoing rapid development. Topics addressed vary each quarter.

Prerequisite: EARTHSS 286B
Repeatability: Unlimited as topics vary.
Restriction: Graduate students only.

EARTHSS 288A. Special Topics in Ecosystems. 1-4 Units.
Each quarter is devoted to current topics relating to Ecosystems. Topics addressed vary each quarter.

Repeatability: Unlimited as topics vary.

EARTHSS 288B. Special Topics in Ecosystems. 1-4 Units.
Each quarter is devoted to current topics relating to Ecosystems. Topics addressed vary each quarter.

Prerequisite: EARTHSS 288A
Repeatability: Unlimited as topics vary.
EARTHSS 288C. Special Topics in Ecosystems. 1-4 Units.
Each quarter is devoted to current topics relating to Ecosystems. Topics addressed vary each quarter.

Prerequisite: EARTHSS 288B
Repeatability: Unlimited as topics vary.

EARTHSS 290. Seminar. 1 Unit.
Weekly seminars and discussions on topics of general and current interest in Earth System Science. Topics addressed vary each quarter.

Grading Option: Satisfactory/unsatisfactory only.
Repeatability: Unlimited as topics vary.
Restriction: Graduate students only.

EARTHSS 298. Practicum in Earth System Science. 4 Units.
Designed to introduce first-year graduate students to research. Students explore research opportunities and develop a proposal for a summer research project under the direction of a faculty mentor.

Restriction: Graduate students only.

EARTHSS 299. Research. 2-12 Units.
Supervised original research in areas of Earth System Science.

Repeatability: May be repeated for credit unlimited times.

EARTHSS 399. University Teaching. 1-4 Units.
Limited to Teaching Assistants.

Grading Option: Satisfactory/unsatisfactory only.
Repeatability: May be repeated for credit unlimited times.
Restriction: Graduate students only.