

DEPARTMENT OF EARTH AND ENVIRONMENTAL SCIENCES

Earth Science Major



Environmental Science Major





Earth, Environmental & Climate Sciences at Columbia



Schermerhorn and Lamont-Doherty Earth Observatory



Focused on how the planet works - including the climate system Linking earth systems – life, climate and solid earth systems Historical dimension – modern processes and deep time Human dimension: resources, hazards, sustainability, climate challenges







DEPARTMENT OF EARTH AND ENVIRONMENTAL SCIENCES

- Undergraduate-friendly department (DEES) is top-ranked in the nation
- Field trips and Field courses
- Summer intern program at Lamont-Doherty Earth Observatory
- Most majors undertake senior research theses
- Diverse career opportunities
- Excellent foundation for continuing to graduate school
- Over 50 undergraduate and graduate classes offered
- More info at https://eesc.columbia.edu









From Recent Graduates:



Ally Peccia, '20

"I discovered DEES through the Solid Earth Systems course, which was a required part of my Engineering curriculum. I loved the class and associated field trips so much that I transferred from SEAS to CC ! I found DEES was unlike any other department at Columbia. Professors were happy to make time to chat with me one-on-one, and I was welcomed into a cohort of passionate and supportive classmates who encouraged me to get involved with research right away."



"My first interaction with DEES was through the Death Valley field trip, which I found out about through a flyer in Carman Hall, in my freshman year. ...DEES professors are not only profoundly passionate and excited about their subjects from Geochemistry to Sea Level Change, but also interested in interacting with students and providing mentorship. DEES formed my community with strong departmental bonding through field trips to Italy and Barbados, and defined my academic experience with collaborative learning environments and models of exceptional teaching and mentorship. I have been challenged to become a stronger thinker, presenter, and scientist through my experience in the department."

SarahShi, '20

Over 40 Instructional Faculty

Our Faculty Win Teaching Awards



Prof. Honisch Lenfest Award Exceptional Teaching at Columbia Oceanography Paleoceanography



Prof. Polvani Great Teacher Award Society of Columbia Graduates Atmospheric Science



Prof. Goldstein Great Teacher Award Society of Columbia Graduates Solid Earth System Isotope Geochemistry

Over 40 Instructional Faculty

Our Newest Faculty!



Prof. Kolawole structural geologist continental rifting fracking

Teaches: Crustal Deformation



Prof. Moussallam volcanologist gas geochemistry magma ascent

Prof. Commane atmospheric chemist Arctic carbon Urban chemistry

Teaches: Mineralogy Chemical Geology

Teaches: Atmospheric Chemistry

Over 100 Researchers at Lamont Campus!





World-Class Facilities at Lamont !



Research Vessel Marcus Langseth



Tree Ring Lab



Lamont Core Lab



Ultra-trace metal geochemistry labs



Earth Science Major

- In depth study of earth, ocean, atmosphere
- Optional plans of study:
 - Geochemistry
 - Geophysics
 - Geology



Earth Science Major

- In depth study of earth, ocean, atmosphere
- Optional plans of study:
 - Geochemistry
 - Geophysics
 - Geology



Environmental Science Major

- Interactions between the Physical Environment and Biosphere and Anthropogenic Processes
- Optional plans of study:
 - Hydrology
 - Environmental Geochemistry
 - Energy and Resources



Earth Science Major

- In depth study of earth, ocean, atmosphere
- Optional plans of study:
 - Geochemistry
 - Geophysics
 - Geology





Environmental Science Major

- Interactions between the Physical Environment and Biosphere and Anthropogenic Processes
- Optional plans of study:
 - Hydrology
 - Environmental Geochemistry
 - Energy and Resources

Climate System Science



 Earth Processes that Govern
Past, Present and Future Climate and Strategies for Solutions to Climate Crisis



Major in: Climate System Science

Launched this Fall !!! by: The Columbia Climate School and The Department of Earth and Environmental Science

"The Climate System Science major is designed for students who are interested in how the past, present, and future climate system works – and in creating strategies for solutions to the rapidly accelerating climate crisis."

"Every student admitted to Columbia has the potential to succeed in the Climate System Science major ."



Major in: Climate System Science

- First CLIMATE Science Major at Columbia University
- Address Critical Needs in the Climate Crisis
- Prepares Students for Professional Opportunities in the Climate Job Market: from Academia to Wall Street to Big Tech to the United Nations



BUBUUK **Climate System Science**

Flexible course structure:

- Foundation in geology, physics, biology, chemistry and math

Major in:

- Core in climate-system science
- Electives in climate solutions, justice, policy and communications
- Original Research

Tracks link to focus areas in The Climate School:

- Sea Level
- Decarbonization
- Modern Climate

Major in Climate System Science					
Program of Study: 43.5 points minimum					
FOUNDATIONAL COURSES - 7.5 points minimum (two courses)					
One required:					
EESC UN2100	Earth's Environmental Systems: The Climate System				
One of:					
EESC UN1009	Global Warming for Global Leaders				
EESC UN1030	Oceanography				
EESC UN1600	Resources and Sus Dev				
EESC UN2330	Science for Sustainable Development				
EESC UN1201	Environmental Risks and Disasters				
EESC UN2300	Earth's Environmental Systems: Life Systems				
EESC UN2200	Earth's Environmental Systems: Solid Earth System				
SUPPORTING COU	RSES - 12 points minimum (four courses)				
One required:					
Calculus I	MATH UN1101 or higher				
Three of:					
Physics I	PHYS UN1201 or higher				
Physics II	PHYS UN1202 or higher				
Chemistry I	CHEM UN1403 or BC2001				
Chemistry II	CHEM UN1404 (after UN1403) or BC3230 (after BC2001)				
EEEB UN2001	Environmental Biology I				
EESC UN2300	Earth's Environmental Systems: Life Systems				
CLIMATE SYSTEM CORE - 15 points minimum (five courses)					
At least one:	Paleoclimate Course (see list)				
At least one:	Modern Climate Course (see list)				
Could include:	Other Climate System Courses (see list)				
Could include one:	Supporting EESC Course (see list)				
CLIMATE SOLUTIO	DNS, JUSTICE, POLICY, COMMUNICATION				
	- 6 points minimum (two courses)				
Any two:	Solutions, Justice, Policy or Communication Courses (see list)				
CLIMATE SYSTEM	CAPSTONE - 3 points minimum (one course)				
One of:					
EESC 3xxx#	Undergraduate Research Project (3 credits)				
BC3800 & EESC3901	Senior Seminar (Senior Thesis) (6 credits)				
Approved Field Course	e Focused on the Climate System ~ 6 weeks				
# to be proposed					

	CLIMATE SYSTEM CORE - 15 points (five courses)		
20	At least one:	Paleoclimate Course	
	EESC GU4235	Sea Level Change*	
	EESC GU4330	Terrestrial Paleoclimate	
EESC GU4480		Paleobiology & Earth Systems	
	EESC GU4920	Paleoceanography	
	EESC GU4937	Cenozoic Paleoceanography	
1	At least one:	Modern Climate Course	
	EESC UN3109	Climate Physics *	
	EESC GU4008	Intro to Atmospheric Sciences*	
	EESC GU4020	Humans and the Carbon Cycle	
	EESC GU4025	Physical Oceanography	
	EESC GU4940	Climate Thermodynamics*	
	EESC GU4930	Earth's Ocean and Atmospheres	
Could include:		Other Climate System Courses	
	EESC BC3025	Hydrology	
	EESC UN3101	Geochemistry Habitable Planet	
	EESC UN3201	Solid Earth Dynamics	
	EESC GU4220	Glaciology*	
	EESC GU4835	Wetlands & Climate Change	
	EESC GU4885	Chemistry of Continental Waters	
	EESC GU4923	Biological Oceanography	
	EESC GU4924	Intro to Atmospheric Chem*	
	EESC GU4926	Chemical Oceanography	
	Could include one:	Supporting EESC Course	
	EESC UN3400	Computational Earth Science	
	EESC GU4210	Geophysical Fluid Dynamics*	
	EESC GU4223	Sedimentary Geology	
	EESC GU4230	Crustal Deformation	
	EESC GU4887	Isotope Geochem I	
	EESC GU4888	Stable Isotope Geochem.	

CLIMATE SOLUTIONS, JUSTICE, POLICY, COMMUNICATION

6 points (2 courses)

Any two from entire list:

	Solutions Courses
ARCH 3120	City, Landscape and Ecology
EESC BC3045	Responding to Climate Change
EAEE 2002	Alternative Energy Resources
EAEE 2100	Better Planet by Design
EAEE 4001	Indust Ecol-Earth Res
EAEE 4002	Field Methods for Env Engineering
EAEE E4300	Introduction to Carbon Management
EAEE E4302	Carbon Capture
EAEE E4301	Carbon Storage
EAEE 4305	CO2 Utilization and Conversion
CEEE 3250	Hydrosystems Eng
MECE 4211	Energy Sources & Conversion
SDEV 4250	Climate Change: Resilience and Adaptation
	0
	Climate Justice, Policy, Economics
ANTH 3861	Climate Justice, Policy, Economics Anthropology of the Anthropocene
ANTH 3861 ANTH BC3932	Climate Justice, Policy, Economics Anthropology of the Anthropocene Climate Ch./Glob. Migration/Human Rights
ANTH 3861 ANTH BC3932 ARCH 3400	Climate Justice, Policy, Economics Anthropology of the Anthropocene Climate Ch./Glob. Migration/Human Rights Environmental Visualizations of NYC
ANTH 3861 ANTH BC3932 ARCH 3400 ECON 4750	Climate Justice, Policy, Economics Anthropology of the Anthropocene Climate Ch./Glob. Migration/Human Rights Environmental Visualizations of NYC Globalization and its Risks
ANTH 3861 ANTH BC3932 ARCH 3400 ECON 4750 ECON BC3039	Climate Justice, Policy, Economics Anthropology of the Anthropocene Climate Ch./Glob. Migration/Human Rights Environmental Visualizations of NYC Globalization and its Risks Environmental & Nat. Res Economics
ANTH 3861 ANTH BC3932 ARCH 3400 ECON 4750 ECON BC3039 ECON2257	Climate Justice, Policy, Economics Anthropology of the Anthropocene Climate Ch./Glob. Migration/Human Rights Environmental Visualizations of NYC Globalization and its Risks Environmental & Nat. Res Economics The Global Economy
ANTH 3861 ANTH BC3932 ARCH 3400 ECON 4750 ECON BC3039 ECON2257 EESC BC 3040	Climate Justice, Policy, Economics Anthropology of the Anthropocene Climate Ch./Glob. Migration/Human Rights Environmental Visualizations of NYC Globalization and its Risks Environmental & Nat. Res Economics The Global Economy Environmental Law
ANTH 3861 ANTH BC3932 ARCH 3400 ECON 4750 ECON BC3039 ECON2257 EESC BC 3040 POLS GU4811	Climate Justice, Policy, Economics Anthropology of the Anthropocene Climate Ch./Glob. Migration/Human Rights Environmental Visualizations of NYC Globalization and its Risks Environmental & Nat. Res Economics The Global Economy Environmental Law Global Energy: Security/Geopolitics
ANTH 3861 ANTH BC3932 ARCH 3400 ECON 4750 ECON BC3039 ECON2257 EESC BC 3040 POLS GU4811 POLS UN3648	Climate Justice, Policy, Economics Anthropology of the Anthropocene Climate Ch./Glob. Migration/Human Rights Environmental Visualizations of NYC Globalization and its Risks Environmental & Nat. Res Economics The Global Economy Environmental Law Global Energy: Security/Geopolitics Governing the Global Economy
ANTH 3861 ANTH BC3932 ARCH 3400 ECON 4750 ECON BC3039 ECON2257 EESC BC 3040 POLS GU4811 POLS UN3648 POLS GU4863	Climate Justice, Policy, Economics Anthropology of the Anthropocene Climate Ch./Glob. Migration/Human Rights Environmental Visualizations of NYC Globalization and its Risks Environmental & Nat. Res Economics The Global Economy Environmental Law Global Energy: Security/Geopolitics Governing the Global Economy Internat. Political Economy of Developing Countries
ANTH 3861 ANTH BC3932 ARCH 3400 ECON 4750 ECON BC3039 ECON2257 EESC BC 3040 POLS GU4811 POLS UN3648 POLS GU4863 SDEV 3355	Climate Justice, Policy, Economics Anthropology of the Anthropocene Climate Ch./Glob. Migration/Human Rights Environmental Visualizations of NYC Globalization and its Risks Environmental & Nat. Res Economics The Global Economy Environmental Law Global Energy: Security/Geopolitics Governing the Global Economy Internat. Political Economy of Developing Countries Climate Change and Law
ANTH 3861 ANTH BC3932 ARCH 3400 ECON 4750 ECON BC3039 ECON2257 EESC BC 3040 POLS GU4811 POLS UN3648 POLS GU4863 SDEV 3355 SDEV 3360	Climate Justice, Policy, Economics Anthropology of the Anthropocene Climate Ch./Glob. Migration/Human Rights Environmental Visualizations of NYC Globalization and its Risks Environmental & Nat. Res Economics The Global Economy Environmental Law Global Energy: Security/Geopolitics Governing the Global Economy Internat. Political Economy of Developing Countries Climate Change and Law Disasters and Development

DECARE	BONIZATION - Example Track for Climate System Major	
Years 1 -2		
[FC1]	Climate System (EESC 2100)	14 Courses Minimum
[FC2]	Resources (EESC 1600) or Solid Earth (EESC 2200)	[FC] - Foundational Courses (2)
[SC1]	Calculus-I (MATH 1101 or higher)	[SC] - Supporting Courses (4)
[SC2]	Chemistry-I (BC2001)	[CC] - Climate Core Courses (5)
[SC3]	Physics-I (PHYS 1201 or higher)	[SJP] - Solutions, Justice and
[SC4]	Physics-II (PHYS 1402) or Chem-II (BC3230)	Policy Courses (2)
[CC1]	Hydrology (BC3025) or Wetlands (EESC 4835)	[Cap] - Capstone (1)
Years 3 – 4		
[CC2]	Geochem (EESC 3101) or Chemistry Cont. Waters (EESC 4885)	
[CC3]	Humans and Carbon Cycle (EESC 4020)	
[CC4]	Terrestrial Paleoclimate (EESC 4330)	
[CC5]	Crustal Deformation (EESC 4230)	
[SJP-1]	Carbon Management, Capture or Storage (EAEE 4300-4302)	
[SJP-2]	Solutions/Justice/Policy - pick one	
[Cap]	Capstone choice	
		1

Other Recommended Courses:

Mineralogy (EESC4113), CO2 Utilization and Conversion (EAEE 4305)

At-a-Glance: Earth and Environmental and Sustainable Development Majors

	Earth Science	Environmental Science	Climate System Science	Sustainable Development
Foundation	Climate System Solid Earth System	Life System Climate System Solid Earth System	Climate System EESC 1000-2000	SusDev Challenges SusDev Seminar Science for SusDev
Supporting	Chem/Phys/EEEB Chem/Phys/EEEB Chem/Phys/EEEB Calc I	Chem/Phys/EEEB Chem/Phys/EEEB Chem/Phys/EEEB Calc I	Chem/Phys/EEEB Chem/Phys/EEEB Chem/Phys/EEEB Calc I	Social Science Social Science EESC/ Chem/Phys EESC/ Chem/Phys Quantitative
Core Courses	EESC Depth EESC Depth EESC Depth EESC Depth EESC Breadth EESC Breadth	EESC Depth EESC Depth EESC Depth EESC Breadth EESC Breadth	Solutions/Justice Solutions/Justice Modern Climate Paleo Climate Climate Elective Climate Elective Climate Elective	Elective / Research Elective / Research Skills/Actions Skills/Actions Analysis/Solutions Analysis/Solutions
Capstone	Sr Thesis/Field Sr Thesis/Field	Sr Thesis Research Sr Thesis Research	Sr/Research/Field	Capstone Workshop Practicum



Earth & Envir. Sci Courses



Social Science



Math & Natural Sciences



Original Research/Fieldwork

EESC Courses: Spring 2023

Geologic Excursion to Death Valley Professor Christie-Blick EESC UN1010

The Climate System Professors Ting & Winckler EESC 2100

The Solid Earth System Professors Goldstein & Hemming EESC 2200

Field Geology - Italy Professors Goldstein & Hemming EESC 3010

The Life System Professors Dyhrman, Olsen, & Palmer EESC 2300 **Thermodynamics/Energy Transfer** Professor Sobel EESC 4040

Cenozoic Paleoceanography Professors Hönisch & Raymo EESC 4937

Earth's Oceans & Atmosphere Professor Gordon EESC 4930

Intro to Chemical Oceanography Professor Anderson EESC 4926

Intro to Atmospheric Chemistry Professor Commane EESC 4924 **Climate Physics** Professor Sobel EESC 3109

Geodynamics Professor Buck EESC 4085

Air-Sea interaction Professor Zappa EESC 4630

Glaciology Professor Kingslake EESC 4220

Sea Level Change Professor Austermann EESC 4235

If interested in DEES majors and concentrations, please contact our Directors of Undergraduate Studies:

Professor Meredith Nettles & Professor Terry Plank

dees-dus@columbia.edu