

Geophysics and Climate Physics

The Geophysics and Climate Physics concentration involves applying physics and mathematics to study processes that operate on and within the Earth and other planets, over short and long timescales. Geophysical approaches are fundamental for understanding how the oceans, atmosphere and ice sheets respond to climate change, managing resources such as water and geothermal energy, mitigating natural hazards such as earthquakes and volcanoes, and understanding the dynamic processes that shape the surfaces and control the interiors of Earth and other planetary bodies. Geophysics spans both theoretical modeling of physical processes and the analysis of geophysical data (including remote sensing and machine learning), and typically involves computing, as well as lab experiments and field work.

Both A.B. and Sc.B. degrees are offered, requiring 12 and 19 courses, respectively. These degrees build skills in critical thinking, data analysis and modeling, finding solutions to complex problems, and written and oral communication. DEEPS provides a highly collaborative learning environment that emphasizes process-oriented, hands-on approaches in the classroom, in labs and on field trips. There are many opportunities for students to do paid research during the summer or academic year.

Students interested in this concentration may also wish to consider related concentrations: Earth, Climate and Biology, Geochemistry and Environmental Chemistry, and Earth and Planetary Science.

Standard program for the A.B. degree

This program is recommended for students interested in applying physical and mathematical principles toward understanding and modeling processes affecting Earth, its environment and climate, and other planets.

Its requirements are well-suited to students seeking to combine these fields with other educational interests, while preparing them for diverse careers including environmental science, global change, and Earth and planetary science. Some course requirements may be flexible based on consultation with the concentration advisor.

Note - For students still enrolled with the prior Concentration in Geology-Physics/Mathematics A.B., please refer to the Archived Bulletin link on left hand navigation for your requirements for the year you declared.

Five supporting science courses:

CHEM 0330	Equilibrium, Rate, and Structure (or equivalent)	1
A course involving mechanics such as:		1
PHYS 0050	Foundations of Mechanics	
PHYS 0070	Analytical Mechanics	
ENGN 0040	Engineering Statics and Dynamics (or the equivalent)	
Three courses in APMA or MATH, one of which must be APMA 0350 or equivalent		3

Seven concentration courses:

Two of these four fundamentals courses:		2
EEPS 0220	Understanding Earth and Environmental Processes	
EEPS 0230	Geochemistry: Earth and Planetary Materials and Processes	
EEPS 0240	Earth: Evolution of a Habitable Planet	
EEPS 0250	Computational Approaches to Modelling and Quantitative Analysis in Natural Sciences: An Introduction	
or EEPS 0350	Mathematical Methods of Fluid	
One of these courses:		1
EEPS 1430	Principles of Planetary Climate	

EEPS 1610	Solid Earth Geophysics	
Two of the following courses, can combine different foci:		2
Climate focus:		
EEPS 1310	Global Water Cycle	
EEPS 1510	Dynamic Meteorology	
EEPS 1520	Ocean Circulation and Climate	
Solid Earth and planets focus:		
EEPS 1410	Mineralogy	
EEPS 1450	Structural Geology	
EEPS 1620	Continuum Physics of the Solid Earth	
Data science focus:		
EEPS 1340	Machine Learning for the Earth and Environment	
or DATA 1340	Machine Learning for the Earth and Environment (EEPS 1340).	
EEPS 1690	Introduction to Methods in Data Analysis	
EEPS 1720	Tackling Climate Change with Machine Learning	
or DATA 1720	Tackling Climate Change with Machine Learning (EEPS 1720)	
One additional EEPS course such as:		1
Climate focus:		
EEPS 1130	Ocean Biogeochemical Cycles	
EEPS 1630	Introduction to Quantitative Glaciology	
EEPS 1820	Geophysical Fluid Dynamics: Rotating, Stratified Turbulence Edition	
Solid Earth and planets focus:		
EEPS 1560	Global Tectonics	
EEPS 1650	Earthquake Seismology	
EEPS 1810	Physics of Planetary Evolution	
Data science focus:		
EEPS 1330	Global Environmental Remote Sensing	
Other alternatives:		
EEPS 1970	Individual Study of Geologic Problems	
a field or sea course or any EEPS course listed in the concentration		
One course in physics or engineering such as:		1
PHYS 0060	Foundations of Electromagnetism and Modern Physics	
PHYS 0470	Electricity and Magnetism	
PHYS 0500	Advanced Classical Mechanics	
PHYS 1600	Computational Physics	
ENGN 0310	Mechanics of Solids and Structures	
ENGN 0490	Fundamentals of Environmental Engineering	
ENGN 0510	Electricity and Magnetism	
ENGN 0810	Fluid Mechanics	
ENGN 1370	Advanced Engineering Mechanics	
Total Credits		12

Standard program for the Sc.B. degree

This program is recommended for students interested in more in-depth study in climate science, geophysics, planetary science and related fields, potentially including graduate school and careers in these areas. Students will gain hands-on experience with theoretical and numerical modeling of processes, data analysis, and computing. Some course requirements may be flexible based on consultation with the concentration advisor.

Note - For students still enrolled with the prior Concentration in Geology-Physics/Mathematics Sc.B., please refer to the Archived Bulletin link on left hand navigation for your requirements for the year you declared.

Five supporting science courses:

CHEM 0330	Equilibrium, Rate, and Structure	1
A course involving mechanics such as:		1
PHYS 0050	Foundations of Mechanics	
PHYS 0070	Analytical Mechanics	
ENGN 0040	Engineering Statics and Dynamics (or the equivalent)	
Three courses in APMA or MATH, one of which must be APMA 0350 or equivalent		3

Fourteen Concentration Courses:

EEPS 0220	Understanding Earth and Environmental Processes	1
EEPS 0230	Geochemistry: Earth and Planetary Materials and Processes	1
or EEPS 0240	Earth: Evolution of a Habitable Planet	
EEPS 0250	Computational Approaches to Modelling and Quantitative Analysis in Natural Sciences: An Introduction	1
or EEPS 0350	Mathematical Methods of Fluid	
EEPS 1430	Principles of Planetary Climate	1
EEPS 1610	Solid Earth Geophysics	1
Three of the following courses, can combine different foci:		3

Climate focus:

EEPS 1310	Global Water Cycle	
EEPS 1510	Dynamic Meteorology	
EEPS 1520	Ocean Circulation and Climate	

Solid Earth and planets focus:

EEPS 1410	Mineralogy	
EEPS 1450	Structural Geology	
EEPS 1620	Continuum Physics of the Solid Earth	

Data science focus:

EEPS 1340	Machine Learning for the Earth and Environment	
EEPS 1690	Introduction to Methods in Data Analysis	
EEPS 1720	Tackling Climate Change with Machine Learning	

One additional EEPS course such as: 1

Climate focus:

EEPS 1130	Ocean Biogeochemical Cycles	
EEPS 1630	Introduction to Quantitative Glaciology	
EEPS 1820	Geophysical Fluid Dynamics: Rotating, Stratified Turbulence Edition	

Solid Earth and planets focus:

EEPS 1560	Global Tectonics	
EEPS 1650	Earthquake Seismology	
EEPS 1810	Physics of Planetary Evolution	

Data science focus:

EEPS 1330	Global Environmental Remote Sensing	
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Other alternatives:

a field or sea course

or any EEPS course listed in the concentration

Three courses in physics or engineering such as: 3

PHYS 0060	Foundations of Electromagnetism and Modern Physics	
PHYS 0470	Electricity and Magnetism	
PHYS 0500	Advanced Classical Mechanics	
PHYS 1600	Computational Physics	
ENGN 0310	Mechanics of Solids and Structures	
ENGN 0490	Fundamentals of Environmental Engineering	

ENGN 0510	Electricity and Magnetism	
ENGN 0810	Fluid Mechanics	
ENGN 1370	Advanced Engineering Mechanics	
One additional upper-level science or math course with approval from the concentration advisor		1
EEPS 1970	Individual Study of Geologic Problems	1
Total Credits		19