

## Geophysics programs at other schools

Data were gathered in early January 2020 by [Carrie Hunter](#), UBC Curriculum & Course Services.

Raw data are in spreadsheet "**Geop-prgms-Analysis 200109.xlsx**". This summary is for quick review purposes only.

Schools included in that collection include Calgary, Toronto, Alberta, Stanford, MIT, Princeton.

**\*Note** the count of "Geo", "math/phys" & "computing/data" courses represent courses available not courses required. Computing & data science techniques may be covered in other courses but those counted here are only those with computing / datascience in their title.

School	Programs	Dep't / faculty	Outcomes or mission. Bold added here to highlight verbs.	*"Geo" "math/ phys" & "comp/ data" courses
Calgary	<ul style="list-style-type: none"> <li>B.Sc – Geophysics</li> <li>B.Sc. Honours – Geophysics</li> <li>BSc and BSc Honours in Geology or Petroleum Geol. Concentration</li> <li>Minors in Geology and Geophysics</li> <li>Double majors: combine any 2 of: (i) Geology or Petroleum Geology Concentration, (ii) Geophysics, (iii) Earth Science, (iv) Environmental Science (Geology).</li> <li>Combined degree: Geophysics with one of (i) Geology, (ii) Petroleum Geology Concentration, (iii) Environmental Science (Geology).</li> </ul>	Geoscience / Science  <a href="#">Geophysics prgm.</a>  <a href="#">Course requirements</a>	This degree <b>provides students with a foundation in</b> geology, geophysics, physics, and mathematics, <b>to apply data acquisition methods and interpretation to</b> geophysical exploration, global earth studies, and the study of relevant rock properties.  No outcomes articulated	G = 18 MP = 11 C = 3
Alberta	<ul style="list-style-type: none"> <li>BSc. Physics, with Specialization in Geophysics</li> <li>BSc. Honors with Specialization in Geophysics</li> </ul>	Physics / Science <a href="#">Geophysics</a> <a href="#">Course requirements.</a>	No mission or description articulated.  No outcomes articulated	G = 23 M = 21 C = 0

School	Programs	Dep't / faculty	Outcomes or mission. Bold added here to highlight verbs.	*“Geo” “math/ phys” & “comp/ data” courses
Toronto	<ul style="list-style-type: none"> <li>• Honours BSc. - Geophysics Specialist</li> <li>• GeoScience Major: Aims to expose students to a traditional geoscience curriculum (Mineralogy, Petrology, Geological structures and Maps, Field Techniques etc.).</li> <li>• GeoScience Minor: The Minor program aims to give students as much leeway as possible to choose particular interests within the diverse and dynamic field of Earth Sciences.</li> <li>• Earth and Environmental Systems Major: for Students wishing a more customized degree.</li> </ul>	<p>Part of both Physics &amp; Earth Sciences / Arts &amp; Sciences</p> <p><a href="#">Geoph options.</a></p> <p><a href="#">Course requirements.</a></p> <p><a href="#">Geoph prgrm intro.</a></p>	<p>The Geophysics specialist program <b>allows students to model physical processes in and on</b> Earth and other planets and to <b>apply non-invasive methods of imaging the subsurface</b>, often in 4D (i.e., space and time); <b>targets may range from</b> archaeological investigations to groundwater imaging and mineral exploration, but <b>also include modeling of</b> mountain-building processes and the exploration of planetary surfaces instead.</p> <p>No outcomes articulated</p>	<p>G = 18 MP = 7 C = 1</p>
Stanford	<ul style="list-style-type: none"> <li>• BSc Geophysics</li> <li>• BSc Honors Geophysics</li> <li>• Geophysics minor as part of a BSc in Physics</li> </ul>	<p>Geophysics, in The School of Earth, Energy &amp; Environmental Sciences</p>	<p>The <b>mission</b> of the undergraduate program in Geophysics is to <b>expose students to</b> a broad spectrum of geophysics, including; resource exploration, environmental geophysics, seismology, and tectonics. Students in the major <b>obtain a solid foundation in the essentials</b> of math, physics, and geology, and build upon that foundation with advanced coursework in geophysics to <b>develop the in-depth knowledge needed to pursue graduate study and professional careers</b> in government or the private sector.</p>	
Stanford (cont'd)	<p><b>Program learning outcomes:</b></p> <ol style="list-style-type: none"> <li>1. <b>understand</b> the physics and geology that form the basis for geophysical observation and measurement.</li> <li>2. <b>understand</b> Earth structure and evolution.</li> <li>3. <b>identify</b> the physical processes governing the behavior of common geophysical systems.</li> <li>4. be able to <b>explain the principles of</b> applying geophysical methods to societally relevant problems, including natural hazards, resource exploration and management, and environmental issues.</li> <li>5. be able to <b>quantitatively describe</b> the behavior of natural systems and the principles of geophysical measurement with physics-based mathematical models.</li> <li>6. <b>investigate these models by solving</b> the governing equations with a combination of analytical and computational methods.</li> <li>7. <b>make</b> their own <b>observations with</b> a variety of geophysical instruments, and reduce, model, and interpret their data and uncertainties.</li> <li>8. effectively <b>communicate</b> their scientific knowledge through written and oral presentations.</li> <li>9. be able to <b>interpret and evaluate</b> the published literature and oral and poster presentations at national meetings.</li> </ol>			

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MIT	<ul style="list-style-type: none"> <li>BSc. in Earth, Atmospheric, and Planetary Sciences</li> </ul>	?	<p>Apply physics, chemistry, and mathematics to the study of the Earth and planets in order to understand the processes that are active in the Earth's interior, oceans, and atmosphere, as well as the interiors and atmospheres of other planets. The department also uses the basic sciences to understand the past history of the Earth and planets. By combining the past history with models of present physical, biological, and chemical processes, faculty and students work to develop an understanding of the dynamics of systems as diverse as the global climate system, regional tectonics and deformation, petroleum and geothermal reservoirs, and the solar system.</p> <p>Preparation for professional careers in a wide range of fields in geoscience (which includes geology, geophysics, geobiology, and geochemistry), atmospheric science, climate science, environmental systems, and planetary science and planetary astronomy.</p>	<p>G MP C</p> <p>Course counts are unclear; many options, with flexible programs.</p>
Princeton	<ul style="list-style-type: none"> <li>Data gathering not completed</li> </ul>			
<a href="#">U. of Sydney</a>	<ul style="list-style-type: none"> <li>Geology and Geophysics</li> </ul>	Science	"Geology and Geophysics will provide you with a unifying context for understanding the surface and internal planetary processes that determine how the earth functions as a system."	very much a solid earth degree, targeting mainly resource industries; also envr, gov't & academe

## Notes:

### Stanford also says:

- The Geophysics curriculum provides field-based classes, engaging research opportunities, and excellent preparation for graduate school and careers in academia, industry, and government.
- Our department aims to teach you powerful skills not only in geophysics, but also in mathematical applications, analytical reasoning, computational problem solving, and communications.
- Undergraduates in Geophysics are exposed to a broad spectrum of topics in the Earth sciences that describe and predict our planet's evolution. Majors build on a solid foundation of mathematics and natural science with advanced coursework in geophysics to develop the in-depth knowledge needed to pursue advanced graduate study and professional careers in government or the private sector.
- A primary focus of the Geophysics Major, both as a primary and secondary major, is the senior research project. Students work closely with a faculty mentor to complete an original research paper that can result in published literature. Students selecting Geophysics as a primary major generally pursue specialized skills in areas such as resource exploration, environmental geophysics, seismology, or tectonics. For students pursuing Geophysics as a secondary major, we encourage multidisciplinary approaches applying broad knowledge to achieve a better understanding of the Earth and its future.

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## A few conclusions from these five institutions

1. Few have clearly articulated the program level learning goals or outcomes. This is a missed opportunity
2. Most list the “knowledge to be gained” rather than the “capabilities students will acquire”.
3. Few have specific datascience or computing components. This represents a gap worth filling.

Other institutions that should or could be summarized?

Canada:

- U. Victoria
- SFU
- McGill
- Waterloo?
- Dalhousie?

US: Based on <https://www.topuniversities.com/university-rankings/university-subject-rankings/2020/geophysics>

- Harvard
- U. Washinton
- Princeton
- Columbia
- U. Colorado, Boulder
- Colo. School of Mines
- UCLA
- UC Berkeley
- Caltech
- Others?

UBC sources: