# GEOHYDROLOGY Option

DEPARTMENT OF EARTH SCIENCES at Montana State University

## What is the Geohydrology Option in Earth Sciences?

The Geohydrology Option is designed for students interested in the relationships between ground water, surface water, people and the earth. The Option prepares you both as a geologist and a hydrologist.

## What courses would I take in the Geohydrology curriculum?

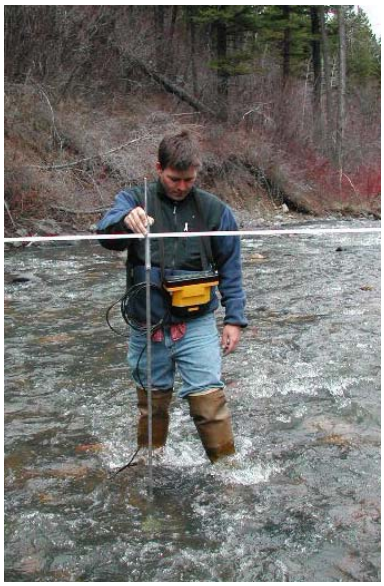
The program requires more mathematics than the geology program because much of the work in ground water and in surface water requires knowledge of differential equations. Calculus based physics prepares a student to think about geophysical techniques that are commonly used to characterize an aquifer, and to think about the factors which influence hydraulic and hydrologic processes in a channel or how ground water moves in response to pumping. Chemistry courses prepare a student both for mineralogy/petrology, and also for concepts in rock water chemical reactions and detection of contaminants. Weather and climate prepares students to interpret weather systems, precipitation, drought, climate regions and the interaction between plants, animals, people, and weather particularly in mountain environments. Such topics are critical because the inputs to the hydrologic system are commonly atmospheric. Students are encouraged to take courses in mathematics, statistics, soils, biology, microbiology, or chemistry depending upon their interest area and how much time is available during their study at MSU. The water topics are examined from a geologic perspective in our department. Students are required to take the core geology courses in the geology option including the summer field course (you will be qualified as a geologist) as well as mathematics, physics and water courses which will help you think about how water interacts with soil and rock on the earth and within the earth.

## What opportunities for fieldwork are there in Geohydrology?

A variety of fieldwork opportunities are available in the Geohydrology Option. These opportunities commonly take advantage of the great regional laboratory in the northern Rocky Mountains. In surface water you will measure and assess streams near Bozeman for channel change, hydraulic characteristics, channel features, and channel form. In ground water you will perform aquifer tests and think about the interaction of geology and water in the ground. There is one part-time student position in ground water monitoring. You will learn to write consulting reports using local subdivisions and real data from data bases. The program is field based and uses field experiences and real hydrologic data available from the web or from field measurements. Geomorphology takes several field trips to measure, observe and interpret landscapes in Montana. These include glacial and fluvial landscapes and the interaction between surficial processes and rock. The geology field course goes to a variety of sites in Southwest Montana and sometimes goes to other Western regions. In addition, juniors and seniors are strongly encouraged to do independent studies on problems of local interest. These projects commonly include a field measurement component and encourage you to learn to interpret hydrologic systems.

## How does the Geohydrology Option prepare me for more advanced training and employment?

A graduate in this option is prepared for a variety of careers related to water. Prospective employers include local, state, and federal agencies; consulting firms; and hydrologic or environmental divisions of major corporations. In ground water, you might work for a consulting firm which specializes in



resource assessment (Where can I find adequate ground water; will the proposed subdivision near me dry up my well?), ground water clean up (where is the pollution plume; can the pollution plume be mitigated; am I in the zone of contamination, will my neighbor's septic system contaminate my ground water; how fast will the contaminant move toward the river; will the contaminant flow to the river?). There may also be employment in a state agency such as the Montana Bureau of Mines and Geology, the Department of Environmental Quality or the Department of Natural Resources and Conservation. In these agencies again you will evaluate aquifer potential, make regulatory decisions about ground-water/surface-water interaction, water contamination, or the hydraulic characteristics of various rocks or sediments. At the Federal level, you might find employment with the United States Geological Survey, the Environmental Protection Agency, or the Natural Resources Conservation Service. You might examine how fractures and faults influence the cone of depression for a subdivision or water entering a mine. You might examine the structure and stratigraphy of the Madison Aquifer and how that information informs a client about geothermal flow to Yellowstone National Park or water quality for a malting operation. You might study whether ground water flows from the ground into the river or from the river into the ground water system.

In surface water, you might work on measuring river discharge, analyzing flood frequency and how the landscape controls where flooding is expected. You might work on channel restoration projects that focus on expected geomorphologic conditions. If you worked for a public agency (Fish Wildlife and Parks or Fish and Wildlife Service; Army Corps of Engineers, Natural Resources Conservation Service), you might assess how to best design a channel that was straightened in 1950. As a consultant, you might help a client understand the geologic source and potential stability of spring flows on a specific property. You might be asked to assess the potential for flooding in an area from a geomorphologic perspective or estimate runoff from a proposed subdivision. You might also work in wetland systems to better understand the linkage between the stream and the groundwater system adjacent to the stream.

### What are the requirements for the M.S. Degree in Earth Sciences (Geohydrology option) and what career opportunities might it offer?

Often students find that a Master of Science degree is required before an employer will consider your application or assign you as lead investigator on a project. The M.S. degree is a two-to-three-year program that produces broadly-trained professional earth scientists. The required thesis involves the student in an independent research and writing project. Specialized graduate-level coursework builds upon an undergraduate background in Geohydrology. A Ph.D. is not required in Geohydrology unless you plan to work at a University or in a research level position with a government agency or major corporation.

*For more information, visit our website!*

**www.montana.edu/wwwes**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