Credits
9 ECTS for full course (individual preparation before the course approx. 60 hours, one-week field course in the Davos area (50 hrs), 40 hours literatur search and summary presentation)

Requirements for participation
The field course can take place as soon as most of the snow has melted (end of June through September). Please be equipped for rain, snow and UV-protection since the conditions can change abruptly in the mountains.
Fitness: Field work can last up to 8 hours daily and will take place at altitudes up to 3000m. This requires endurance and a certain physical fitness. Participants need to be prepared.
Clothing: Sturdy, waterproof walking boots are a must since we will traverse rough mountainous terrains, rock fields, snow and ice.
Insurance: Health and accident insurance are the responsibility of the participant. Insurance policies have to be valid outside your country.

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High Altitude Geo-Microbiology

Life Strategies in Alpine aquatic Ecosystems

Project Leader Kurt Hanselmann

Target Groups
Field course module for the upper level base curriculum (Bachelor, 6th semester) and as a geo-biological specialty block course for advanced Master students
5 days with excursions.

Mountain lakes in the Joeri Catchment, 2400 to 3000 m a.s.l.

Didactic Approach
Investigation of field sites, follow-up analyses in the laboratory, preparation lectures and papers on-line, exercises on concept formulation, ecosystem modelling, presentation of experimental results.

Context
The terrestrial hydrological cycle, which begins in the central European Alps distributes water by 4 major river systems across much of continental Europe. Millions of people depend on water originating in the Alps for drinking water, power generation, transport, industrial purposes and recreation.
The course introduces the microbial habitats at the origin of the European hydrological cycle.

Course objectives
Field studies on microbial life strategies and geochemical nutrient scavenging in nutrient-poor high mountain aquatic ecosystems

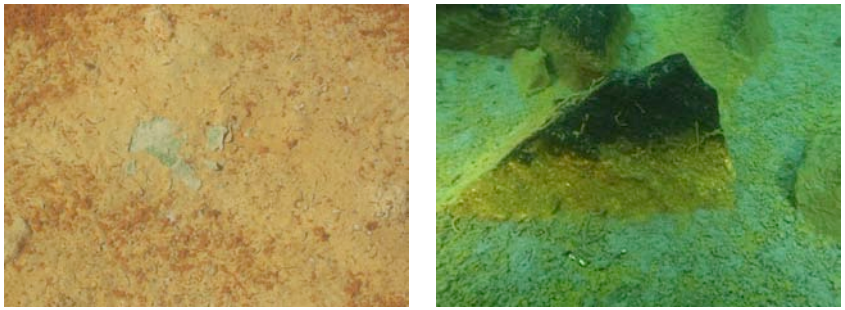
Course contents
- Landscape changes during events of glacial retreat
- Alpine water resources and climate change
- Acidification in slightly buffered, recently formed mountain lakes
- Relations of hydrology and hydrochemistry to local alpine geology
- Sources and sinks for nutrients for life processes
- Nutrient scavenging and transport in remote areas
- Role of erosion nanoparticles
- Regulation of nutrient balances in oligotrophic environments
- Microbially mediated biogeochemical cycling of P, Fe, Mn
- Life strategies under extremes of temperature, radiation and low-nutrient concentrations
- Life in ice and cold water ecosystems
- Microbial colonization and alpine habitat evolution
- Limits to habitability in oxic-anoxic redox transients during periods of ice and snow cover
- Biosphere responses to atmosphere-geosphere interactions (weathering and erosion)
- Iron and sulfur driven aquatic ecosystems relate to evolution of habitats in Earth history
- Modeling the regulation of selection, adaption and extinction in high mountain ecosystems

Learning Environment
We are studying in the field and in the lab, how microorganisms respond and adapt physiologically to the complex interactions between chemical, geological and atmospheric determinants in the lakes of the Jöri catchment, thereby contributing to efforts aimed at understanding evolutionary processes in ecosystem research and the microbial diversity in cold-extreme environments.

Knowledge assessment
Each course participant focuses on a scientific question of his / her interest, searches for details in the literature and presents a short summary of the course research.

High Altitude Geo-Microbiology

Background and Learning Material
- Chapters from Alpecole: http://www.geo.unizh.ch/virtualcampus/alpecole/alpwebsite/en/html/index.html
- Power point slides to the individual modules, partially available as recorded lectures online via OLAT
- Scientific papers to aspects of specific interest



Cyanobacterial biofilms in iron-oxide mats and redox expressions in rock varnish

Distance Learning
The preparation for the field work is designed as a partial distance education course via the internet. Lectures along with other course-related material can be viewed before the field course. Students will need to complete a variety of assignments and participate at discussion fora on OLAT before being accepted to the field course.
Enrolment and library access required.

How blooms of dinoflagellates and cyanobacteria can occur in low-nutrient aquatic systems