ENV-425 **Limnology**

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Cursus	Sem.	Type
Environmental Sciences and Engineering	MA2, MA4	Opt.

Language of teaching	English
Credits	5
Session	Summer
Semester	Spring
Exam	Oral
Workload	150h
Weeks	14
Hours	**4 weekly**
Lecture	2 weekly
Exercises	2 weekly
Number of positions	

Summary

Focus is on lakes, rivers and reservoirs as aquatic systems. Specific is the quantitative analyse (incl. exercises) of physical, biogeochemical and sedimentological processes / interactions. The goal is to understand the relevant processes (focus on water quality) from an engineering perspective.

Content

The themes comprise: themes
1. Water, nutrient, oxygen and salt balances (critical loads, one-box models, flux analysis)
2. Physical conditions of aquatic systems (density, stratification, currents, advection, diffusion, turbulence, heat and gas fluxes)
3. Mixing regimes (boundary layers, wind and convection, stratified turbulence, double diffusion)
4. Geochemical environment (photosynthesis, remineralisation, sedimentation, biogeochemical elemental cycling, particles, oxygen depletion, anaerobic processes, gas exchange)
5. Biological environment (photosynthesis, mineralisation, vertical distribution of substances, turbidity)
6. Remote sensing of inlands water
7. System analysis combining advection, diffusion, and reactions
8. Limnological research techniques
9. Environmental issues (eutrophication, pollution, water quality and WWT).

Keywords

Natural water resources, aquatic systems, production-mineralization cycle, biogeochemical cycling, water quality, air-water fluxes, turbulent mixing/fluxes

Learning Prerequisites

Required courses

BSc completed. Basic courses in hydrology and biogeochemistry, enjoy physics and mathematics; interest in system analysis and quantitative model/formulations

Recommended courses

System analysis, hydrology, aquatic geochemistry, aquatic biology, aquatic ecosystems

Important concepts to start the course

Numerical quantification of natural processes in stratified waters
Aquatic system analysis

Linking physical boundary conditions to quantitative flux estimates of matter (gases), momentum, and energy (heat, mechnaical)
Equation of motions

Learning Outcomes

By the end of the course, the student must be able to:

- Quantify primary production, system net production and net sedimentation based on nutrient inputs
- Structure models of lake-internal matter fluxes
- Predict vertical structures of water quality parameters, such as oxygen, nutrients, particles, turbidity
- Estimate sediment-to-water and air-water (and vice versa) dissolved substances and heat fluxes.

Teaching methods

2 hrs per week of instructions (basic knowledge and concepts) and 2 hrs per week of problem solving. Problem solving will be based on real data and practical questions. The goal is to learn the real lake- and reservoir-processes by addressing concrete quantitative questions which can be generalized. Motivation is given by scientific as well as practical engineering problems.

Expected student activities

One set of problems per week of homework, which will be digested and generalized in class. The students are expected not only to solve the problem as homework, but also to present and discuss the solutions in class.

Assessment methods

Feedback on the problem solving each week by the assistants.
50% test during the semester (exercises)
50% final exam

Supervision

Assistants	Yes

Resources

Bibliography

Weekly classnotes (about 200 pages in total) will be provided and a list of further readings

Notes/Handbook

Yes, every week

Moodle Link

- https://go.epfl.ch/ENV-425