ENV-320 **Physics and chemistry of the atmosphere**

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Cursus	Sem.	Type
Environmental Sciences and Engineering	BA6	Obl.
HES - SIE	E	Opt.

Language of teaching	English
Credits	5
Session	Summer
Semester	Spring
Exam	Written
Workload	150h
Weeks	14
Hours	**6 weekly**
Courses	3 weekly
Exercises	2 weekly
Project	1 weekly
Number of positions	

Summary

The course provides an introduction to the physical and chemical processes that govern the atmospheric dynamics at small and large scales. The basis is laid for an in depth understanding of our atmospheric environment and the climate system.

Content

- Atmospheric Thermodynamics
- Large Scale Atmospheric Motion
- Radiative Transfer in the Atmosphere
- Energy Balance at the Surface-Atmosphere interface
- Atmospheric Boundary Layer
- Weather and Climate Systems
- Atmospheric composition
- Tropospheric and stratospheric ozone
- Aerosols and clouds
- Homogeneous and heterogeneous reaction classifications and rate expressions
- Gas-particle mass transfer
- Collision theory for molecules, particles, and hydrometeors
- Atmospheric Measurements and Instruments

Keywords

Atmospheric Physics, Atmospheric Chemistry, Radiative Transfer, Weather, Climate, Aerosols, Clouds, Ozone, Air Pollution, Boundary Layer, Energy Balance, Nucleation, Sensors, Measurements

Learning Prerequisites

Required courses

Recommended courses

ENV-200, ENV-221, ENG-272

Important concepts to start the course

- Differential, integral, and vector calculus
- Linear algebra
- Basic physics (Momentum Conservation, Dynamics)
- Basic chemistry (reaction rates, chemical thermodynamics)
- Basic GNU Octave/MATLAB programming

Learning Outcomes

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

- Compute simple atmospheric quantities
- Explain atmospheric phenomena
- Interpret atmospheric observations
- Describe fate and transport of atmospheric constituents
- Identify similarities with other environmental fields
- Categorize important atmospheric processes at different scales
- Perform simple measurements of atmospheric variables

Transversal skills

- Access and evaluate appropriate sources of information.
- Write a scientific or technical report.
- Use a work methodology appropriate to the task.
- Assess one's own level of skill acquisition, and plan their on-going learning goals.

Teaching methods

Lectures, Exercises, Laboratory (Practical work)

Expected student activities

Regularly attending lectures and exercises
Participation in a mandatory laboratory course (block session)
Complete exercises and practical work (computer projects and lab report)
Studying provided and indicated course material

Assessment methods

Written exam (50%)
Exercise assignments (35%)
Laboratory and report (15%)

Supervision

Office hours	Yes
Assistants	Yes
Forum	Yes

Resources

Bibliography

John M. Wallace and Peter V. Hobbs: Atmospheric Science, An Introductory Survey
Ken S. Carslaw (ed.): Aerosols and Climate, link

John H. Seinfeld and Spyros N. Pandis: Atmospheric chemistry and physics: from air pollution to climate change link

Ressources en bibliothèque

- Atmospheric Science / Wallace
- Aerosols and Climate / Ken S. Carslaw (ed.):
- Atmospheric chemistry and physics: from air pollution to climate change / John H. Seinfeld and Spyros N. Pandis

Références suggérées par la bibliothèque

- Atmospheric science / Wallace

Notes/Handbook

See Moodle

Moodle Link

- https://go.epfl.ch/ENV-320

Prerequisite for

Air Pollution (ENV-409)