# ENV-320 Physics and chemistry of the atmosphere

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Cursus	Sem.	Туре	Languago of	Englich
Environmental Sciences and Engineering	BA6	Obl.	teaching	Linglish
HES - SIE	E	Opt.	Credits Session Semester Exam Workload Weeks Hours Lecture Exercises Project Number of positions	5 Summer Spring Written 150h 14 <b>6 weekly</b> 3 weekly 2 weekly 1 weekly

### 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

- 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**

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

### 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)