

ENV-410

**Science of climate change**

Schmale Julia

Cursus	Sem.	Type
Civil & Environmental Engineering		Obl.
Environmental Sciences and Engineering	MA1, MA3	Opt.
Managmt, dur et tech	MA1	Obl.
Minor in Engineering for sustainability	H	Opt.
Territories in transformation and climate minor	H	Opt.
Urban Planning and Territorial Development minor	H	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
<b>Hours</b>	<b>4 weekly</b>
Lecture	2 weekly
Exercises	2 weekly
<b>Number of positions</b>	

**Summary**

The course equips students with a comprehensive scientific understanding of climate change covering a wide range of topics from physical principles, historical climate change, greenhouse gas emissions, the IPCC assessment to future scenarios and climate action.

**Content**

**The basics:** physics and chemistry of the climate system, historical climate change, climate variability, sensitivity, feedbacks

**Climate change assessment:** IPCC review of present-day climate change, tipping elements, extremes, regional climate change

**Scenarios and carbon budget:** climate change scenarios, remaining carbon budget, climate metrics, short-lived climate forcers/pollutants

**Climate action:** mitigation, adaptation and climate engineering

**Keywords**

Climate change, regional climate change, Earth system, IPCC, greenhouse gases, carbon budget, climate scenarios, greenhouse gas emissions

**Learning Prerequisites****Required courses**

none

**Recommended courses**

ENV-320 : Physics and chemistry of the atmosphere

ENV-409 : Air pollution

ENV-407: Atmospheric processes: from cloud to global scale

**Important concepts to start the course**

Basics of physics and chemistry

**Learning Outcomes**

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

- Express the basic physics and chemistry of climate change
- Discuss the concepts of climate variability and climate sensitivity
- Reason why present day climate change is different from historical climate change
- Contrast climate change scenarios
- Apply simple climate metrics
- Interpret basic climate data and model output
- Critique mitigation, adaptation and climate engineering options

### Transversal skills

- Assess one's own level of skill acquisition, and plan their on-going learning goals.
- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Communicate effectively with professionals from other disciplines.
- Give feedback (critique) in an appropriate fashion.
- Summarize an article or a technical report.
- Access and evaluate appropriate sources of information.

### Teaching methods

In-depth teaching. Exercises with educational support. Project work in teams. Discussions.

### Expected student activities

Lecture attendance, exercise assignments, project work, presentations

### Assessment methods

50 % exercises, 50 % exam

### Supervision

Assistants	Yes
Forum	Yes

### Resources

#### Virtual desktop infrastructure (VDI)

No

### Bibliography

Seinfeld, J. H. & Pandis, S. N. *Atmospheric Chemistry and Physics: From Air Pollution to Climate Change*. John Wiley & Sons, New York, 2016.

John M. Wallace and Peter V. Hobbs *Atmospheric Science, An Introductory Survey*, Elsevier, Amsterdam, 2006

Peixoto, José P., *Physics of climate*, New York : American Institute of Physics, 1992

### Ressources en bibliothèque

- [Seinfeld. - Atmospheric Chemistry and Physics BOOK](#)
- [Wallace. - Atmospheric science, an introductory survey BOOK](#)
- [Peixoto. - Physics of climate BOOK](#)

### Notes/Handbook

lecture slides; recordings

### Websites

- <https://www.ipcc.ch/report/ar6/wg1/>
- <https://www.ipcc.ch/sr15/>
- <https://www.ipcc.ch/srocc/>
- <https://gml.noaa.gov/ccgg/trends/>
- <https://www.globalcarbonproject.org/>
- <https://interactive-atlas.ipcc.ch/>

### Moodle Link

- <https://go.epfl.ch/ENV-410>