

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
Hours	4 weekly
Courses	2 weekly
Exercises	1 weekly
Project	1 weekly
Number of positions	

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, carbon offsets, 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

please note that relevant basic material will be made available at the start of the semester for students to work through if they have not taken the recommended classes

Recommended courses

ENV-320 : Physics and chemistry of the atmosphere

ENV-409 : Air pollution

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

Please note that relevant basic material will be made available at the start of the semester for students to work through if they have not taken the recommended classes.

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
- Express the basic physics and chemistry of climate change
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- 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

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

Notes/Handbook

lecture slides; recordings

Websites

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

Moodle Link

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