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**
Lecture	2 weekly
Exercises	2 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, 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