

ENV-410

Science of climate change

Schmale Julia

Cursus	Sem.	Type
Managmt, dur et tech	MA1	Obl.
Minor in Engineering for sustainability	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	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 and sensitivity

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, climate scenarios, climate action

Learning Prerequisites**Required courses**

none

Recommended courses

ENV-320 : Physics and chemistry of the atmosphere

ENV-400 : Air pollution and climate change

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

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,

Krauss, Lawrence M, *The Physics of Climate Change*, London: Head of Zeus, 2021

Ressources en bibliothèque

- [The Physics of Climate Change / Krauss](#)
- [Atmospheric Science / Wallace](#)
- [Atmospheric Chemistry and Physics / Seinfeld](#)
- [Physics of climate / Peixoto](#)

Notes/Handbook

lecture slides

Websites

- [http://5th assessment report of the Intergovernmental Panel on Climate Change: https://www.ipcc.ch/report/ar5/syr/](https://www.ipcc.ch/report/ar5/syr/)
- [http://Special report on Global Warming of 1.5°C by the IPCC: https://www.ipcc.ch/sr15/](https://www.ipcc.ch/sr15/)
- [http://Special report on the Ocean and Cryosphere in a Changing Climate: https://www.ipcc.ch/srocc/](https://www.ipcc.ch/srocc/)

- [http://National Oceanic and Atmospheric Administration, Global Monitoring Laboratory:
https://gml.noaa.gov/ccgg/trends/](http://National%20Oceanic%20and%20Atmospheric%20Administration,%20Global%20Monitoring%20Laboratory:https://gml.noaa.gov/ccgg/trends/)
- [http://Global Carbon Project: https://www.globalcarbonproject.org/](http://Global%20Carbon%20Project:https://www.globalcarbonproject.org/)