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 forcings/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

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/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