



UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Climate Change Mechanism

2627-2-E3304M013-E3304M013-2

Aims

The module provides the basic concepts of the physical properties of the Earth system. It offers the necessary elements to understand and discuss our current climate change, highlighting the relevant processes at play.

O1 - Knowledge and understanding

- Learn the fundamental physical properties of the ocean, the atmosphere and the polar cryosphere.
- Understand the processes that drive the global oceanic and atmospheric circulation.
- Understand the reasons for the current climate change.
- Learn how various processes contribute to climate change.

O2 - Ability to apply knowledge and understanding

- Learn how to critically look at global maps of oceanic and atmospheric properties (e.g. temperature, pressure, velocity).
- Learn how to read IPCC (Intergovernmental Panel on Climate Change) reports.

O3 - Autonomy of judgment

- Know how to conduct a reasoned analysis of climate change phenomena based on the definitions and processes studied.
- Know how to interpret the news about climate change, knowing the main mechanisms that explain it.

O4 - Communication skills

- Know how to illustrate with proper language the meaning of the definitions and processes of climate change science.

O5 - Learning ability

- Be able to apply the skills and concepts acquired to understand real phenomena.

Contents

This module introduces students to the concepts and methods of climate science and climate change science, covering topics that span from the general circulation of the ocean and the atmosphere on our planet, to topics that they encounter in the news, such as the greenhouse effect and global warming. The module exploits basic statistical analysis, ordinary differential equations and simple experiments that highlight the physical mechanisms that characterize climate change.

Detailed program

1. Introduction to thermodynamics and temperature (experiment: thermal agitation)
2. Introduction to electromagnetism and radiative transfer
3. Earth's energy balance and the greenhouse effect: a two-layer model
4. Radiative forcing, logarithmic dependence on carbon dioxide
5. IPCC reports: Equilibrium and Transient Climate Sensitivity (ECS and TCS)
6. Uncertainties in future projections and scenarios
7. Basics of atmospheric physics (experiment: cloud in a bottle)
8. Atmospheric general circulation
9. Fundamental properties of the ocean (experiment: fluid stratification)
10. Ocean general circulation (wind-driven and buoyancy driven circulation)
11. Climate feedbacks (albedo, water vapor, lapse rate, ...) and tipping points
12. Sea level rise (experiment: land/sea ice)

Prerequisites

None.

Teaching form

24 hours in person that include 4 hours of interactive teaching with experiments done by the lecturer.

Textbook and teaching resource

"Global warming science: A quantitative introduction to climate change and its consequences", E. Tziperman, Princeton Press, ISBN: 9780691228792,
<https://press.princeton.edu/books/paperback/9780691228792/global-warming-science>

Slides from the instructors will also be provided, containing additional online resources to support the learning.

Semester

First semester.

Assessment method

There will be no interim evaluation.

The final evaluation consists of a set of 12 multiple-choice questions and 6 open questions that cover the topics of both modules of the course. The exam session will last two hours.

The following parameters will be evaluated:

- Conceptual knowledge and understanding ability;
- Ability to apply knowledge and understanding;
- Communication and argumentative skills.

Office hours

Please contact the instructors.

Sustainable Development Goals

QUALITY EDUCATION | CLIMATE ACTION
