Paleoclimatology, climatology and climate models

Katinka Bellomo
Associate professor
Department of Geosciences, University of Padua
Room: 003-037
E-mail: katinka.bellomo@unipd.it

TEACHING METHODOLOGY

12 CFU/ ECTS (European Credit Transfer System)

PALEOCLIMATOLOGY MODULE => 6 ECTS
(semester start to mid November)
Prof. Claudia Agnini
40 hours (face to face classes)
16 hours work group activities + class laboratory
(Journal club) => group presentation

CLIMATOLOGY AND CLIMATE MODELS => 6 ECTS
(mid November to semester end)
associate professor GEO/12
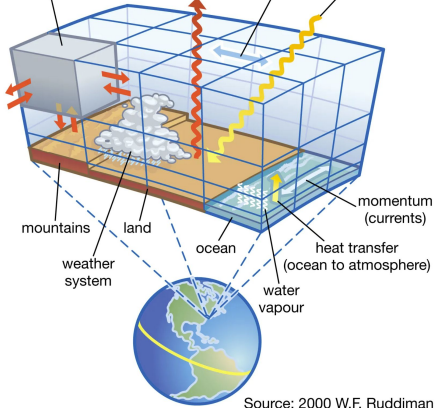48 hours (face to face classes)

About me

- 2005-2010: B.S.+M.S. in Physics from University of Turin (Italy)

- 2010-2015: Ph.D. Meteorology and Physical Oceanography from University of Miami (USA)

- 2015-2018: Postdoctoral research scientist at Columbia University (USA)

- 2018-2019: Data scientist

- 2019-2021: Postdoctoral research scientist at CNR-ISAC (Turin, Italy)

- 2021-2024: Research scientist at Polytechnic of Turin (Italy)

- Since November 2024: Associate professor at University of Padua (Italy)
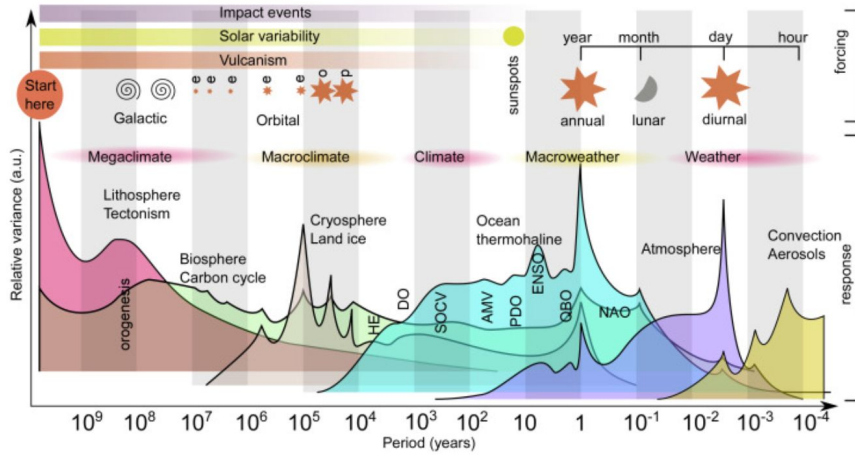
Research interests

Climate modelling

Concept diagram of climate modeling

3-D grid box (CO_2, dust, H_2O)

emitted and reflected radiation

momentum (winds)

incoming solar radiation

momentum (currents)

mountains   land   ocean

heat transfer (ocean to atmosphere)

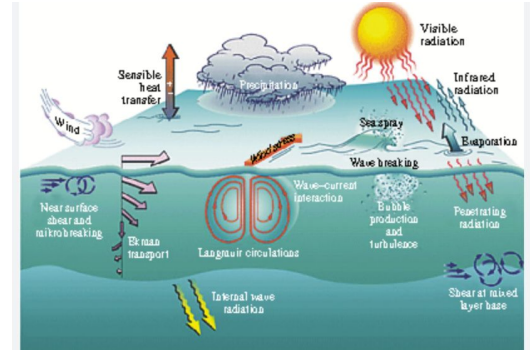weather system

water vapour

Source: 2000 W.F. Ruddiman

Climate variability & change

Atmospheric science & extreme events

Oceanography

Class schedule from Nov. 18th 2024 until Jan. 10th 2025

	Monday	Tuesday	Wednesday	Thursday	Friday
8:30-9:15					Room 1F
9:30-10:15					Room 1F
10:30-11:15				Room 2H	
11:30-12:15				Room 2H	
12:30-13:15					
13:30-14:15				Room 1F	
14:30-15:15				Room 1F	Room 1F
15:30-16:15					Room 1F
16:30-17:15					
17:30-18:15					

**November 29th: room changes: 830-1015 in room 2H; 1430-1615: lab. Paleontologia.
**December 5th: room change. 1330-1515 instead of room 1F, we will meet in room 2H.

EXAM DATES

PALEOCLIMATOLOGY, CLIMATOLOGY AND CLIMATE MODELS		
(L-34 Earth and Climate Dynamics– II Year - I Semester)		
Exam dates A.A. 2024-2025		
Date	Hour	Venue
22/01/2025	h. 9.00	Dip. di Geoscienze (Room TBD)
11/02/2025	h. 9.00	Dip. di Geoscienze (Room TBD)
18/06/2025	h. 9.00	Dip. di Geoscienze (Room TBD)
04/07/2025	h. 9.00	Dip. di Geoscienze (Room TBD)
21/08/2025	h. 9.00	Dip. di Geoscienze (Room TBD)

Exam for "climatology and climate models" module:

1. Written test:
- 2-4 open questions
- multiple choice questions

2. Report (at home) to be delivered on the day of the exam, to choose from:
1. Workshops from lectures/textbook from class lectures (python notebooks).
2. Analysis of dataset on Copernicus climate data store
   (https://cds.climate.copernicus.eu/applications).
3. Analysis of IPCC Atlas (https://interactive-atlas.ipcc.ch/).

Reports: Groups of 2/3 people (sign-up here). Max 3 pages (max 12pt font, 1.5pt spacing), 2-3 figures, PDF.

Final grade: Written test (70%) + Report (30%); "lode/honors" if sum > 30.

Evaluation criteria for written test:

- Multiple choice:
  - 8-10 questions: 1 point if correct, 0 points if not correct, no penalty

- Open questions:
  - 2-4 open questions with points ranging 2 to 8 for each question for a total of 16 (max points assigned for each question will be written clearly on the exam sheet).

  - <u>Evaluation criteria</u>: knowledge of the topic, logic and ability to connect ideas and topics, synthesis ability, correct use of terminology. Writing too much does not always help, strive for correctness and stick to the question.

EVALUATION CRITERIA GRID - OPEN QUESTIONS

Knowledge of the Topics Covered in the Course

Level 1 (Poor): Knowledge of the topics is very limited and incomplete. The student demonstrates a superficial understanding of fundamental concepts.

Level 2 (Adequate): Knowledge of the topics is sufficient but could be improved. The student shows a basic understanding of key concepts.

Level 3 (Good): Knowledge of the topics is solid and comprehensive. The student demonstrates a good understanding of the concepts covered in the course.

Level 4 (Excellent): Knowledge of the topics is exceptional. The student shows a deep and sophisticated understanding of the material.

Understanding of the Topics Covered in the Class

Level 1 (Poor): Understanding of the topics is limited, and the student has difficulty connecting concepts.

Level 2 (Adequate): Understanding of the topics is adequate but could be deepened. The connection between concepts is present but not always clear.

Level 3 (Good): Understanding of the topics is solid, and the student can connect concepts clearly.

Level 4 (Excellent): Understanding of the topics is exceptional, and the student demonstrates an advanced ability to critically and thoroughly connect concepts.

Criticism and Link Capability on the Knowledge Acquired During the Course

Level 1 (Poor): The ability to criticize and link information is poor or absent.

Level 2 (Adequate): The ability to criticize is present but could be further developed. The linking of information is sufficient.

Level 3 (Good): The ability to criticize is good, and the student can effectively link the information acquired during the course.

Level 4 (Excellent): The ability to criticize is exceptional. The student demonstrates deep reflection and an advanced ability to link acquired knowledge innovatively.

Synthesis Ability

Level 1 (Poor): Synthesis ability is limited or absent.

Level 2 (Adequate): Synthesis ability is present but could be further developed. The presentation of information is basic.

Level 3 (Good): Synthesis ability is good, and the student can present information clearly in a synthesized manner.

Level 4 (Excellent): Synthesis ability is exceptional. The student demonstrates an advanced ability to integrate and present information clearly and concisely.

Proper Terminology

Level 1 (Poor): The use of terminology is imprecise or inappropriate.

Level 2 (Adequate): The use of terminology is adequate but could be improved in some cases.

Level 3 (Good): The use of terminology is good, and the student demonstrates an appropriate mastery of the specific language of the course.

Level 4 (Excellent): The use of terminology is excellent. The student demonstrates an advanced and accurate mastery of the terminology related to the course.

Evaluation criteria for report:

- Ability to pose a research question and address it using the online tools that will be explained during class

- Proper use of terminology, units, and correct interpretation of maps/graphs

- Understanding of the physical variables and their role in the climate system

AIM OF THE COURSE

Understanding of the physical components of the climate system, their interactions and their change through the historical past, present and future climate. Practical application of concepts learned through hands-on activities using Google Colab and python to analyze data.

Prerequisites, textbook and study material

Prerequisites: basic knowledge of maths, physics and computers

Textbook and study material:

- D. Hartmann: Global physical climatology
- E. Tziperman: Global warming science
- Lecture PDFs (STEM moodle)
- Class notes
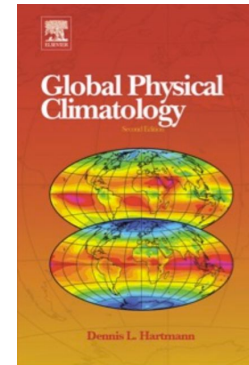
Google Colab

Start familiarizing with Google Colab and Python notebooks

Important:

- Create and use a Google account (if you already have one, you can use it, but if you prefer you can create one just for this class).

- Download the files provided in the "Notebooks" folder on a Google Drive folder called "Colab".

- Try open and interact with the *.ipynb* files with Google Colab (open with: "google colaboratory".

- Find out what *.pickle* files are.

Online resources: same as the paleoclimatology module

E-learning – moodle STEM

https://stem.elearning.unipd.it/

FURTHER INFO: SYLLABUS

https://en.didattica.unipd.it/off/2023/LT/SC/SC2736/000ZZ/SCQ3102458/N0