UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Earth System Models in Climate Change Science

2122-1-F7401Q116

Aims

The aim of the course is to enable students to gain a basic knowledge of the climate system and its representation in numerical Earth System Models (ESMs), as a fundamental tool in the framework of climate change studies.

For all students, this course will provide basic knowledge on climate change, and it will allow them to communicate with experts in climate modeling, and make sense of climate model data that may constitute the inputs / starting point of their future work, for instance on the impacts of climate changes.

For those who are interested in pursuing modelling climate or other aspects of the physical world, this course could be good starting point, and should be complementary to more focused courses.

Contents

- The climate system and climate change
- Theoretical bases of numerical climate prediction
- Applications with the WRF regional climate model

Detailed program

During the frontal lessons there will be a review of the main aspects of physical climatology (such as the energy budget of the Earth, the general circulation of the atmosphere and the oceans, the concept of feedbacks in the climate system, etc.), and a presentation of some background information on the physical bases of climate change, as well as impacts, adaptation and vulnerability in the context of the IPCC workflow.

Part of the lab will be devoted to the acquisition of the theoretical bases of numerical climate prediction, focusing on numerical integration and on the representation of the dynamical aspects and physical parameterizations of ESMs.

The practical sessions of the lab will build up from scratch, guiding the students toward the acquisition of software tools necessary to set up and perform climate simulations, in this case with the regional WRF model. General tools will be first introduced: Unix shell, Fortran, very simple data handling and visualization tools (nco, ncview, etc.). Simple Fortran programs will be used / produced to test some of the basic concepts described in the theory. Finally, the students will learn how to set up and run simple simulations with WRF, and acquire very basic knowledge on how to visualize and discuss the output of model simulations.

During the last practical sessions the students will have the opportunity to start working, with the teacher's assistance, on individual projects using the WRF model; those will contribute to 50% of the final evaluation.

All practical sessions will be hosted on virtual machines accessible through individual authentication with personal UNIMIB credentials (also from students' private computers), for a limited number of hours, including those deemed necessary to complete the individual projects.

Prerequisites

Physical Geography.

Teaching form

Frontal lessons and practical laboratory sessions. Adaptable from teaching in presence (if the sanitary conditions allow) to fully in remote with space for live online interactions, and a course forum for discussion. The detailed schedule of synchronous ("live") sessions on Webex will be made clear in due time, with long enough notice. Lessons and teaching material are in English.

Textbook and teaching resource

Teacher slides and links to scientific papers and webpages, distributed via elearning.

Books available through the university library:

· Numerical Weather and Climate Prediction, T.T. Warner, Cambridge University Press, 2011 (also in eBook format).

· An introduction to three-dimensional climate modelling, W.M. Washington and C.L. Parkinson, University Science Book, 2005.

- A climate modelling primer, K. McGuffie and A. Henderson-Sellers, Wiley Blackwell, 2014.

Semester

1st semester.

Assessment method

Oral exam: 50% presentation and discussion of a final individual project, 50% theory and topics discussed during the course.

Office hours

By appointment.