lphys2267

2019

Paleoclimate dynamics and modelling

In view of the health context linked to the spread of the coronavirus, the methods of organisation and evaluation of the learning units could be adapted in different situations; these possible new methods have been - or will be - communicated by the teachers to the students.

5 credits	22.5 h + 7.5 h	Q2

Teacher(s)	Yin Qiuzhen ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	Changes of the Earth's climate from geological past to present and future ; approaches to reconstruct and understand past climate changes, including climate variables like temperature, precipitation, ice volume, sea level, CO_2 concentration and vegetation ; key climate forcings and causes of climate changes on different time scales ; major paleoclimate theories and hypotheses ; response of the major climate components (ice, ocean, land, atmosphere, vegetation) as well as their interactions and feedbacks under natural and anthropogenic forcings ; contribution of understanding paleoclimates to climate projection.
Aims	**a. Contribution of the teaching unit to the learning outcomes of the programme (PHYS2MA and PHYS2M1)** 1.1, 1.2, 1.3, 1.5, 1.6 2.1, 2.3, 2.5 4.2 5.1, 5.2, 5.3, 5.4 6.1, 6.2, 6.3, 6.5 7.1, 7.2, 7.3, 7.4, 7.5, 7.6 8.1 **b. Specific learning outcomes of the teaching unit** At the end of this teaching unit, the student will be able to : 1. describe the major variations of the Earth's climate on different time scales, and explain their differences ; 2. discuss how to reconstruct paleoclimates from proxy records and their uncertainties ; 3. discuss the hypotheses and theories which are proposed to explain paleoclimate variations and raise questions ; 4. choose appropriate climate models for answering different questions in climate and paleoclimate research ; 5. design climate modelling experiments and analyze and criticize model outputs for a given climate question ; 6. validate modelling results with paleoclimate data ; 7. assess present and future climate changes in the framework of long-term variations of the Earth's climate, and compare them with past warm climate conditions ; 8. use paleoclimate information to improve climate projections ; 9. deepen knowledge of paleoclimate by using scientific literature 1 - - - - *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** Written exams : question answering at class or for homework. Individual oral examination at the end of the course. Project report.

Teaching methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** Lectures. Articles to read. Class and homework exercises. Modelling exercise through computer simulation sessions. Integrative project.
Content	1. 1. A brief overview of the climate system (time scales of the Earth's climate changes, forcings, responses, feedbacks) 2. Paleoclimate archives, proxy data, chronology and models 3. Tectonic-timescale climate changes 4. Astronomical-timescale climate changes (glacial-interglacial cycles) 5. Millennial-scale oscillations, abrupt climate changes and tipping points 6. Climate changes during the last millennium and the last century 7. Climate changes and human society in ancient and modern times 8. Understanding paleoclimate for better climate projections
Bibliography	Ruddiman W.F., 2013. Earth's and Climate: Past and Future. Third edition. W.H. Freeman, New York, 464pp. Bradley R.S., 1999. Paleoclimatology: Reconstructing climates of the Quaternary. Second edition. Harcourt/Academic Press, Burlington, 613pp. Berger A., 1992. Le Climat de la Terre, un passé pour quel avenir. De Boeck Université, Bruxelles, 479pp. Ramstein G. 2015. Voyage à travers les climats de la Terre. Odile Jacob, Paris, 351pp.
Faculty or entity in charge	PHYS

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Chemistry and Bioindustries	BIRC2M	5		
Master [60] in Physics	PHYS2M1	5		
Master [120] in Agricultural Bioengineering	BIRA2M	4		
Master [120] in Environmental Bioengineering	BIRE2M	5		
Master [120] in Geography : Climatology	CLIM2M	5		
Master [120] in Forests and Natural Areas Engineering	BIRF2M	5		
Master [120] in Physics	PHYS2M	5		