UCLouvain

lphys2267

2021

Paleoclimate dynamics and modelling

5.00 credits	22.5 h + 7.5 h	Q2

Teacher(s)	Yin Qiuzhen ;
Language :	English
Place of the course	Louvain-la-Neuve
Prerequisites	This course assumes that the students have acquired the basic knowledge on the dynamics of the climate system and its modelling as covered for example by LPHYS2162 and LPHYS2163.
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.
Learning outcomes	**At the end of this learning unit, the student is able to :** **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. tell how to reconstruct paleoclimates from proxy records and their uncertainties ; 3. discuss about 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. know how to use paleoclimate information to improve climate projections ; 9. deepen knowledge of paleoclimate by using scientific literature
Evaluation methods	The students are evaluated based on three parts: - Oral exam at the end of the course (60% of the final score). * Student who attends less than 80% of the course can not register for the exam. - Written homework (25% of the final score) - Group project and its oral presentation (15% of the final score)
Teaching methods	Lectures in class. Articles to read. Class and homework exercises. 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	Learning outcomes
Master [120] in Geography : Climatology	CLIM2M	5		
Master [120] in Physics	PHYS2M	5		
Master [120] in Chemistry and Bioindustries	BIRC2M	5		
Master [60] in Physics	PHYS2M1	5		