UCLouvain

lphys2268

2022

Forecast, prediction and projection in climate science

5.00 credits	22.5 h + 7.5 h	Q2

Teacher(s)	Massonnet François ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	Having followed LPHYS2162 and LPHYS2163 is an asset
Main themes	Mechanisms of climate fluctuations from sub-seasonal to millennial time scales ; weather vs climate predictability ; sources of climate predictability ; modes of weather and climate variability, oscillations, extreme events ; approaches used to generate climate predictions ; data assimilation ; verification of predictions ; bias correction ; climate model ensembles ; processing and interpretation of climate predictions.
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)** AA1: AA1.1, AA1.5 AA2: AA2.3, AA2.4 AA3: AA3.3, AA3.4 AA4: AA4.1 AA5: AA5.1, AA5.2 AA6: AA6.1, AA6.3 AA7: AA7.5, AA7.6 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 main sources of predictability in the climate system and detail the underlying physical mechanisms ; 2. assess the skill of sub-annual to decadal climate forecasts based on available information (forecasts and observational references) ; 3. develop simple bias-correction techniques to calibrate ensembles of climate forecasts ; 4. apply the concepts of data assimilation in a simple framework (toy climate model) to different problems, including state and parameter estimation ; 5. describe the hierarchy of models used to generate climate predictions and argue about their limitations.
Evaluation methods	Written presentation (report) of a group project. Individual oral examination based on a group project, aiming at verifying that the student masters the theoretical concepts addressed in the course. A part of the final mark will be based on the written report. This part of the mark will be used for each session and cannot be updated. In case of sanitary crisis, the means of evaluation will possibly be revised during the semester and will be communicated to the students.
Teaching methods	Lectures (slides available from MoodleUCL) Integrative project. Practical computer sessions. List of articles to read.
Content	1. Predictability of weather and climate : physical drivers 2. Sources of uncertainty in climate predictions and projections 3. Modes of weather and climate variability from day to decades 4. Climatic extreme events 5. Approaches to climate prediction and projection 6. Verification of climate predictions and projections 7. Data assimilation, state estimation, parameter estimation 8. Interpretation of model ensembles, post-processing, constraints

Bibliography	Jolliffe, I. T., and David B. Stephenson. Forecast verification : a practitioner's guide in atmospheric science. Chichester, West Sussex, Eng. Hoboken, N.J: J. Wiley, 2003. Kalnay, Eugenia. Atmospheric Modeling, Data Assimilation and Predictability. Cambridge: Cambridge University Press, 2002. Palmer, Tim, and Renate Hagedorn. Predictability of weather and climate. Cambridge New York: Cambridge University Press, 2006.
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 [60] in Physics	PHYS2M1	5		
Master [120] in Physics	PHYS2M	5		