Land Management, Environment and Safety

Ca' Foscari Challenge School

Università Ca'Foscari Venezia

CLIMATE CHANGE SCIENCE AND MANAGEMENT

LEVEL II – EDITION ONE

A.Y. 2018-2019

Presentation

Climate change is one of the main challenges facing the planet's population. Its impacts affect most of its geographical areas, all of its main production sectors and all aspects of social organisation forming the basis for civil cohabitation within a country and between countries. It is therefore important to know how to predict changes in the climate, assess their impact, manage their consequences and plan preventive measures. The Master's Programme provides the scientific competencies necessary to understand the mechanisms guiding climate and economic changes and assess the importance and, most importantly, the costs and benefits of the measures to be taken.

Objectives

The Master's provides students with:

- methodological and analytical tools, statistical and econometric techniques, modelling and forecasting skills
- techniques for the scientific assessment of climate changes and their impacts
- economic assessment methods to quantify the costs and benefits of climate change impacts and the strategies to control them
- tools to programme and manage mitigation and adaptation strategies

Didactic activities

MODULE 1

Introduction to climate dynamics

The module will offer an introduction to the concepts of climate, climate systems and climate change and the underlying dynamics and thermodynamics. The objective is to provide students with a common knowledge basis on climate, climate dynamics and climate change. The module will introduce the fundamental physical principles to understand how climate works and will explain the physics of climate change. Current and future climate change will be quantitatively documented.

MODULE 2

Mathematical methods for climate change analysis

The objective of the module is to provide students with an understanding of dynamic systems, starting with some preliminary concepts (linear algebra, eigenvalues, complex numbers, etc.). It will then introduce mathematical instruments for dynamic systems, in particular, finite difference equations (FDE), differential equations (DE) and FDE and DE systems, with a focus on the linear case, stability analysis and the non-linear case, as well as elements of bifurcation and chaos. Examples and suggestions of possible applications to environmental problems will be proposed.

MODULE 3

Statistical methods for climate change analysis

The objective of the module is to provide students with a practical understanding of statistical instruments useful in climate change studies. It will discuss and illustrate several important statistical methods through the use of case studies. Students will learn how to specify, fit and interpret a variety of statistical models and how to use them to answer scientific questions about the climate. Hands-on sessions with R statistical software will be an integral part of the module.

MODULE 4

Climate change economics: theory, methods and applications

The objective of the module is to introduce students to the concept of climate change economics, starting from the foundations of environmental economics. Students will understand the specific features of the climate change problem. They will learn about the concepts of market failures and environmental externalities. Students will understand how to use policy instruments for global externalities such as climate change. Each lesson will combine a classroom lecture with in-class activities (hands-on sessions, student presentations).

MODULE 5

Climate of the past

The objective of the module is to introduce students to climate studies, including the origins of the solar system, time scales, and climate in human history. Students will learn about 1) methods for detecting climate change, including proxies, ice cores, instrumental records, and time series analysis, 2) physical and chemical processes in climate, including the primordial atmosphere, ozone chemistry, carbon and oxygen cycles, and heat and water budgets, 3) internal feedback mechanisms, including ice, aerosols, water vapor, clouds, and ocean circulation, 4) climate forcing, including orbital variations, volcanism, plate tectonics, and solar variability, 5) climate models and mechanisms of variability, including energy balance, coupled models, and global ocean and atmosphere models.

MODULE 6

Methods and tools for the analysis of climate change impacts and policies

The objective of the module is to provide students with a theoretical and practical understanding of methods and tools to estimate climate change risk and assess the economic benefits of climate adaptation. It also introduces students to the analysis of climate policies and management of risks deriving from climate change and variability.

MODULE 7

Decision theory and multi-criteria analysis

The objective of the module is to provide students with the methodological basis of Decision Theory with uncertainty and under certainty conditions. The module will focus on methods as well as applications. These include Utility Theory, Decision Tree, Group Decision, Weighted Averaging, Ordered Weighted Averaging. Students will learn how to understand, specify and describe a number of problems in this field and implement a resolution strategy. The module will also cover methods for optimization problems, in particular the Linear Programming approach and some extensions.

MODULE 8

Socio-economic impacts of climate change and adaptation strategies

The module will provide students with an overview of the approaches used to study the socio-economic impacts of climate change and the adaptation responses. The first part of the module will focus on four different topics emphasizing in particular the related modelling aspects: discounting, impact assessment, mitigation and adaptation policy assessments. The second part of the module will focus on a particular category of economic models, Computable General Equilibrium (CGE)

models. Students will learn the theoretical foundations of these models and how to apply them to analyze the socio-economic impacts of climate change.

MODULE 9

Adaptive management of natural resources and agricultural systems

The objective of the module is to introduce students to the principles of natural resources management and the challenges of designing and implementing operational approaches in the real, changing world. The focus is on the interactions between the natural and human components within socio-ecosystems, with a focus on agro-ecosystems. The notions of sustainability and sustainable development are a common inspiration of the module. Spatial and temporal dynamics are explored with concrete examples and case studies, with a common approach based upon system dynamics techniques and geographical information systems. Each lesson will combine a classroom lecture with in-class activities (e.g. team work on selected case studies).

MODULE 10

Climate change policies – negotiations, implementation and assessment I & II

The objective of the module is to introduce students to the use of 1) econometric methods to evaluate historical environmental and climate policies, with an empirical focus on their impacts on innovation and employment and 2) ex-ante modeling tools and scenario approaches to evaluate and design future climate policies. Students will learn about the problem of climate change as an economic problem as well as the process of international negotiations on climate change. They will learn how to evaluate the socio-economic implications of mitigation and adaptation policies and how to apply economic methods to analyze and design innovative climate policy solutions.

Duration and summary of didactic activities and university credits (CFU)

The Master's lasts for **one year** with **400 hours of didactic activities**. A **250 hour internship** forms an integral part of the course and represents an excellent opportunity to enter the workplace. However, for students already working professionally in the sector, the internship is optional and may be replaced by targeted **project work**.

Including individual study and preparation of a final thesis, the course requires an overall commitment of **2,250 hours**, for a total of **90 CFU.**

Qualification issued

Students attending the didactic activities, completing the internship and passing the intermediate verifications and final examination will be awarded a 2nd Level Master's in Climate Change Science and Management.

Course period

September 2018 > September 2019

Teaching method

Classroom lectures

Language

ENGLISH

Attendance

Attendance will be monitored by signing a register. Regular attendance in the classroom is obligatory to passing the individual modules. Absences must not in any case exceed 20% of teaching hours for each individual module. Credits are assigned with completion of the individual modules and internship/project work activities and passing of the final examination. Students employed in a professional activity coherent with the Master's course may ask for this to be recognised in calculating the credits allocated to internship and work placement activities.

Course location

Ca' Foscari Challenge School - Venezia Marghera (VEGA Venice Scientific Technological Park - Porta dell'Innovazione Building) / San Giobbe Campus

Admission requirements

SECOND LEVEL

/ To enrol on the Master's, candidates must be in possession of at least a second cycle, specialisation or pre-reform (Italian Ministerial Decree no. 509/99) degree in a scientific or economic subject

/ On the discretion of the Master's Board of Professors, candidates with other degrees, or foreign qualifications, may be considered on the basis of their previous education and training and in respect of current legislation

/ Equivalent foreign university qualification, following approval from the Teachers' Board
/ English language to at least level B2

Admission application

Candidates must fill in the online admission application, the details of which are defined under **article 3 of the University's Call for Applications**. Only applications accompanied by all the required documentation will be considered. The Call for Applications and relative attachments can be downloaded from the Master's web profile.

Selection procedure

A specific Board will assess candidates based on their CVs, qualifications submitted and a face-to-face interview (the date, time and place will be communicated by email with sufficient advance notice; on motivated request, the interview may take place by video-conference).
The oral admission test, in English, will aim to ascertain the candidate's motivations, but also to verify the competencies already acquired in subjects necessary for quantitative analysis and mathematical and statistical modelling, as well as the candidate's ability to express themselves in English.
The main factors considered for the purposes of selection will be: qualifications, motivation, relational skills, relevant former educational and professional experiences and a willingness to respect the necessary attendance requirements.

Graduate eligibility

Students about to graduate may also be admitted to the course, provided they qualify within one month from the start of the course. In this case, enrolment on the Master's may be finalised only after the valid qualification for admission has been awarded.
Candidates without a degree may enrol as auditors and will be awarded a certificate of attendance.

Available places

/ Maximum number of available places: **15**
/ The Master's course will only be activated if at least **5** students have enrolled

Course fees: € 6.000

/ 1st instalment by **30/08/2018**: € 3.016 (including € 16 stamp duty)*
/ 2nd instalment by **10/01/2019**: € 3.000
** Stamp duty is not refundable.*

Study support

Loans are available from the University's partner banks (for more information: http://www.unive.it/pag/8560/).

Enrolment

ADMISSION APPLICATION SUBMISSION (online procedure, Call for Applications, art. 3)
by 15 July 2018
SELECTION RESULT ANNOUNCEMENT
by 6 August 2018
ENROLMENT COMPLETION (online procedure, Call for Applications, art. 6)
by 30 August 2018
Start of course: September 2018

Course director

Prof. Enrica De Cian

For information

/ on **enrolment procedures**, contact the Ca' Foscari Challenge School Administration Office:
Tel: (+39) 041-2346853
e-mail master.challengeschool@unive.it

/ on **didactic activities**, **internships** and the **calendar** of lessons, contact:
e-mail phd-climate-change@unive.it