



## IDENTIFYING DATA

### Climate Models

Subject	Climate Models			
Code	V10M153V01205			
Study programme	(*)Máster Universitario en Oceanografía			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Optional	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	Gómez Gesteira, Ramón			
Lecturers	Costoya Noguero, Jorge Gómez Gesteira, Ramón			
E-mail	mggesteira@uvigo.es			
Web	<a href="http://masteroceanografia.com/">http://masteroceanografia.com/</a>			
General description	Climate models course will deal about the different types of models that are used for the study of the climate as well as its evolution over the years. You will see different models and their output files in order to learn how to treat and analyze their results. Finally, we will know the climatic models, their function and their main characteristics.			

### Skills

Code	
A1	Students who have demonstrated knowledge and understanding that is founded upon and extends and/or enhances that typically associated with the first cycle, and that provides a basis or opportunity for originality in developing and/or applying ideas, often within a research context
A5	Students who have the learning skills to allow them to continue to study in a manner that may be largely self-directed or autonomous.
B2	The students will interpret the behaviour of the global oceanic system and their controlling factors.
B5	The students will be able to develop the sufficient autonomy to participate in research projects and scientific collaborations, especially in interdisciplinary contexts
C3	The students will analyse situations and specific oceanographic conditions related with the global change
C7	The students will obtain knowledge that will allow them reinforce and deepen in the physical mechanisms that control the atmosphere-ocean interactions, the climatic variability, as well as the validity and contrast of climatic models.
D2	The students will possess the handle skills in the laboratory that allow them to develop autonomous work.
D4	The students will be able to understand the need and obligation to perform a continuous training, to a large extent autonomous, for the scientific development, updating the knowledges, skills and attitudes of the professional competences along the life.

### Learning outcomes

Expected results from this subject	Training and Learning Results
RA1. Knowledge of the evolution of climate models both in space-time and in their complexity of simulation of the different climate processes	A5 B2 C3 C7 D4
RA2. Develop skills to validate a climate model and to enter necessary modifications when discrepancies between the predictions of the model and the observations are observed. Knowledge and analysis of climate models from a global and regional point of view.	C3 D2 D4
RA3. Develop skills and skills in the exhibition of the results obtained to a skilled audience.	A1 A5 B5 D4

<b>Contents</b>	
Topic	
Numerical Models and Climatic System	Introduction to Numerical Models Introduction to the climatic system. Climatic data. Radiative Balance Continental distribution and topography Atmosphere Continents Ocean Cryosphere Variability Forcings
History and introduction to the climatic models	Introduction to the modelling. Types of models. History of the models for the study of the climate. Sensitivity of the climatic models. Parametrisation of the climatic processes.
Models of balance of energy	Energy Budget Structure of the models of balance of energy. Parametrisations. Models of Box. Models of balance of energy.
Radiative-convective models	Structure of the radiative-convective model. Calculation of the radiation and convective adjust . Development of the radiative-convective model
Two-dimensional models	Main characteristics of the two-dimensional models. Comparison between two-dimensional and three-dimensional models. Climatic models of intermediate Complexity
Climatic models of general circulation	Structure of the climatic models of general circulation. Climatic models of general circulation in cartesian grid. Spectral climatic models of general circulation. Parametrisations. Models joined up ocean-atmosphere.
Practical examples	Examples of simple models. Examples of models of intermediate complexity. Examples of models of general circulation.

## Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	28	56
Problem solving	14	28	42
Presentation	4	12	16
Seminars	1	0	1
Problem and/or exercise solving	2	0	2
Essay	1	7	8

\*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

## Methodologies

	Description
Lecturing	The teacher explains the theoretical concepts of the different subjects of the course using powerpoint.
Problem solving	Seminars in which the student solve practical cases supervised by the teacher. They are activities developed to improve the significant construction of the knowledge through the interaction between students. The aim of the teacher is to present the aims, to orient students and to realize the follow-up of the procedure to carry out the practical activity.
Presentation	Individual or group oral session of a subject from the course. The teacher presents the aims, orients and supervises the oral presentation.
Seminars	Significant construction of the knowledge through the interaction between the teacher and the student by means of sessions of personalized supervision or in group very reduced, where the teacher orients and resolves doubts.

## Personalized assistance

### Methodologies Description

Problem solving	The function of the professor is to present the aims, orient the work and realises the follow-up of the same.
Seminars	By means of sessions of tutorials personalised or in groups very reduced, the professor will orient and will resolve the doubts.

### Assessment

Description	Qualification	Training and Learning Results			
		A1	B2	C3	D2
Problem and/or exercise solving	40	A5	B5	C7	
Essay	60	A1	B2	C3	D2
		A5	B5	C7	D4

### Other comments on the Evaluation

Class attendance is mandatory especially to the seminars.

The students that cannot attend the course must justify it properly. The evaluation will be carried out by means of alternative activities proposed by the teacher.

Tutorials: Online through Remote Campus by appointment

#### Examinations:

March 14, 2022, 10- 12 h

July 8, 2022, 12- 14 h.

The dates of the evaluation tests can be seen in: <http://masteroceanografia.com/horarios/>

Changes in the dates of examinations approved officially will be published in the board of announcements and in the web of the Centre.

### Sources of information

#### Basic Bibliography

Hartman, D. L., **Global Physical Climatology**, 1999

Henderson-Sellers, A. and K. Mc Guffie, **ntroducción a los Modelos Climáticos**, Omega, 1990

Kendal McGuffie, Ann Henderson-Sellers, **A Climate Modelling Primer**, Wiley-Blackwell, 2014

#### Complementary Bibliography

Berger, A. L. and C. Nicolis, **New Perspectives in Climate Modeling. Developments in Atmospheric Science 16.**, Elsevier Science, 1984

Daley, R, **Atmospheric Data Analysis**, Cambridge Atmospheric and Space Science Series, 1993

Houghton, J. T., et al., **Climate Change 2001:**, The Scientific Basis. Cambridge University Press,,

Lozán, J. L., Grassl H., Hupfer P., **Climate of the 21st Century: Changes and Risks**, Scientific Facts. Wissenschaftliche Auswertungen,, 2001

Randall, D. A., **General Circulation Model Development. Past, Present and Future.**, Academic Press, 2001

Trenberth, Kevin, **Climate System Modeling**, Cambridge University Press, 1992

### Recommendations

#### Subjects that are recommended to be taken simultaneously

Global Change and Marine Ecosystems/V10M153V01208

Atmosphere-Ocean Interaction/V10M153V01207

#### Subjects that it is recommended to have taken before

Modelling in Coastal Systems/V10M153V01209

Physical Oceanography/V10M153V01CF101

### Other comments

Students willing so could attend personal tutorials to solve doubts and/or uncertainties. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation. Students are strongly requested to fulfil honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole academic year. An internal dossier

of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record

---

## **Contingency plan**

---

### **Description**

---

=== EXCEPTIONAL MEASURES SCHEDULED ===

In front of the uncertain and unpredictable evolution of the sanitary alert caused by the COVID-19, the University of Vigo establishes extraordinary planning that will activate at the moment in that the administrations and the own institution determine it attending to criteria of security, health, and responsibility, and guaranteeing the teaching in a no face-to-face stage or partially face-to-face. These already scheduled measures guarantee, at the moment that was prescriptive, the development of the teaching of a more agile and effective way when being known in advance (or with a wide \*antelación) by the students and the professorate through the tool normalized and institutionalized of the educational guides.

=== ADAPTATION OF THE METHODOLOGIES ===

\* educational Methodologies that keep

We will keep the use of MOOVI platform to upload all information necessary to reach the main objectives of the subject

Presentations

Problem-solving

Seminars

\* educational Methodologies that modify

All methodologies will be on-line through Remote Campus, Zoom, Teams, or similar platforms.

\* Mechanism no face-to-face attention to the students (tutoring)

Tutorial classes will be virtual through Remote Campus with previous appointment

\* Modifications (if they proceed) of the contents to give

There will be no modifications

\* additional Bibliography to facilitate the car-learning

It will be no necessary additional bibliography

\* Other modifications

=== ADAPTATION OF THE EVALUATION ===

\* Test already made

Tests already made will keep their weight

\* Test slopes that keep

Pending tests also will keep their weight

\* Test that they modify

[Face-to-Face tests] => [Online tests through Moovi, Campus Remoto, Teams, Zoom].]

\* New proofs

There will be new tests

\* additional Information

---