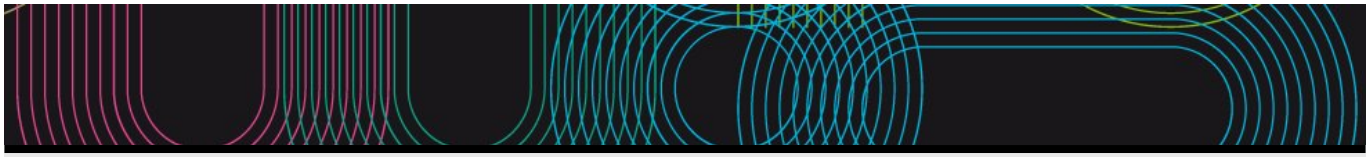

IDENTIFYING DATA				
Climate Models				
Subject	Climate Models			
Code	V10M153V01205			
Study programme	(*)Máster Universitario en Oceanografía			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Optional	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	Lorenzo Gonzalez, Maria de las Nieves			
Lecturers	Cabrera Crespo, Alejandro Jacobo de la Torre Ramos, Laura Gómez Gesteira, Ramón Lorenzo Gonzalez, Maria de las Nieves Santos González, Francisco José			
E-mail	nlorenzo@uvigo.es			
Web	http://masteroceanografia.com/			
General description				

Competencies	
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 interdiscipinary 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
Knowledge and deepening of advanced mathematical and numerical methods used in climate simulation models.	A1 A5
Knowledge of the evolution of climate models both in space and time.	B2
Knowledge of the complexity of the simulation of the different climatic processes.	B5
Ability to validate a climate model and make the necessary changes when discrepancies are observed between model predictions and observations.	C3 C7
Ability to analyze the observed change models and the expected developments of future climate under different scenarios.	D2 D4
Knowledge and analysis of climate models from a global and regional perspective.	

Contents
Topic

Climate	Components of the climatic system. Modelling and climatic prediction. Changes in the climate. Mechanisms of feedback. Perturbations in the climatic system.
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
Master Session	28	28	56
Troubleshooting and / or exercises	14	28	42
Presentations / exhibitions	4	12	16
Group tutoring	1	0	1
Short answer tests	2	0	2
Jobs and projects	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
Master Session	It consists in the exhibition of contents by part of the professor, analysis of competitions, explanation and demonstration of capacities, skills and knowledges in the classroom, using like methodology the participatory masterclass and in which the function of the professor is to explain the theoretical foundations of the distinct matters.
Troubleshooting and / or exercises	Work session for the resolution of problems, in the laboratory or classroom of computing, supervised by the professor. Significant construction of the knowledge through the interaction and activity of the student. They are activities developed in spaces and with skilled equipment that improve the significant construction of the knowledge through the interaction and activity of the student. They realise in laboratory and the function of the professor is to present the aims, orient the work and realises the follow-up of the same.
Presentations / exhibitions	Realisation and/or individual exhibition or in group on a subject of the subject with participation shared. The professor presents the aims, orients and supervise the work, with participation shared with the students. This methodology carries implicit a load of work no face-to-face significantly upper to the activities signalled previously, that will have to be quantified in the programming of each subject, matter or module.
Group tutoring	Significant construction of the knowledge through the interaction between tutor and student by means of sessions of personalized supervision or in group very reduced, where the professor orients and resolves doubts.

Personalized attention

Methodologies	Description
Troubleshooting and / or exercises	The function of the professor is to present the aims, orient the work and realises the follow-up of the same.
Group tutoring	By means of sessions of tutoríals personalised or in groups very reduced, the professor will orient and will resolve the doubts.

Assessment

	Description	Qualification	Training and Learning Results			
Short answer tests	Questions on the lessons	40	A1 A5	B2 B5	C3 C7	
Jobs and projects	It will value the work and the progress of the student during the classes and the practices. As well as the realisation and presentation of the memories and works that ask by part of the professors.	60	A1 A5	B2 B5	C3 C7	D2 D4

Other comments on the Evaluation

Class attandance is mandatory especially to the seminars. The students that by justified cause can not assist to classes have to justify it properly.

The evaluation will be realised with complementary works that will propose or/to professor according to the case.
Tutorials:Monday: 16:00- 18:00Tuesday: 16:00- 18:00

Sources of information

New Perspectives in Climate Modeling. Developments in Atmospheric Science 16., Berger, A. L. and C. Nicolis,
Daley, R, **Atmospheric Data Analysis**, Cambridge Atmospheric and Space Science Series,
Hartman, D. L., **Global Physical Climatology**, Global Physical Climatology,
Henderson-Sellers, A. and K. Mc Guffie, **ntroducción a los Modelos Climáticos**, Omega,
Climate Change 2001:, Houghton, J. T., et al.,
Climate of the 21st Centuty: Changes and Risks, Lozán, J. L., H. GraВl,
General Circulation Model Development. Past, Present and Future., Randall, D. A.,
Climate System Modeling, Trenberth, Kevin,

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