



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 Domínguez Alonso, José Manuel Fernández Nóvoa, Diego Gómez Gesteira, Ramón			
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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.			

Training and Learning Results

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.
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
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.

Expected results from this subject

Expected results from this subject	Training and Learning Results
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

Contents

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	27	28	55
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
Objective questions exam	1	0	1

*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			
Problem and/or exercise solving	It will value the work and the progress of the student during the kinds and the practical.	40	A1 A5	B5	C3	
Essay	It will evaluate the result of the learning AR2 It will evaluate the realization and presentation of the memories and works that ask by part of the professors.	40	A1 A5	B5	C3	D2 D4
Objective questions exam	It will evaluate the result of the learning AR3 Short questionnaires about the content of the subject.	20			C3	

Other comments on the Evaluation

The preferred assessment method is Continuous Evaluation. Students who wish to take the Global Evaluation (100% of the grade based on the official exam) must inform the course instructor, via email or through the Moovi platform, within one month from the start of the course.

Attendance to lectures, especially seminars, is mandatory.

Students who are unable to attend classes due to justified reasons must provide appropriate justification. Evaluation will be conducted through complementary assignments proposed by the professor, depending on the circumstances.

Online tutoring sessions will be available through the virtual office of each professor on Campus Remoto, by appointment.

All tests are evaluable on the second chance. Non-attendance to lectures and seminar precludes the possibility to be evaluated in the second chance.

Exam Dates:

November 3, 2023, 10-12 am.

July 5, 2024, 12-2 pm.

The exam dates can be consulted at: <http://masteroceanografia.com/horarios/>

Any changes to the officially approved exam dates will be posted on the notice board and the Center's website.

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

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
