



(*)Facultade de Ciencias do Mar

University Master's Degree in Oceanography

Subjects

Year 1st

Code	Name	Quadmester	Total Cr.
V10M153V01101	Physical Processes in the Ocean	1st	5
V10M153V01102	Oceanography of Ecosystems	1st	5
V10M153V01103	Chemical Reactions in the Ocean	1st	5
V10M153V01104	Geological Processes in Continental Margins and Ocean Basins	1st	5
V10M153V01201	Large-scale and Small-scale Oceanography	2nd	5
V10M153V01202	Biological Processes and Global Change	2nd	5
V10M153V01203	CO2 and Ocean Acidification	2nd	5
V10M153V01204	Oceanography of Unique Regions: Polar, Equatorial and Upwelling Regions	2nd	5
V10M153V01205	Climate Models	2nd	5
V10M153V01206	Palaeoclimatology and Paleoceanography	2nd	5
V10M153V01207	Atmosphere-Ocean Interaction	2nd	5
V10M153V01208	Global Change and Marine Ecosystems	2nd	5
V10M153V01209	Modelling in Coastal Systems	2nd	5
V10M153V01210	Anthropogenic Impact on the Coast	2nd	5
V10M153V01211	Biogeochemistry of Coastal Systems	2nd	5
V10M153V01212	Coastal Ecosystems	2nd	5
V10M153V01301	Design and Carrying out of Oceanographic Campaigns	An	5
V10M153V01302	Master's Degree Dissertation	An	15
V10M153V01CF101	Physical Oceanography	1st	3
V10M153V01CF102	Chemical Oceanography	1st	3
V10M153V01CF103	Biological Oceanography	1st	3
V10M153V01CF104	Geological Oceanography	1st	3

IDENTIFYING DATA				
Physical Processes in the Ocean				
Subject	Physical Processes in the Ocean			
Code	V10M153V01101			
Study programme	University Master's Degree in Oceanography			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Mandatory	1st	1st
Teaching language	Spanish			
Department				
Coordinator	Roson Porto, Gabriel			
Lecturers	Gil Coto, Miguel Roson Porto, Gabriel			
E-mail	groson@uvigo.es			
Web	http://masteroceanografia.com/			
General description	Study of the main physical processes, paying attention to their time and spatial scales.			

Competencies	
Code	
A2	Students who can apply their knowledge and understanding, and problem solving abilities in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study
A4	Students who can communicate their conclusions, and the knowledge and rationale underpinning these, to specialist and nonspecialist audiences clearly and unambiguously
B1	The students will understand in a detailed and based form the theoretical and practical aspects and the work methodology of the oceanography
B4	The students will be able to analyse oceanographic databases and obtain skills for their treatment.
C1	The students will be able to obtain advanced and relevant knowledge, of skilled and multidisciplinary character, in the field of the oceanography and their application to the marine environment
C3	The students will analyse situations and specific oceanographic conditions related with the global change
D1	The students will know and will be able to apply the scientific method in the academic and research fields.
D3	The students will be able to communicate the obtained information and their conclusions in a effective way to the general public, to other scientists and to the competent authorities, listening and answering of effective form and, using an appropriate language to the audience and to the context

Learning outcomes	
Expected results from this subject	Training and Learning Results
To deep understand of the physical processes that occur in the ocean	A2 A4 B1 B4 C1 C3 D1 D3
To adquire understanding about the different spatial and time scales.	A2 C1
To adquire understanding about the effects of the coastal boundaries in those processes.	B1 C1
To achieve the skill of analyze experimental data by means of low level languages.	A2 C1 C3 D3

Contents	
Topic	
Theory:	Coastal and oceanic Upwelling and downwelling: Influence of Climate change.
Surface and deep circulation Dynamics	Deep Circulation and Climate changes.
Practical:	(*)Casos de estudo de interesse rexional.
Time series processing	

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	26	27	53
Seminars	24	23	47
Presentation	0	25	25

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

Methodologies	
	Description
Lecturing	Explanation of contents by the teacher. Analysis of competences, abilities and skills, in the classroom, using participatory master class session methodology. The purpose of the teacher is to explain the theoretical fundamentals of the matter.
Seminars	Group work session for problem resolution supervised by teacher. Activities that develop the knowledge through the interaction and the activity of the student.
Presentation	Explanation by student about a physical process

Personalized assistance

Methodologies	Description
Lecturing	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation. Mon-Tue-Thu 10-13 h.
Seminars	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation. Mon-Tue-Thu 10-13 h.
Presentation	Individual attention will be carried out in group sessions, previously fixed in the schedule.

Assessment

	Description	Qualification	Training and Learning Results			
Seminars	Explanations of exercises, topics or projects.	60	A2	B1	C1	D1
			A4	B4	C3	D3
Presentation	Oral individual presentations by students.	40	A2	B4	C1	D3

Other comments on the Evaluation

Students are strongly requested to fulfil a 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

Sources of information

Basic Bibliography

POND, S., G.L.PICKARD, **Introductory Dynamical Oceanography**, Pergamon Press,

CUSHMAN-ROISIN, B., **Introduction to Geophysical Fluid Dynamics**, Ray Henderson & Deirde Cavanaugh,

Complementary Bibliography

Benoit Cushman-Roisin, Jean-Marie Beckers, **INTRODUCTION TO GEOPHYSICAL FLUID DYNAMICS. Physical and Numerical Aspects**, ACADEMIC PRESS,

Recommendations

Subjects that continue the syllabus

Atmosphere-Ocean Interaction/V10M153V01207

Climate Models/V10M153V01205

Subjects that it is recommended to have taken before

Physical Oceanography/V10M153V01CF101

Other comments

If any student did not come from Marine Science studies, the previous study of the matter "Physical Oceanography" is strongly recommended.

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

* Teaching methodologies maintained

All methodologies would be maintained.

* Teaching methodologies modified

In the case of on line teaching, two resources will be set up, the remote campus <https://campusremoto.tv.uvigo.es/> and the on line teaching platform <https://faitic.uvigo.es/>, as well as other resorts that will help students to access to the contents of the matter.

* Non-attendance mechanisms for student attention (tutoring)

Personal attention will be arranged through the virtual office 2308 (Gabriel Rosón). Password: SeguroqueaprueboOF1 , as well as via email, only through the institutional student domain @alumnos.uvigo.es. Emails send via non institutional domain will not answered.

Tutoring schedule will be increased from monday to friday from 10 to 18 h.

* Modifications (if applicable) of the contents

Not applicable

* Additional bibliography to facilitate self-learning

In order to make learning easier, all additional bibliography will be uploaded in the online platform faitic if necessary.

* Other modifications

Not applicable

=== ADAPTATION OF THE TESTS ===

* Tests already carried out

Test XX: [Previous Weight 00%] [Proposed Weight 00%]

Not applicable

* Pending tests that are maintained

Test XX: [Previous Weight 00%] [Proposed Weight 00%]

Not applicable

* New tests

Not applicable

* Additional Information

In this unusual situation, students are required to face this matter with a responsible and honest behaviour.

IDENTIFYING DATA				
Oceanography of Ecosystems				
Subject	Oceanography of Ecosystems			
Code	V10M153V01102			
Study programme	University Master's Degree in Oceanography			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Mandatory	1st	1st
Teaching language	Spanish			
Department				
Coordinator	Mouriño Carballido, Beatriz			
Lecturers	Aranguren Gassis, María Marañón Sainz, Emilio Mouriño Carballido, Beatriz			
E-mail	bmourino@uvigo.es			
Web	http://masteroceanografia.com/			
General description	This course addresses the trophic organisation and ecological functioning of pelagic communities, paying special attention to physical-biological coupling at different scales. Control factors of primary production and the role of the pelagic ecosystem in global biogeochemical cycles are studied. The course includes local oceanography case studies of the NW Iberian peninsula.			

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
B1	The students will understand in a detailed and based form the theoretical and practical aspects and the work methodology of the oceanography
B3	The students will be able to deepen in the main oceanographic processes and their spatiotemporal scales
B4	The students will be able to analyse oceanographic databases and obtain skills for their treatment.
C1	The students will be able to obtain advanced and relevant knowledge, of skilled and multidisciplinary character, in the field of the oceanography and their application to the marine environment
C3	The students will analyse situations and specific oceanographic conditions related with the global change
D1	The students will know and will be able to apply the scientific method in the academic and research fields.
D3	The students will be able to communicate the obtained information and their conclusions in a effective way to the general public, to other scientists and to the competent authorities, listening and answering of effective form and, using an appropriate language to the audience and to the context

Learning outcomes	
Expected results from this subject	Training and Learning Results
Interpretation of distribution patterns of planktonic organisms as well as fundamental biological processes.	A1 B3 C1 C3
Familiarise with advanced methodological tools for the study of pelagic ecosystems	B1 B4 D1
Understanding the way in which different key processes (physical, chemical and biological) interact in the ocean, using exhaustive analysis of regional cases	C1 C3 D3

Contents	
Topic	
Introduction	Pelagic ecosystems and their interactions with hydrodynamics. Key functional groups in the plankton. Production and fate of organic matter.
Physical-biological coupling in pelagic ecosystems	Scales of variability in the interaction between physical and biological processes: mixing and stratification, internal waves, frontal systems, sub- and meso-scale structures.
Plankton size structure: ecological and biogeochemical implications	Size-dependence of phytoplankton abundance, biomass and metabolism. Plankton size spectra. Environmental and ecological control of size structure.

Trophic analysis of pelagic ecosystems	Pelagic food webs. Bacteria-phytoplankton coupling. Grazing and mixotrophy. Structure of planktonic communities and biogeochemical circulation.
The role of pelagic ecosystems in global biogeochemical cycles.	Controlling factors of primary production. Processes and patterns of ocean nutrient limitation. The spring bloom: underlying mechanisms. The biological pump and the global carbon cycle.
Regional oceanography: the upwelling system of NW Iberian peninsula	Ecological and biogeochemical impact of the Galician upwelling. Links between size structure and metabolic balance in Ría de Vigo. Irradiance and nutrients as controlling factors of phytoplankton growth. Responses of microbial plankton to global change processes.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	20	10	30
Seminars	25	20	45
Mentored work	0	40	40
Presentation	5	5	10

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

Methodologies

	Description
Lecturing	Fundamental theoretical contents are explained, supported by visual material and key review articles.
Seminars	Using data from articles and/or databases, theoretical concepts are applied quantitatively, so that a deep understanding of the topics can be obtained.
Mentored work	Students prepare, under the instructor's supervision, a seminar that consists in an analysis of data combined with a bibliographic review. The seminar is present orally and is followed by a session of debate.
Presentation	Oral presentation of mentored work

Personalized assistance

Methodologies Description

Mentored work	The students are supervised by the instructor during the preparation of the seminar. Tutorial hours are also used to solve any difficulties related to the acquisition of knowledge and skills.
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Assessment

	Description	Qualification	Training and Learning Results			
Seminars	Evaluation of the understanding of the different concepts and processes treated during the theoretical classes and the seminars. The proof consists of short questions.	50	A1	B1 B3	C1 C3	
Mentored work	Evaluation of the seminar's oral presentation. The following points are taken into consideration: rigour in data analysis, understanding and command of the concepts used, use of diverse bibliographic sources, and clarity and precision during the presentation and discussion.	50	A1	B1 B3 B4	C1 D3	D1

Other comments on the Evaluation

Sources of information

Basic Bibliography

Kirchman DL (Ed.) (2008), **Microbial Ecology of the Oceans**, 2a,

Williams RG, Follows MJ (2011), **Ocean dynamics and the carbon cycle: principles and mechanisms**, 1a,

Complementary Bibliography

Fasham MJR (2003), **Ocean biogeochemistry**, 1a,

Mann KH, Lazier JRN (2006), **Dynamics of marine ecosystems: biological-physical interactions in the oceans**, 3a,

Miller CB (2012), **Biological oceanography**, 2a,

Simpson JH, Sharples J (2012), **Introduction to the Physical and Biological Oceanography of Shelf Seas**, 1a,

Steele JH, Turekian KK, Thorpe SA (2008), **Encyclopedia of Ocean Sciences**, 2a (online),

Recommendations

Subjects that continue the syllabus

Global Change and Marine Ecosystems/V10M153V01208

Subjects that it is recommended to have taken before

Biological Oceanography/V10M153V01CF103

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 an extraordinary planning that will activate in 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, in 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 *profesorado through the tool normalised and institutionalised of the educational guides.

=== ADAPTATION OF THE METHODOLOGIES ===

In case that the modality of teaching was no face-to-face or mixed, will use the Remote Campus to give classes and seminars, as well as to solve problems and supervise the students, and for the presentation of the mentored projects.

IDENTIFYING DATA				
Chemical Reactions in the Ocean				
Subject	Chemical Reactions in the Ocean			
Code	V10M153V01103			
Study programme	University Master's Degree in Oceanography			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Mandatory	1st	1st
Teaching language	Spanish			
Department				
Coordinator	Nieto Palmeiro, Óscar			
Lecturers	Álvarez Salgado, Xose Antón Cobelo García, Antonio Gago Duport, Luís Carlos Nieto Cid, María del Mar Nieto Palmeiro, Óscar Padín Álvarez, José Antonio			
E-mail	palmeiro@uvigo.es			
Web	http://masteroceanografia.com/			
General description	In this matter tackle appearances advanced of the chemical oceanography and his relation with the biological processes, physicists and geological. It does emphasis in the thermodynamic and kinetical **appearances of the processes of exchange between compartments, establishing flows between them and standing out the importance in the generation of vertical flows.			

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
A4	Students who can communicate their conclusions, and the knowledge and rationale underpinning these, to specialist and nonspecialist audiences clearly and unambiguously
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
C1	The students will be able to obtain advanced and relevant knowledge, of skilled and multidisciplinary character, in the field of the oceanography and their application to the marine environment
C4	The students will be able to apply in the practice the obtained knowledge and issue resolutions and judgments in the different oceanography fields
D1	The students will know and will be able to apply the scientific method in the academic and research fields.
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
Understand and explain from a theoretical and practical point of view the chemical processes that take place in half marine and that are related with the biological processes, physicists and geological that produce in a multicomponent system as it is the ocean and his importance in the generation of vertical profiles.	A1 A4 B2 B5 C1 C4 D1 D4

Comprise the importance of the thermodynamic and kinetical aspects of the processes of exchange of compounds between the atmosphere, the ocean and the sediments, doing a special reference to the methodologies employed to establish flows between environmental compartments.	A1 A4 B2 B5 C1 C4 D1 D4
Understand the behaviour of the C, N, P and Si from a global perspective, basing in the approach of biogeochemical cycles that put of self-evident to importance of the processes of vertical transport in the ocean.	A1 A4 B2 B5 C1 C4 D1 D4
Understand the variables that affect to the biogeochemical cycle of the metals traces in the oceans and purchase the necessary methodology for the study.	A1 A4 B2 B5 C1 C4 D1 D4

Contents

Topic	
Approximations used in the biogeochemical models.	Environmental compartments. Main flows between the environmental compartments. Equilibrium and kinetical models.
Models and parametrizations used to characterise the exchange of gases through the interphase waters-atmosphere.	Dissolution of gases in the atmosphere. Exchange atmosphere ocean. Structural appearances of the solubility in gases.
Reactivity of the elements in the superficial waters, transport of the particulate material and segregation in the deep ocean.	Properties of the superficial waters. Introduction to the 1D models with advection + diffusion + reaction through the column of sediments.
Biogeochemical cycles in the ocean.	Utilisation of the models PHREEQC for the modelling of biogeochemical cycles. Training, dissolution and preservation of calcium carbonate and opal.
Vertical transport of organic matter and remineralization.	Dissolved and particulate organic matter in the ocean. Sources of organic matter. Importance of the cycles of the C, O, N and P.
Reactivity and biogeochemical cycles of metals in the ocean	Processes related with the complexation of metals. Chemical speciation under the influence of future changes.

Planning

	Class hours	Hours outside the classroom	Total hours
Project based learning	15	20	35
Seminars	10	15	25
Practices through ICT	10	12	22
Laboratory practical	5	5	10
Mentored work	7	15	22
Presentation	1	2	3
Seminars	1	2	3
Problem and/or exercise solving	1	4	5

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

Methodologies

	Description
Project based learning	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 to participatory masterclass and in which the function of the professor is to explain the theoretical foundations of the distinct matters.

Seminars	Sessions of groupal work oriented by the professor, whose purpose is the research of data or information in libraries, databases, internet, etc. The professor indicates the need of extension of knowledges and orients in the research. This methodology carries implicit a load of work no face-to-face significant that it will have to be quantified in the programming of each matter, matter or module.
Practices through ICT	Session of groupal work for the resolution of problems in the classroom of computing, supervised by the professor. Significant construction of the knowledge through the interaction and activity of the student.
Laboratory practical	Activities developed in spaces and with specialized equipments that improve the significant construction of the knowledge through the interaction and activity of the student. It is carried out at th laboratory and the function of the professor is to present the aims, orient the work and realise the follow-up of the student.
Mentored work	Realisation in group of a work on a subject of the matter with participation shared. The professor presents the aims, orients and tutorizes the work, with participation shared with the students.
Presentation	Exhibition in group of the tutored work.
Seminars	Significant construction of the knowledge through the interaction between tutor and student by means of sessions of tutorial activities personalised or in group very reduced, where the professor orients and resolves doubts.

Personalized assistance

Methodologies	Description
Project based learning	Any doubt that arise to the student can consult it through the forums that enable for this in the platform TEMA or can agree an appointment with the professor to interview in his dispatch.
Laboratory practical	Any doubt that arise to the student can consult it through the forums that enable for this in the platform TEMA or can agree an appointment with the professor to interview in his dispatch.
Practices through ICT	Any doubt that arise to the student can consult it through the forums that enable for this in the platform TEMA or can agree an appointment with the professor to interview in his dispatch.
Seminars	It does not have place
Seminars	Any doubt that arise to the student can consult it through the forums that enable for this in the platform TEMA or can agree an appointment with the professor to interview in his dispatch.
Mentored work	Any doubt that arise to the student can consult it through the forums that enable for this in the platform TEMA or can agree an appointment with the professor to interview in his dispatch.
Presentation	Any doubt that arise to the student can consult it through the forums that enable for this in the platform TEMA or can agree an appointment with the professor to interview in his dispatch.
Tests	Description
Problem and/or exercise solving	In the review of examinations

Assessment

	Description	Qualification	Training and Learning Results			
Practices through ICT	The students will realise a work on a geochemical modelling in order to evaluate the capacity to know use of the computer programs employees.	20	A1	B2	C1	D1
Laboratory practical	It will evaluate the attitude of work during the session of the laboratory (5%) as well as the report of practices (15%) that will be evaluated in agreement with the criteria that will be published as a rubric in the platform TEMA.	20	A1	B5	C1	D1
Mentored work	The students in group will present a memory of work that will be evaluated in agreement with the criteria that will be published as a rubric in the platform TEMA.	15	A1	B2	C1	D1
Presentation	The students in group will realise an exhibition of the tutored work realised and that will evaluate in agreement with the criteria that will be published as a rubric in the platform TEMA.	5	A4		C4	D1
Problem and/or exercise solving	The student will have to answer briefly join it questions in which it will evaluate the capacity to comprise and relate the concepts learnt during the matter.	40	A1	B2	C1	D1
			A4	B5	C4	D4

Other comments on the Evaluation

To surpass the matter, all and each one of the parts that compose the matter have to be surpassed with a minimum qualification of 5 points.

In case that the proof of short answer no scope to minimum note, will repeat the examination in the announcement of July. In case that it do not reach the minimum note in the "practices of laboratory", "practices in classrooms of computer", "tutored works" and/or "presentations/exhibitions", they will present again the works in the terms that the *profesorado of the matter estimate timely.

Sources of information

Basic Bibliography

J.P. Riley y R. Chester, **Introducción a la química marina**, 1ª edición en castellano y ediciones en inglés, A.G.T., 1989

Susan M. Libes, **Introduction to marine biogeochemistry**, 2ª edición, Elsevier-Academic Press, cop., 2009

Robert A. Berner, **Early diagenesis : a theoretical approach**, Princeton University Press, cop., 1980

Patrick L. Brezonik, **Chemical kinetics and process dynamics in aquatic systems**, Lewis, cop., 1994

Antonio C. Lasaga, **Kinetic theory in the earth sciences**, Princeton University Press, cop., 1998

R. Chester y T.D. Jickells, **Marine Geochemistry**, 3ª edición, Willey Blackwell cop., 2012

Complementary Bibliography

Frank J. Millero, **Chemical oceanography**, 4ª edición, CRC Press, 2013

J. P. Riley, R. Chester (eds.), **Chemical oceanography**, Academic Press, 1989

C.A.J. Appelo, D. Postma, **Geochemistry, groundwater and pollution**, 2ª edición, CRC Press, 2005

Recommendations

Contingency plan

Description

=== EXCEPTIONAL PLANNED MEASURES ===

In the face of the uncertain and unpredictable evolution of the health alert triggered by COVID-19, the University establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it based on safety criteria, health and responsibility, and ensuring teaching in a non face-to-face or non face-to-face setting. These already planned measures guarantee, when it is mandatory, the development of teaching in a more agile and effective way to be known in advance (or with a long advance) by pupils and teachers through the standardised and institutionalised tool of the DOCNET teaching guides.

=== ADAPTATION OF METHODOLOGIES ===

Not applicable

* Teaching methodologies to be modified

- Laboratory practice

Laboratory practices that cannot be done in face-to-face mode will be done in the form of a simulation through the virtual classroom (Remote Campus) that the University of Vigo has the disposition of teachers and students. After the virtual classroom session, they will have to present the corresponding report according to the criteria and indications of the trainee teachers.

- Introductory activities:

- Master Lesson: The

The sessions of these activities that cannot be done in person, will be carried out through the virtual classroom that the University of Vigo has the disposition of teachers and students.

* Off-site student care (tutoring)

Students can consult their questions by appointment in the teacher's virtual office: Room 1752, access code coDC4elw

On the TEMA platform is enabled the Forums section, where a forum will be open for each classroom topic taught, as well as several forums for laboratory practices, problem classes and seminars. In this way, students will be able to ask questions that can be answered by both teachers and/or classmates/classmates.

* Modifications (if applicable) of the contents to be imparted

* Additional bibliography to facilitate self-learning

Websites and related videos will be used to complement the training of students, which will be made available to students on the TEMA platform.

* Other amendments

=== ADAPTATION OF THE EVALUATION ===

* Tests already carried out

Test *XX: [Previous Weight 00%] [Proposed Weight 00%]

Not applicable

* Evidence pending and ongoing

Test *XX: [Previous Weight 00%] [Proposed Weight 00%]

- Practice report

- Work

- Problem solving and exercises

Does not change the weighting in the final note

* Tests to be modified

[Previous test] => [New test]

Not applicable

* New evidence

* Additional information

IDENTIFYING DATA**Geological Processes in Continental Margins and Ocean Basins**

Subject	Geological Processes in Continental Margins and Ocean Basins			
Code	V10M153V01104			
Study programme	University Master's Degree in Oceanography			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Mandatory	1st	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Nombela Castaño, Miguel Angel			
Lecturers	Alejo Flores, Irene Francés Pedraz, Guillermo García Gil, María Soledad Mena Rodríguez, Ángel Nombela Castaño, Miguel Angel Pérez Arlucea, Marta María			
E-mail	mnombela@uvigo.es			
Web	http://masteroceanografia.com			
General description	<p>This subject tackles the knowledge of the geological processes that take place in the marine field from the line of coast until the abyssal plain. They will analyse the processes of transport and sedimentation that control the movement of sediment and the sedimentary structures resultant in the different marine environments. Also it tackles the sismostratigraphical interpretation, like tool for the interpretation of sequences and geological cycles in the differents sedimentary environments.</p> <p>The practical content of the subject will consist in a field trip of several days of length to see different ancient sedimentary environments. It proposes visit the neogen basins of Sorbas; Nijar and Tabernas in the province of Almería for the characterisation in situ of the lithology, the facies and the sedimentary architecture of a wide variety of environments (alluvial fans, beaches, deltas, reefs, carbonatic shelves, evapories, slumps, debris flows, turbidites, pelagic), as well as the sedimentary processes and tectonic that have controlled his origin and space-temporary evolution .</p>			

Competencies

Code	
A3	Students who have the ability to integrate knowledge and handle complexity, and formulate judgments with incomplete or limited information, but that include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments
A4	Students who can communicate their conclusions, and the knowledge and rationale underpinning these, to specialist and nonspecialist audiences clearly and unambiguously
B1	The students will understand in a detailed and based form the theoretical and practical aspects and the work methodology of the oceanography
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
C4	The students will be able to apply in the practice the obtained knowledge and issue resolutions and judgments in the different oceanography fields
D1	The students will know and will be able to apply the scientific method in the academic and research fields.
D3	The students will be able to communicate the obtained information and their conclusions in a effective way to the general public, to other scientists and to the competent authorities, listening and answering of effective form and, using an appropriate language to the audience and to the context

Learning outcomes

Expected results from this subject	Training and Learning Results
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Capacity to interpret seismic profiles. Recognise inside the context of the sequential stratigraphy the courtships *sedimentarios and his relation with the stages *eustáticas.	A3 B1 B5 C3 C4 D1 D3
Capacity for the integration of data and interpretation of the physical and geological processes in oceanic environments.	A3 B1 B5 C3 C4 D1 D3
Capacity for the recognition and interpretation of sequences and cycles.	A3 B1 C3 C4 D1
Capacity to identify the means *sedimentarios, his processes associated and the factors that have controlled his evolution *espaciotemporal.	A3 B1 C3 C4 D1
Capacity to evaluate the economic potential of the oceanic basins with regard to diverse geological resources.	A3 A4 B1 C4 D1 D3

Contents

Topic	
T1. Tectonic and geomorphological configuration of the oceanic bottom	The sub-topic coincides with the topic
T2. Geological processes in coastal environments	The sub-topic coincides with the topic
T3. Processes in of continental shelf environments	The sub-topic coincides with the topic
T4. Origin and distribution of marine sediments	The sub-topic coincides with the topic
T5. Processes of resedimentation associated to the continental slope: turbidites	The sub-topic coincides with the topic
T6. Processes in hemipelagic and pelagic environments	The sub-topic coincides with the topic
T7. Evolution of continental margins and oceanic basins. Interaction between the internal and external geological processes	The sub-topic coincides with the topic
T8. Seismic-stratigrafical interpretation of marine sedimentary environments..	The sub-topic coincides with the topic
P1. Geological characterisation of coastal environments	Practical contents developed in the Field Trip of Almería
P2. Identification and characterisation of shelf environments	Practical contents developed in the Field Trip of Almería
P3. Characterisation of continental slope environments	Practical contents developed in the Field Trip of Almería
P4. Caracerización of pelagic environments	Practical contents developed in the Field Trip of Almería
P5. Space-temporary evolution of continental margins and oceanic basins. Filling of basins: budget-tectonic-sedimentation relations	Practical contents developed in the Field Trip of Almería

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	23	35	58
Introductory activities	2	0	2
Field practice	0	10	10
Studies excursion	20	20	40

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

Methodologies	
	Description
Lecturing	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 matter.
Introductory activities	It will contextualise the subject inside the *master as well as the zone of exit of studies.
Field practice	The students will have to make a memory of field with photographic material and own annotations, as well as resolve practical exercises, so much on the terrain as in cabinet, using specific bibliography collected and the guide of field.
Studies excursion	Session of work *grupal in practices of field, under the supervision of the professor, making possible the significant construction of the knowledge through the interaction and activity of the student and his contact with the reality where has to apply his knowledges. It will do a route by the outcrops *Neógenos of several basins *sedimentarias of the *sureste peninsular in which there is glorious examples of half *sedimentarios marine fossils, that include platforms *carbonatadas, *turbiditas, *evaporitas, reefs, *sedimentación *pelágica, etc.

Personalized assistance	
Methodologies	Description
Lecturing	The students will be attended of personal form by any one of the professors that give the matter, by means of concerted previous appointment by email. Likewise, they will be attended in front of any query during the development of the lessons *magistrales.
Studies excursion	The students will be attended of personal form by any one of the professors that give the matter, by means of concerted previous appointment by email. Likewise, they will be attended in front of any query during the development of the exits of studies.
Introductory activities	The students will be attended of personal form by any one of the professors that give the matter, by means of concerted previous appointment by email. Likewise, they will be attended in front of any query during the development of the introductory activities.
Field practice	The students will be attended of personal form by any one of the professors that give the practices of field

Assessment		Qualification Training and Learning Results				
	Description					
Lecturing	They will evaluate the knowledges purchased by means of proofs written and/or oral	60				
Report of practices, practicum and external practices	They will evaluate the reports of field and exercises elaborated by the/the student/to	40	A3 A4	B1 B5	C4	D1 D3

Other comments on the Evaluation

The official dates for the proofs of evaluation can consult in: <http://masteroceanografia.com/horarios/requirements> of the students that *curse this matter a responsible and honest behaviour. It considers inadmissible any form of fraud (copy or plagiarism) directed to *falsear the level of knowledges and skills reached in all type of proof, report or work. The fraudulent behaviours will be able to suppose suspend the subject during a complete course. It will carry an internal register of these performances so that, in case of *reincidencia, request the opening to the rectorship of a disciplinary file

Sources of information

Basic Bibliography

Arche, A. (ed.), **Sedimentología**,
Chiocci, F.L. y Chivas, A.R. (eds.), **Continental Shelves of the World**,
Huneke, H. y Mulder, T., **Deep-sea sediments**,

Complementary Bibliography

Rebesco, M. and Camerlenghi, A. (eds.), **Contourites**,
Nittrouer, C.; Austin, J.; Field, M.; Kravitz, J.; Syvitski, J.; Wiberg, P. (eds.), **Continental margin sedimentation: from sediment transport to sequence stratigraphy**,
Mather, A., **A Field guide to the neogene sedimentary basins of the Almería province, SE Spain**,
Braga, J.C. et al., **Geología del Entorno Árido Almeriense. Guía Didáctica de Campo**,
CIESM Workshop, **The Messinian Salinity Crisis from mega-deposits to microbiology. A consensus report**,

Recommendations

Subjects that it is recommended to have taken before

Geological Oceanography/V10M153V01CF104

Other comments

For those students that have not graduated in Sciences of the Sea or in Geology is fundamental to have *cursado the subject of Geological Oceanography.

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 establishes an extraordinary planning that will activate in 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 no totally face-to-face. These already scheduled measures guarantee, in the moment that was prescriptive, the development of the teaching of a way but agile and effective when being known in advance (or with a wide *antelación) by the students and the *profesorado through the tool normalised and institutionalised of the educational guides **DOCNET.

=== ADAPTATION OF The METHODOLOGIES ===

* educational Methodologies that keep

- 1.- Mixed teaching: they keep
- 2.- Teaching no face-to-face: they will adapt to the available resources.

* Educational methodologies that modify

- 1.- Mixed teaching: they do not modify
- 2.- Teaching no face-to-face: the exits of field inside the Camp by the Neogene basins of the of Spain (Almería) will treat of virtualizar the most possible. Likewise they will propose activities that stimulate his self learning. If it is necessary, will work with flights of Google Earth, aerial photography, field photography and videos, as well as with diagrams of stratigraphical records, signposts of correlation, etc.

* Mechanism no face-to-face of attention to the students (**tutorías)

- 1.- Mixed teaching: previous concertation by email, face-to-face and/or virtual through Remote Campus.
- 2.- Teaching no face-to-face: previous concertation by email, virtual through Remote Campus

* Modifications (yes proceed) of the contents to give

- 1.- Mixed teaching: it does not have intention to change the contents
- 2.- Teaching no face-to-face: it does not have intention to change to contained

* additional Bibliography to facilitate the car-learning
is not necessary.

* Other modifications

=== ADAPTATION OF The EVALUATION ===

* Test already made

Proof **XX: [previous Weight 00%] [Weight Proposed 00%]

- 1.- Mixed teaching: they conserve the weights of the face-to-face situation.
- 2.- Teaching no face-to-face: exam 60%/40%; practical report 40%/60%

* pending Proofs that keep

Proof **XX: [previous Weight 00%] [Weight Proposed 00%]

...

* Proofs that modify

[previous Proof] => [new Proof]

- 1.- Mixed teaching: they do not modify
- 2.- Teaching no face-to-face: it does not modify

* New test

* additional Information

During the no face-to-face teaching, requires of the ***estudiantado that, in these exceptional circumstances, face this matter with a responsible and honest behaviour. It will consider inadmissible any form of copy directed to *falsear the level of knowledges and skills reached in the preparation of the ***entregables, as well as during the virtual examination. Yes there is some suspicion of some type of fraudulent behaviour, will be able to subject to the students to an additional control to check his veracity.

IDENTIFYING DATA**Large-scale and Small-scale Oceanography**

Subject	Large-scale and Small-scale Oceanography			
Code	V10M153V01201			
Study programme	University Master's Degree in Oceanography			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Optional	1st	2nd
Teaching language				
Department				
Coordinator	Teira Gonzalez, Eva Maria			
Lecturers	Teira Gonzalez, Eva Maria			
E-mail	teira@uvigo.es			
Web				
General description	The teaching guide of this subject is available in the following link: https://www2.ulpgc.es/index.php?pagina=plan_estudio&ver=wpe005&codTitulacion=5044&codPlan=50&tipotitulacion=M&codEspecialidad=11 , and is imparted by the Universidad de Las Palmas de Gran Canaria.			

Competencies

Code

Learning outcomes

Expected results from this subject	Training and Learning Results
------------------------------------	-------------------------------

Contents

Topic

Planning

Class hours	Hours outside the classroom	Total hours
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*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

Description

Personalized assistance**Assessment**

Description	Qualification	Training and Learning Results
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Other comments on the Evaluation**Sources of information****Basic Bibliography****Complementary Bibliography****Recommendations****Contingency plan****Description**

=== EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering

safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

- * Teaching methodologies maintained
- * Teaching methodologies modified
- * Non-attendance mechanisms for student attention (tutoring)
- * Modifications (if applicable) of the contents
- * Additional bibliography to facilitate self-learning
- * Other modifications

=== ADAPTATION OF THE TESTS ===

- * Tests already carried out
- Test XX: [Previous Weight 00%] [Proposed Weight 00%]
- ...

- * Pending tests that are maintained
- Test XX: [Previous Weight 00%] [Proposed Weight 00%]
- ...

- * Tests that are modified
- [Previous test] => [New test]

- * New tests

- * Additional Information
-

IDENTIFYING DATA				
Biological Processes and Global Change				
Subject	Biological Processes and Global Change			
Code	V10M153V01202			
Study programme	University Master's Degree in Oceanography			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Optional	1st	2nd
Teaching language				
Department				
Coordinator	Teira Gonzalez, Eva Maria			
Lecturers	Teira Gonzalez, Eva Maria			
E-mail	teira@uvigo.es			
Web				
General description	The teaching guide of this subject is available in the following link: https://www2.ulpgc.es/index.php?pagina=plan_estudio&ver=wpe005&codTitulacion=5044&codPlan=50&tipotitulacion=M&codEspecialidad=11 , and is imparted by the Universidad de Las Palmas de Gran Canaria.			

Competencies
Code

Learning outcomes	
Expected results from this subject	Training and Learning Results

Contents
Topic

Planning			
	Class hours	Hours outside the classroom	Total hours

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

Methodologies
Description

Personalized assistance

Assessment		
Description	Qualification	Training and Learning Results

Other comments on the Evaluation

Sources of information
Basic Bibliography
Complementary Bibliography

Recommendations

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering

safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

- * Teaching methodologies maintained
- * Teaching methodologies modified
- * Non-attendance mechanisms for student attention (tutoring)
- * Modifications (if applicable) of the contents
- * Additional bibliography to facilitate self-learning
- * Other modifications

=== ADAPTATION OF THE TESTS ===

- * Tests already carried out
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...
- * Pending tests that are maintained
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...
- * Tests that are modified
[Previous test] => [New test]

- * New tests

- * Additional Information
-

IDENTIFYING DATA				
CO2 and Ocean Acidification				
Subject	CO2 and Ocean Acidification			
Code	V10M153V01203			
Study programme	University Master's Degree in Oceanography			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Optional	1st	2nd
Teaching language				
Department				
Coordinator	Teira Gonzalez, Eva Maria			
Lecturers	Teira Gonzalez, Eva Maria			
E-mail	teira@uvigo.es			
Web				
General description	The teaching guide of this subject is available in the following link: https://www2.ulpgc.es/index.php?pagina=plan_estudio&ver=wpe005&codTitulacion=5044&codPlan=50&tipotitulacion=M&codEspecialidad=11 , and is imparted by the Universidad de Las Palmas de Gran Canaria.			

Competencies

Code	
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Learning outcomes

Expected results from this subject	Training and Learning Results
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Contents

Topic	
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Planning

	Class hours	Hours outside the classroom	Total hours
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*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

Description	
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Personalized assistance

Assessment

Description	Qualification	Training and Learning Results
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Other comments on the Evaluation

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee,

at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

- * Teaching methodologies maintained

- * Teaching methodologies modified

- * Non-attendance mechanisms for student attention (tutoring)

- * Modifications (if applicable) of the contents

- * Additional bibliography to facilitate self-learning

- * Other modifications

=== ADAPTATION OF THE TESTS ===

- * Tests already carried out
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

 - * Pending tests that are maintained
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

 - * Tests that are modified
[Previous test] => [New test]

 - * New tests

 - * Additional Information
-

IDENTIFYING DATA**Oceanography of Unique Regions: Polar, Equatorial and Upwelling Regions**

Subject	Oceanography of Unique Regions: Polar, Equatorial and Upwelling Regions			
Code	V10M153V01204			
Study programme	University Master's Degree in Oceanography			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Optional	1st	2nd
Teaching language				
Department				
Coordinator	Teira Gonzalez, Eva Maria			
Lecturers	Teira Gonzalez, Eva Maria			
E-mail	teira@uvigo.es			
Web				
General description	The teaching guide of this subject is available in the following link: https://www2.ulpgc.es/index.php?pagina=plan_estudio&ver=wpe005&codTitulacion=5044&codPlan=50&tipotitulacion=M&codEspecialidad=11 , and is imparted by the Universidad de Las Palmas de Gran Canaria.			

Competencies

Code	
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Learning outcomes

Expected results from this subject	Training and Learning Results
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Contents

Topic	
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Planning

	Class hours	Hours outside the classroom	Total hours
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*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

Description	
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Personalized assistance**Assessment**

Description	Qualification	Training and Learning Results
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Other comments on the Evaluation**Sources of information****Basic Bibliography****Complementary Bibliography****Recommendations****Contingency plan****Description**

=== EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

- * Teaching methodologies maintained
- * Teaching methodologies modified
- * Non-attendance mechanisms for student attention (tutoring)
- * Modifications (if applicable) of the contents
- * Additional bibliography to facilitate self-learning
- * Other modifications

=== ADAPTATION OF THE TESTS ===

- * Tests already carried out
- Test XX: [Previous Weight 00%] [Proposed Weight 00%]

...

- * Pending tests that are maintained
- Test XX: [Previous Weight 00%] [Proposed Weight 00%]

...

- * Tests that are modified
- [Previous test] => [New test]

- * New tests

- * Additional Information
-

IDENTIFYING DATA				
Climate Models				
Subject	Climate Models			
Code	V10M153V01205			
Study programme	University Master's Degree in Oceanography			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Optional	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	Gómez Gesteira, Ramón			
Lecturers	Costoya Noguerol, Jorge de la Torre Ramos, Laura Fernández Nóvoa, Diego Gómez Gesteira, Ramón González Cao, José			
E-mail	mggesteira@uvigo.es			
Web	http://masteroceanografia.com/			
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.			

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

Contents
Topic

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

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.
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Assessment						
	Description	Qualification	Training and Learning Results			
Problem and/or exercise solving	Questions with short answer about the different subjects of the course.	40	A1 A5	B2 B5	C3 C7	
Essay	It will value the work and the progress of the student during the classes and the practical cases as well as, the realization and presentation of summaries and works proposed by the teachers.	60	A1 A5	B2 B5	C3 C7	D2 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 11, 2021, 10- 12 h

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, **Introducción 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

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 FAITIC 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 of attention to the students (*tutorías)

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 Faitic, Campus Remoto, Teams, Zoom].]

* New proofs

There will be new tests

* additional Information

IDENTIFYING DATA				
Palaeoclimatology and Paleoceanography				
Subject	Palaeoclimatology and Paleoceanography			
Code	V10M153V01206			
Study programme	University Master's Degree in Oceanography			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Optional	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	Marino , Gianluca			
Lecturers	Álvarez Iglesias, Paula Marino , Gianluca Mohamed Falcón, Kais Jacob Rey García, Daniel Rubio Armesto, María Belén			
E-mail	gianluca.marino@uvigo.es			
Web	http://masteroceanografia.com/			
General description	The subject centres on the timing, magnitude, and rates of past ocean and climate change. Emphasis is given to the: (i) different timescales and patterns of (palaeo)climate change; (ii); most commonly used tools of investigation, and (iii) relationship between (palaeo)climate forcings, feedbacks, and responses of the climate system. Focusing on the investigative tools, the lectures illustrate the various micropalaeontological, geochemical, and geophysical proxies as well as the statistical methods that allow to rigorously determine confidence levels of e.g., chronological frameworks and proxy-based reconstructions. Examples are given of the different episodes of climate change that punctuated the Earth's climate history. These will be taken from the last few centuries to millennia, the last 2 million years, and the so-called 'deep-time'. Insights are also provided into the use of the palaeoclimate record to better constrain 'climate sensitivity' that is an essential metric to predict by how much, and how fast, the Earth may warm in response to the ongoing anthropogenic greenhouse gas forcing.			

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
A2	Students who can apply their knowledge and understanding, and problem solving abilities in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study
A4	Students who can communicate their conclusions, and the knowledge and rationale underpinning these, to specialist and nonspecialist audiences clearly and unambiguously
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.
B3	The students will be able to deepen in the main oceanographic processes and their spatiotemporal scales
C1	The students will be able to obtain advanced and relevant knowledge, of skilled and multidisciplinary character, in the field of the oceanography and their application to the marine environment
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.
D3	The students will be able to communicate the obtained information and their conclusions in a effective way to the general public, to other scientists and to the competent authorities, listening and answering of effective form and, using an appropriate language to the audience and to the context

Learning outcomes	
Expected results from this subject	Training and Learning Results

To obtain information from the various palaeoceanographic and palaeoclimatic proxies and comprehend how they are used to reconstruct ocean and climate changes.	A1 A2 A4 A5 B2 B3 C3 C7 D3
To integrate the information retrieved from regionally to globally distributed palaeoceanographic and palaeoclimatic records.	A1 A2 A4 A5 B2 B3 C1 C3 C7 D3
To understand the natural mechanisms of climatic change at the different temporal and spatial scales.	A1 A2 A4 A5 B2 B3 C1 C3 C7 D3
To exploit the continuous nature of the oceanic sedimentary record to reconstruct the history of Earth's climate.	A1 A2 A4 A5 B2 B3 C1 C3 C7 D3
To extract information from the palaeoclimate record and use it to better understand current climate change and improve predictions of future climate developments.	A1 A2 A4 A5 B2 B3 C1 C3 C7 D3

Contents

Topic	
Topic 0. Introduction to palaeoclimatology and paleoceanography	0.1. Aims of the course; 0.2. Lectures and of topics addressed by the course; 0.3. Laboratory practicals; 0.4. Seminars; 0.5. Assessment.
Topic 1. Basic concepts and current climate change	1.1. Overview of climate change and methods of investigation; 1.2. Spatial and temporal scales of climate change; 1.3. Climate change and climate variability; 1.4. Earth's climate and energy budget; 1.5. Forcing, feedback, and response mechanisms of the climate system; 1.6. Transient climate response, equilibrium climate sensitivity, and Earth system sensitivity; 1.7. Global warming and the 1.5°C and 2.0°C climate thresholds.

Topic 2. Proxies of past ocean and climate change	2.1. Introduction to proxies and tracers; 2.2. Micropaleontological proxies and transfer functions; 2.3. Geochemical proxies; 2.4. Geophysical proxies; 2.5. Sedimentological and mineralogical proxies.
Topic 3. Chronologies of past ocean and climate change	3.1. The importance of chronology to decipher timing and rates of change; 3.2. Radiometric methods of dating (e.g., uranium-thorium, radiocarbon); 3.3. Oxygen isotope stratigraphy; 3.4. Site to site correlations.
Topic 4. Tectonic-Scale Climate Change	4.1. Plate tectonics, weathering, CO ₂ , and long-term climate; 4.2. Greenhouse and icehouse climates.
Topic 5. Orbital-Scale Climate Change	5.1. Astronomical control of solar radiation; 5.2. Insolation control of ice sheets; 5.3. Insolation control of monsoons; 5.4. Orbital-scale forcing, feedbacks, and responses; 5.5. The 40,000- and the 100,000-year ice-age cycles.
Topic 6. Millennial- and centennial-scale (suborbital) climate variability	6.1. Patterns and mechanisms of sub-orbital climate variability; 6.2. The role of Northern Hemisphere ice sheets; 6.3. The role of the Atlantic Meridional Overturning Circulation; 6.4. The role of solar output; 6.5. Dansgaard-Oeschger, Heinrich events, and Bond cycles.
Topic 7. The role of the ocean in atmospheric CO ₂ variations	7.1. Terrestrial, atmospheric, and oceanic reservoirs of carbon; 7.2. Ocean carbonate chemistry and the carbonate compensation feedback; 7.3. Glacial-interglacial variations in atmospheric CO ₂ concentrations.
Laboratory practicals	Laboratory practical 1. Dating methods in marine sediments; Laboratory practical 2. Environmental magnetism; Laboratory practical 3. X-ray diffraction (XRD) as a tool to determine mineral content in marine sediments. Laboratory practical 4. X-Ray Fluorescence (XRF) scanning as a tool to determine bulk sediment geochemistry of in marine sediments; Laboratory practical 5. The sensitivity of global and polar temperatures to climate forcing.
Seminars	Seminar 1. Past and future climate variability in the Indo-Pacific: drivers and mechanisms (Kaustubh Thirumalai, University of Arizona, USA); Seminar 2. Diatom productivity and the marine silica cycle (Oscar Romero, MARUM, University of Bremen, Germany); Seminar 3. Palaeoclimatic and palaeoenvironmental significance of Mediterranean terrestrial carbonates (Eleonora Regattieri, Istituto di Geoscienze e Georisorse IGG-CNR, Italy); Seminar 4. Climate and vegetation changes in Europe in response to glacial-interglacial cycles and more rapid events over the last million years (Maria Fernanda Sanchez Goñi, CNRS 5805 EPOC - OASU, University of Bordeaux, France).

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	25	25	50
Laboratory practical	15	10	25
Presentation	2	22	24
Seminars	6	6	12
Essay	1	10	11
Problem and/or exercise solving	1	2	3

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

Methodologies	
	Description
Lecturing	Lectures on the 7 topics of the program. Coverage of the topics will be flexible to address questions and issues that may arise over the duration of the course. Some lectures will be given by (foreigner) guest lecturers and done by remote-connection.
Laboratory practical	They illustrate those methods and protocols that are commonly used to generate sedimentological, geophysical, and/or geochemical data from deep-sea sediment cores.
Presentation	Oral presentations on topics that are related to those addressed during the lectures.

Seminars	Additional presentations centred on specific, timely topics within the wider fields of palaeoclimatology and paleoceanography given by invited speakers from outside the Universidade de Vigo.
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Personalized assistance

Methodologies	Description
Lecturing	Questions and doubts that may arise during lectures will be addressed during tutorials. In order to schedule a tutorial students and/or group of students should contact the professors well in advance in order to efficiently schedule the tutorial.
Laboratory practical	Questions and doubts that may arise during laboratory practicals will be addressed during tutorials. In order to schedule a tutorial students and/or group of students should contact the professor well in advance in order to efficiently schedule the tutorial.
Presentation	Prior to the final presentation the students can contact the professors in order to be advised about literature material that could be used to develop the presentation topic.
Seminars	Questions and doubts that may arise during seminars will be addressed during tutorials. In order to schedule a tutorial students and/or group of students should contact the professors well in advance in order to efficiently schedule the tutorial.

Assessment

	Description	Qualification	Training and Learning Results	
Essay	Oral presentations on topics that are related to those addressed during the lectures.	70	A1	C3
Problem and/or exercise solving	Development of a short report (2 to 5 pages) on two or more topics related to those addressed during lectures.	30	B2 B3	C1 C7

Other comments on the Evaluation

Attendance at lectures and laboratory practicals is an essential requirement to obtain a positive evaluation. Students that cannot attend some of these activities are expected to provide a proper justification for their absence. The team of professors is in charge of selecting the topics for the final presentations and reports.

Date, time and place of the exams will be published in the official web of the Master in Oceanography:

<http://masteroceanografia.com/horarios/>

Students are strongly requested to fulfil an 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.

Sources of information

Basic Bibliography

- Archer, D.E., **The Global Carbon Cycle**, Princeton Primers in Climate, 2010
- Barron, E.J., **Climatic Variation in Earth History**, University Science Books, 1996
- Clement, A. & Peterson, L., **Mechanisms of abrupt climate change of the last glacial period**, AGU, 2008
- Cronin, T. M., **Paleoclimates: Understanding Climate change past and present**, Columbia University Press, 2010
- Gornitz, V. (ed.), **Encyclopedia of Paleoclimatology and ancient environments**, Springer, 2009
- Hemming, S., **Heinrich Events: Massive Late Pleistocene detritus layers on the North Atlantic and their global climate imprint.**, Reviews in Geophysics, 42, 2004
- Stocker, T.F. et al. (Ed.), **IPCC, 2013: Climate Change 2013: The Physical Science Basis**, Cambridge University Press, 2013
- Pierrehumbert, R.T., **Principles of Planetary Climate**, Cambridge University Press, 2010
- Rapp, D., **Ices Ages and interglacials: measurements, interpretations and models**, Springer-Verlag, 2009
- Ruddiman, W. F., **Earth's Climate. Past and Future**, W. H. Freeman and Company, 2008
- Wilson, R. C.L., Drury, S. & Chapman, A., **The Great Ice Age**, Routledge, 2000

Complementary Bibliography

Recommendations

Subjects that are recommended to be taken simultaneously

Design and Carrying out of Oceanographic Campaigns/V10M153V01301
Biological Oceanography/V10M153V01CF103
Physical Oceanography/V10M153V01CF101
Geological Oceanography/V10M153V01CF104
Chemical Oceanography/V10M153V01CF102

Subjects that it is recommended to have taken before

Geological Oceanography/V10M153V01CF104
Geological Processes in Continental Margins and Ocean Basins/V10M153V01104

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19 pandemic, the University of Vigo establishes an extraordinary plan that will be activated when the the regional and national governments and of the university itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===*** Teaching methodologies maintained**

Contents of lectures, laboratory practicals, and seminars will stay the same as for campus-based teaching. In the case of lockdown, teaching will be entirely or partly moved online, using, e.g., the flipped classroom technique and CampusRemoto (<https://campusremotouvigo.gal>). In addition, teaching will be complemented where needed with additional literature material and/or videos.

*** Teaching methodologies modified**

Flipped classroom technique. This is a pedagogical model that transfers part of the work out of the classroom and requires students make part of the reading and comprehension work prior to the lecture, laboratory practical, or seminar. In this way, the class-based work will be enriched with questions and in-depth debates.

*** Non-attendance mechanisms for student attention (tutoring)**

Entirely or partly moved online using CampusRemoto.

*** Modifications (if applicable) of the contents**

None

*** Additional bibliography to facilitate self-learning**

None

*** Other modifications**

None.

=== ADAPTATION OF THE TESTS ===*** Tests already carried out**

Seminars and practicals: [Previous Weight 0%] [Proposed Weight 5%]

Topical questionnaires: [Previous Weight 0%] [Proposed Weight 5%]

Report: [Previous Weight 30%] [Proposed Weight 25%]

Presentation: [Previous Weight 70%] [Proposed Weight 65%]

*** Pending tests that are maintained**

Report: [Previous Weight 30%] [Proposed Weight 25%]

Presentation: [Previous Weight 70%] [Proposed Weight 65%]

*** Tests that are modified**

None.

*** New tests**

Seminars and practicals: [Previous Weight 0%] [Proposed Weight 5%]

Topical questionnaires: [Previous Weight 0%] [Proposed Weight 5%]

* Additional Information

None.

IDENTIFYING DATA				
Atmosphere-Ocean Interaction				
Subject	Atmosphere-Ocean Interaction			
Code	V10M153V01207			
Study programme	University Master's Degree in Oceanography			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Optional	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	Castro Rodríguez, María Teresa de			
Lecturers	Castro Rodríguez, María Teresa de Des Villanueva, Marisela Eiras Barca, Jorge Ferriz Mas, Antonio Gimeno Presa, Luís Nieto Muñiz, Raquel Olalla Sorí Gómez, Rogert Vázquez Domínguez, Marta			
E-mail	mdecastros@uvigo.es			
Web	http://masteroceanografia.com/			
General description	The atmosphere and the ocean are two physical systems interacting. In this subject we will study all those processes which deal about the interaction between the ocean and the atmosphere as well as their exchanges.			

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
A2	Students who can apply their knowledge and understanding, and problem solving abilities in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study
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.
B3	The students will be able to deepen in the main oceanographic processes and their spatiotemporal scales
B4	The students will be able to analyse oceanographic databases and obtain skills for their treatment.
C2	The students will be able to schedule, design and execute original applied investigations from the stage of recognition until the evaluation of results and discoveries.
C5	The students will be able to draft scientific articles and present their results with clarity, using solid arguments in the development of their conclusions
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.
D1	The students will know and will be able to apply the scientific method in the academic and research fields.
D2	The students will possess the handle skills in the laboratory that allow them to develop autonomous work.
D3	The students will be able to communicate the obtained information and their conclusions in a effective way to the general public, to other scientists and to the competent authorities, listening and answering of effective form and, using an appropriate language to the audience and to the context
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

The students will learn that the atmosphere and the ocean works like an integrated system and they will understand the different temporal and spatial scales of the atmosphere and the ocean.	A1 A2
The student will be able to analyse atmospheric and oceanographic databases and to develop skills in the treatment of the same.	A5 B3 B4 C2 C5 C7 D1 D2 D3 D4

Contents

Topic	
Introduction	Atmosphere influence on ocean Ocean influence on atmosphere Atmosphere and ocean as an integrated system
Previous concepts	Equation of movement of a geophysical fluid Latent Heat Specific Heat Transfer of Heat Density Comparison between atmospheric and oceanic properties
Upwelling	Ekman Transport Coastal Process Upwelling areas Primary production Fisheries
Thermohaline Circulation	Definition of deep water and implications Transport of Heat and budget of CO ₂ Theory of Deep circulation Gulf Current North Atlantic Current. Canary Current Labrador Current
Oceanic evaporation and precipitation	Oceanic evaporation Global Distribution of water steam. Flow of water steam and his divergence Changes in sea water salinity. Transport of water steam to big distance, sources and sinks. Global of humidity Extreme Events: the oceans role on the jet modulation at low levels Atmospheric rivers, implications of climate change
Hurricanes	Definition Physical structure Mechanics Process of training Places and main regions of training Movement and route
El Niño	Introduction Effects of the warm phase (La Niña) Indexes Mechanism
Monsoons	Different warming in earth and ocean Geographic Distribution Diets of winds Extreme rains

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
Essay	1	7	8
Problem and/or exercise solving	2	0	2

*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 main theoretical aspects of the subject in class by means of Powerpoint or similar.
Problem solving	Seminars during which students solve practical activities supervised by the teacher. They are activities developed to improve the significant construction of the knowledge through the interaction between students. The function of the teacher is to present the aims, supervise and to realize the follow-up of the same.
Presentation	Individual or group oral session of a subject from the course.
Seminars	Significant construction of the knowledge through the interaction between the teacher and the student by means of tutorials to orient and solve doubts.

Personalized assistance

Methodologies	Description
Problem solving	During the resolution of practical cases and in the tutorial classes, the attention to the student will be customized with the aim to resolve any type of doubt so much theoretical like practice. Tutorial classes will be virtual through the Campus Remoto by appointment
Seminars	During the resolution of practical cases and tutorials the attention to the student will be able to be customized with the aim to resolve any type of doubt so much theoretical like practice. Tutorials: Monday from 16:00 to 18:00 and Wednesday from 9:00 to 11:00

Assessment

	Description	Qualification	Training and Learning Results			
Essay	Individual or group oral session of a subject from the course.	50	A2 A5	B3	C2 C5 C7	D1 D2 D3 D4
Problem and/or exercise solving	Short answers test about the subjects	50	A1 A2 A5	B3 B4	C7	D2 D4

Other comments on the Evaluation

It is mandatory the attendance the masterlessons and especially the seminars of practical activities.

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/s.

Examinations:

March 11, 15- 17 h 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

Pedlosky, J., **Geophysical Fluid Dynamics**, 1, Springer- Verlag, 1979

Gill, A.E., **Atmosphere- Ocean Dynamics**, 1, Academic Press, 1982

Complementary Bibliography

Recommendations

Subjects that are recommended to be taken simultaneously

Global Change and Marine Ecosystems/V10M153V01208

Climate Models/V10M153V01205

Physical Processes in the Ocean/V10M153V01101

Subjects that it is recommended to have taken before

Physical Oceanography/V10M153V01CF101

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

* Teaching methodologies maintained

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

Problem solving

Seminars

Presentations

* Teaching methodologies modified

Lecturing will be online through Remote Campus, "Zoom", "Teams" or another similar platform

* Non-attendance mechanisms for student attention (tutoring)

Tutorial classes will be virtual through the Campus Remoto by appointment

* Modifications (if applicable) of the contents

Not applicable

* Additional bibliography to facilitate self-learning

Not necessary

* Other modifications

=== ADAPTATION OF THE TESTS ===

* Tests already carried out

Tests done will keep their weight

...

* Pending tests that are maintained

Pending tests will keep their weight

...

* Tests that are modified

[Problems and/or exercise solving face-to-face] => [Problems and/or exercise solving online through FAITC, Remote Campus ...]

* New tests

There will be not any additional test

* Additional Information

IDENTIFYING DATA				
Global Change and Marine Ecosystems				
Subject	Global Change and Marine Ecosystems			
Code	V10M153V01208			
Study programme	University Master's Degree in Oceanography			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Optional	1st	2nd
Teaching language	#EnglishFriendly Spanish Galician English			
Department				
Coordinator	Sobrinó García, María Cristina			
Lecturers	Álvarez Salgado, Xosé Antón González Castro, Bernardino Martínez García, Sandra Sobrinó García, María Cristina Teira González, Eva María			
E-mail	sobrinoc@uvigo.es			
Web	http://masteroceanografia.com/			
General description	The subject is focused to the study of the main processes of global change that affect to the biology of the ocean in different levels of organisation. For this *desglosa the results of observational and experimental studies directed to determine the effect of the global change on populations, communities and marine ecosystems, by means of masterclasses, practices of laboratory, resolution of practical cases and seminars.			

Competencies

Code	
A2	Students who can apply their knowledge and understanding, and problem solving abilities in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study
A4	Students who can communicate their conclusions, and the knowledge and rationale underpinning these, to specialist and nonspecialist audiences clearly and unambiguously
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.
B1	The students will understand in a detailed and based form the theoretical and practical aspects and the work methodology of the oceanography
B2	The students will interpret the behaviour of the global oceanic system and their controlling factors.
B3	The students will be able to deepen in the main oceanographic processes and their spatiotemporal scales
B5	The students will be able to develop the sufficient autonomy to participate in research projects and scientific collaborations, especially in interdisciplinary contexts
C1	The students will be able to obtain advanced and relevant knowledge, of skilled and multidisciplinary character, in the field of the oceanography and their application to the marine environment
C2	The students will be able to schedule, design and execute original applied investigations from the stage of recognition until the evaluation of results and discoveries.
C3	The students will analyse situations and specific oceanographic conditions related with the global change
C4	The students will be able to apply in the practice the obtained knowledge and issue resolutions and judgments in the different oceanography fields
D1	The students will know and will be able to apply the scientific method in the academic and research fields.
D2	The students will possess the handle skills in the laboratory that allow them to develop autonomous work.
D3	The students will be able to communicate the obtained information and their conclusions in a effective way to the general public, to other scientists and to the competent authorities, listening and answering of effective form and, using an appropriate language to the audience and to the context
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
The students will learn the importance of the human effect on the biogeochemical processes to scale global and temporary scales, its repercussions for the marine environment and the sustainability of the ecosystems.	A5
	B3
	B5
	D1
	D4

The students will acquire the capability to interpret and analyse critically the results of observational and experimental studies aimed to determine the effect of the global change on populations, communities and marine ecosystems.	C2 C4 D1
The students will work their skills to express the ideas and knowledge about the topic by oral and written communications.	A2 A4 B2 B3 C3 C4 D3
The students will learn laboratory or field methodologies that will help them to interpret the results showed in the scientific publications related with the field of the Global Change	B1 C1 D2

Contents	
Topic	
SUBJECT 1.	Introduction and reflections to start with a course of global change.
SUBJECT 2.	Global change versus climatic change. Natural environmental variability and antropogenic. The biology of the ocean under global change: answers to different levels of organisation. Multiple factors of stress. Adaptation and acclimation.
SUBJECT 3.	Temperature and nutrients in the context of the global change. Metabolic theory of the ecology.
SUBJECT 4	Effect of the degradation of ozone layer and the increase of the UV radiation on the marine ecosystems. The ozone cycle. UVR penetration in the aquatic environment. Photodegradation and photo inhibition. Direct and indirect effects of UV radiation on marine organisms.
SUBJECT 5.	Impact of the global change on the oxygen cycle in the oceans: expansion of the suboxic and anoxic zones.
SUBJECT 6.	Impact of the global change on the carbon cycle in the oceans: storage of antropogenic carbon and acidification. Effect of CO2 increase on marine organisms and ecosystem
SUBJECT 7.	Impact of the global change on the nitrogen and phosphorus cycles: antropogenic fertilisation by atmospheric and continental drivers.
SUBJECT 8.	Impacts of the global change in the structure and operation of the planktonic communities. Distribution and abundance of functional key groups. Changes in the structure of the communities and in food webs. Interdecadal trends in primary production.
SUBJECT 9.	Fisheries overexploitation. The magnitude of fishing. Effect of fishing on populations and ecosystem. Overexploitation: types, causes and solutions. Overexploitation and the future of fishing.
SUBJECT 10.	Impact of global change on coastal ecosystems. Effects on benthic communities.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	26	26	52
Seminars	6	22	28
Problem solving	0	6	6
Laboratory practical	9	9	18
Seminars	4	4	8
Presentation	2	10	12
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	Exhibition by part of the professor of the concepts but notable of the matter.
Seminars	Work of practical character guided by the professor. It can have individual character or of group. The communication of scientific works in international congresses
Problem solving	Resolution of a practical case: Impact of the global change in the Estuary of Vigo.

Laboratory practical	Laboratory practical classes:
	1) Determination of metabolic taxes: phytoplankton primary production. Photosynthesis-Irradiance curves 2) Multivariate statistical techniques
Seminars	Group tutorials to supervise the work that has to be defended at the end of the course. The students will have to show the advances and argue their proposals to the professor and the rest of the students.
Presentation	Oral defense of a topic related to the subject. The topic will be chosen by the student. The defence of the work will consist of roughly 15 min presentation supported by computer (i.e. power point or similar) and discussion of the main questions made by the professor and/or students. A written report of the work can be required if necessary.

Personalized assistance

Methodologies	Description
Lecturing	The student that wish to be attended in a one-to-one tutorial will be scheduled between 13:00 and 15:00 h. The student shall previously contact the corresponding professor by email.
Seminars	The student that wish to be attended in a one-to-one tutorial will be scheduled between 13:00 and 15:00 h. The student shall previously contact the corresponding professor by email.
Problem solving	The student that wish to be attended in a one-to-one tutorial will be scheduled between 13:00 and 15:00 h. The student shall previously contact the corresponding professor by email.
Laboratory practical	The student that wish to be attended in a one-to-one tutorial will be scheduled between 13:00 and 15:00 h. The student shall previously contact the corresponding professor by email.
Seminars	In group.

Assessment

	Description	Qualification	Training and Learning Results			
Lecturing	Knowledge will be evaluated by a written test.	25	A5	B3	C1	D4
Seminars	Oral defense of a communication to a scientific meeting (poster).	25	A2	B2	C1	D1
				B3	C2	D3
				B5	C4	
Problem solving	Report with the results of a practical case.	15			C1	
					C3	
					C4	
Laboratory practical	Knowledge will be evaluated by a written test.	10			C1	
					C4	
Presentation	Preparation and presentation of a scientific work related to the subject. The follow-up of the work will be done by means of group tutorials. The evaluation will be made taking into account the contribution and implication of the students during the group tutorials, the quality of the written work (if provided) and the oral defence.	25	A5	B2	C1	D1
				B3	C2	D3
					C3	

Other comments on the Evaluation

The evaluation of the theoretical (masterclasses) and practical (laboratory practical lessons) knowledge will be carried out in one examination. The rates obtained from the call in June will be saved for the for the call in July, only in the same academic course. The dates and deadlines will be published in <http://masteroceanografia.com/horarios/>.

It is required from the students that course this subject a responsible and honest behaviour. Any form of fraud (copy or plagiarism) aimed to modify the level of knowledge and skills reached in all type of proof, report or work will be punished. The fraudulent behaviour will be produce the failure of the subject during a complete course. An internal registration of these performances will be also registered, and in case of new fraudulent events, a disciplinary file can be opened.

Sources of information

Basic Bibliography

Intergovernmental Panel on Climate Change (IPCC), **Fifth assessment report (Climate Change 2014: Synthesis Report)**, 2014

Hilborn, R. and Hilborn, U., **Overfishing. What everyone needs to know**, Oxford University Press, 2012

Gattuso & Hansson, **Ocean acidification**, Oxford University Press, 2011

Bode et al., **Cambio climático y oceanográfico en el Atlántico del norte de España**, Instituto Español de Oceanografía, 2012

Complementary Bibliography

Barange et al., **Marine ecosystems and global change**, Oxford University Press, 2010

Zeebe & Wolf-Gladrow, **CO2 in seawater: equilibrium, kinetics, isotopes.**, Elsevier Oceanography Series, 2005

Recommendations

Subjects that are recommended to be taken simultaneously

Atmosphere-Ocean Interaction/V10M153V01207

Palaeoclimatology and Paleoceanography/V10M153V01206

Subjects that it is recommended to have taken before

Biological Oceanography/V10M153V01CF103

Physical Oceanography/V10M153V01CF101

Chemical Oceanography/V10M153V01CF102

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

* educational Methodologies that keep :

All the educational methodologies.

* Educational methodologies that modify

In case of a no face-to-face teaching, all the methodologies will be adapted virtually using as main tools the Remote Campus and Faitic platforms. The modifications will not be significant for most of the methodologies excepting the laboratory lessons and field classes which will be explained using specific tutorials for each subject.

* Mechanism no face-to-face of attention to the students (*tutorías)

One-to-one tutorials with the professors will be performed by using the virtual offices in Remote Campus platform.

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

Contents will not be modified.

* Additional bibliography to facilitate the car-learning

Additional bibliography will not be necessary

=== ADAPTATION OF THE EVALUATION ===

The final test will be replaced by a written individual report that will include the answers to specific questions provided by the professors about the main contents from both, master classes and practical lessons, of the subject.

* Proofs that modify

[Test] = [Written individual report]

IDENTIFYING DATA				
Modelling in Coastal Systems				
Subject	Modelling in Coastal Systems			
Code	V10M153V01209			
Study programme	University Master's Degree in Oceanography			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Optional	1st	2nd
Teaching language				
Department				
Coordinator	Teira Gonzalez, Eva Maria			
Lecturers	Teira Gonzalez, Eva Maria			
E-mail	teira@uvigo.es			
Web				
General description	The teaching guide of this subject is available in the following link: https://ccmaryambientales.uca.es/asignaturas-master-en-oceanografia/ , and is imparted by the Universidad de Cádiz.			

Competencies

Code

Learning outcomes

Expected results from this subject	Training and Learning Results
------------------------------------	-------------------------------

Contents

Topic

Planning

Class hours	Hours outside the classroom	Total hours
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*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

Description

Personalized assistance

Assessment

Description	Qualification	Training and Learning Results
-------------	---------------	-------------------------------

Other comments on the Evaluation

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering

safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

- * Teaching methodologies maintained
- * Teaching methodologies modified
- * Non-attendance mechanisms for student attention (tutoring)
- * Modifications (if applicable) of the contents
- * Additional bibliography to facilitate self-learning
- * Other modifications

=== ADAPTATION OF THE TESTS ===

- * Tests already carried out
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...
- * Pending tests that are maintained
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...
- * Tests that are modified
[Previous test] => [New test]

- * New tests

- * Additional Information
-

IDENTIFYING DATA				
Anthropogenic Impact on the Coast				
Subject	Anthropogenic Impact on the Coast			
Code	V10M153V01210			
Study programme	University Master's Degree in Oceanography			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Optional	1st	2nd
Teaching language				
Department				
Coordinator	Teira Gonzalez, Eva Maria			
Lecturers	Teira Gonzalez, Eva Maria			
E-mail	teira@uvigo.es			
Web				
General description	The teaching guide of this subject is available in the following link: https://ccmaryambientales.uca.es/assignaturas-master-en-oceanografia/ , and is imparted by the Universidad de Cádiz.			

Competencies
Code

Learning outcomes
Expected results from this subject
Training and Learning Results

Contents
Topic

Planning			
	Class hours	Hours outside the classroom	Total hours

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

Methodologies
Description

Personalized assistance

Assessment		
Description	Qualification	Training and Learning Results

Other comments on the Evaluation

Sources of information
Basic Bibliography
Complementary Bibliography

Recommendations

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes

an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

- * Teaching methodologies maintained

- * Teaching methodologies modified

- * Non-attendance mechanisms for student attention (tutoring)

- * Modifications (if applicable) of the contents

- * Additional bibliography to facilitate self-learning

- * Other modifications

=== ADAPTATION OF THE TESTS ===

- * Tests already carried out
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

- * Pending tests that are maintained
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

- * Tests that are modified
[Previous test] => [New test]

- * New tests

- * Additional Information
-

IDENTIFYING DATA				
Biogeochemistry of Coastal Systems				
Subject	Biogeochemistry of Coastal Systems			
Code	V10M153V01211			
Study programme	University Master's Degree in Oceanography			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Optional	1st	2nd
Teaching language				
Department				
Coordinator	Teira Gonzalez, Eva Maria			
Lecturers	Teira Gonzalez, Eva Maria			
E-mail	teira@uvigo.es			
Web				
General description	The teaching guide of this subject is available in the following link: https://ccmaryambientales.uca.es/asignaturas-master-en-oceanografia/ , and is imparted by the Universidad de Cádiz.			

Competencies

Code

Learning outcomes

Expected results from this subject	Training and Learning Results
------------------------------------	-------------------------------

Contents

Topic

Planning

	Class hours	Hours outside the classroom	Total hours
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies

Description

Personalized assistance

Assessment

Description	Qualification	Training and Learning Results
-------------	---------------	-------------------------------

Other comments on the Evaluation

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering

safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

- * Teaching methodologies maintained
- * Teaching methodologies modified
- * Non-attendance mechanisms for student attention (tutoring)
- * Modifications (if applicable) of the contents
- * Additional bibliography to facilitate self-learning
- * Other modifications

=== ADAPTATION OF THE TESTS ===

- * Tests already carried out
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...
- * Pending tests that are maintained
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...
- * Tests that are modified
[Previous test] => [New test]

- * New tests

- * Additional Information
-

IDENTIFYING DATA				
Coastal Ecosystems				
Subject	Coastal Ecosystems			
Code	V10M153V01212			
Study programme	University Master's Degree in Oceanography			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Optional	1st	2nd
Teaching language				
Department				
Coordinator	Teira Gonzalez, Eva Maria			
Lecturers	Teira Gonzalez, Eva Maria			
E-mail	teira@uvigo.es			
Web				
General description	The teaching guide of this subject is available in the following link: https://ccmaryambientales.uca.es/asignaturas-master-en-oceanografia/ , and is imparted by the Universidad de Cádiz.			

Competencies

Code

Learning outcomes

Expected results from this subject	Training and Learning Results
New	

Contents

Topic

Planning

	Class hours	Hours outside the classroom	Total hours
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies

Description

Personalized assistance

Assessment

Description	Qualification	Training and Learning Results
-------------	---------------	-------------------------------

Other comments on the Evaluation

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes

an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

- * Teaching methodologies maintained

- * Teaching methodologies modified

- * Non-attendance mechanisms for student attention (tutoring)

- * Modifications (if applicable) of the contents

- * Additional bibliography to facilitate self-learning

- * Other modifications

=== ADAPTATION OF THE TESTS ===

- * Tests already carried out
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

- * Pending tests that are maintained
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

- * Tests that are modified
[Previous test] => [New test]

- * New tests

- * Additional Information
-

IDENTIFYING DATA				
Design and Carrying out of Oceanographic Campaigns				
Subject	Design and Carrying out of Oceanographic Campaigns			
Code	V10M153V01301			
Study programme	University Master's Degree in Oceanography			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Mandatory	1st	An
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Nombela Castaño, Miguel Angel			
Lecturers	Alejo Flores, Irene Nombela Castaño, Miguel Angel Ramil Blanco, Francisco José Roson Porto, Gabriel Vázquez Otero, María Elsa			
E-mail	mnombela@uvigo.es			
Web	http://masteroceanografia.com/			
General description	<p>The subject "Design and realisation of oceanographic campaigns" will give from the 4 areas of knowledge, where each one they contributes his own methodology. The high cost of the Oceanographic Research does that the oceanographic campaigns have to be necessarily interdisciplinaries, and his design and execution has to realise from the perspective of the optimisation of the available resources. The subject includes the realisation of an oceanographic campaign, whose length will depend on the budgetary availability and of oceanographic ships. It considers a minimum time of ship of 2 days by student to be able to assimilate the distinct methodologies of sampling, taking of data and usual instrumental techniques in Oceanography.</p> <p>This subject will give with annual character, so that it allow a flexible design in function of the availability of oceanographic vessels. Inside his planning considered the possibility that the students can ship in other campaigns of opportunity that realise researchers and that they can offer available squares for teaching.</p>			

Competencies	
Code	
A3	Students who have the ability to integrate knowledge and handle complexity, and formulate judgments with incomplete or limited information, but that include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments
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.
B1	The students will understand in a detailed and based form the theoretical and practical aspects and the work methodology of the oceanography
B4	The students will be able to analyse oceanographic databases and obtain skills for their treatment.
C2	The students will be able to schedule, design and execute original applied investigations from the stage of recognition until the evaluation of results and discoveries.
C4	The students will be able to apply in the practice the obtained knowledge and issue resolutions and judgments in the different oceanography fields
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
Realise a complete route by the methodology of the oceanographic discipline, from the planning of the campaign, the obtaining of data in situ on board of the Oceanographic Vessel going through the learning of the treatment and presentation of the oceanographic results.	A3 A5 B1 B4 C2 C4 D2 D4

Contents	
Topic	
Design of the oceanographic campaign.	Adjusting the aims to the technical characteristic of the Oceanographic Vessel (O.V.) Configuration of the O.V. to reach the aims. Calculation of time in traffics and in stations.
Execution of the oceanographic campaign.	Management of the human resources. Management of the technical equipments. Management of the time.
Broadcast of reports of oceanographic campaigns.	Structure. Contents. Incidents.
Handling oceanographic equipment of data acquisition	Direct: samplings in the water column and in the bottom. Indirect: in the water column and in the bottom.
Treatment of oceanographic data.	Handling of acquisition software and of oceanographic data.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	5	7.5	12.5
Laboratory practical	15	18.75	33.75
Studies excursion	25	37.5	62.5
Presentation	1	12.75	13.75
Seminars	2	0.5	2.5

*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 basic concepts related to the design and realization of oceanographic campaigns will be presented by the professor.
Laboratory practical	The students will become familiar with the laboratory techniques for the preparation of the samples collected in the oceanographic campaign before their analysis, with the use of oceanographic data acquisition and treatment software.
Studies excursion	A campaign will be made on board an Oceanographic Vessel to become familiar with the use of the different data acquisition equipment both in the water column and in the substrate.
Presentation	With the information collected in the campaign at a Oceanographic vessel, the students will have to make the report of the campaign and expose it in the class.
Seminars	There will be tutorials in small groups where students can ask questions and answer questions.

Personalized assistance	
Methodologies	Description
Lecturing	The students will be personally attended during the development of the master sessions as well as during the individual tutorials enabled for this purpose.
Laboratory practical	The students will be personally attended during the development of laboratory practices as well as during the individual tutorials enabled for this purpose.
Studies excursion	The students will be personally assisted during the development of field trips as well as during the individual tutorials enabled for this purpose.
Presentation	The students will be personally attended during the development of the presentations / exhibitions as well as during the individual tutorials enabled for that purpose.
Seminars	The students will be personally attended during the development of the group tutorials as well as during the individual tutorials enabled for that purpose.

Assessment						
	Description	Qualification	Training and Learning Results			
Laboratory practical	Will be evaluated the attitude and the use of the activities realised in the laboratory and in the use of specific software.	25	A3	B1 B4	C2	D2
Studies excursion	Will be evaluated so much the quality of the report of campaign like the attitude during unroll it of the same.	50	A3 A5	B1 B4	C2 C4	D2 D4
Presentation	Will be evaluated the structure, content, clarity of the exhibition and organisation of the time during presentation.	25	A5	B4		D4

Other comments on the Evaluation

The date, time and place of the evaluation tests will be published on the master's official website.

Students who study this subject are responsible and honest behavior. Any form of fraud (copying, or plagiarism) aimed at distorting the level of knowledge and skills reached in any type of test, report or work will be considered inadmissible. Fraudulent behaviors may involve suspending the subject during a full course. An internal record of these actions will be kept so that, in the case of recidivism, request the opening of a disciplinary file to the Rectorate.

Sources of information

Basic Bibliography

Emery, W.J., and Thomson, R.E., **Data analysis methods in physical oceanography**, Elsevier,

Complementary Bibliography

Varios, **Manuales de los diferentes equipos empleados**, varias,

Varios, **Methods in oceanography**, Elsevier,

Varios, **Informes de diferentes campañas oceanográficas**, Non publicados,

Recommendations

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

* Teaching methodologies maintained

- 1.- Mixed teaching: they keep
- 2.- Teaching no face-to-face: they will adapt to the available resources.

* Teaching methodologies modified

- 1.- Mixed teaching: they do not modify
- 2.- Teaching no face-to-face: the practices of laboratory and cruise will be virtualized the most possible. Likewise, it will propose activities that stimulate his self learning

* Non-attendance mechanisms for student attention (tutoring)

- 1.- Mixed teaching: previous concertation by email, face-to-face and/or virtual through Remote Campus.
- 2.- Teaching no face-to-face: previous concertation by email, virtual through Remote Campus

* Modifications (if applicable) of the contents

- 1.- Mixed teaching: it does not have the intention to change the contents
- 2.- Teaching no face-to-face: it does not have the intention to change the contained

* Additional bibliography to facilitate self-learning

Is not necessary

* Other modifications

=== ADAPTATION OF THE TESTS ===

* Tests already carried out

Test XX: [Previous Weight 00%] [Proposed Weight 00%]

- 1.- Mixed teaching: they conserve the weights of the face-to-face situation.

2.- Teaching no face-to-face: they conserve the weights of praises face-to-face situation

* Pending tests that are maintained

Test XX: [Previous Weight 00%] [Proposed Weight 00%]

...

* Tests that are modified

[Previous test] => [New test]

1.- Mixed teaching: they do not modify (oral presentation and defense of the report of an oceanographic campaign)

2.- Teaching no face-to-face: it does not modify (oral presentation and defense of the report of an oceanographic campaign)

* New tests

* Additional Information

During the no face-to-face teaching, requires of the students that, in these exceptional circumstances, face this matter with a responsible and honest behaviour. It will consider inadmissible any form of copy directed to false the level of knowledges and skills reached in the preparation of the homeworks, as well as during the virtual examination. If there is some suspicion of some type of fraudulent behaviour, will be able to subject to the students to an additional control to check his veracity.

IDENTIFYING DATA				
Master's Degree Dissertation				
Subject	Master's Degree Dissertation			
Code	V10M153V01302			
Study programme	University Master's Degree in Oceanography			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	15	Mandatory	1st	An
Teaching language	Spanish			
Department				
Coordinator	Nieto Palmeiro, Óscar			
Lecturers	Nieto Palmeiro, Óscar			
E-mail	palmeiro@uvigo.es			
Web	http://masteroceanografia.com/trabajo-fin-de-master/			
General description	It will consist in a work of investigation in the field of the Oceanography, in which sintetice and integrate the competitions purchased in the educations.			

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
A2	Students who can apply their knowledge and understanding, and problem solving abilities in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study
A3	Students who have the ability to integrate knowledge and handle complexity, and formulate judgments with incomplete or limited information, but that include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments
A4	Students who can communicate their conclusions, and the knowledge and rationale underpinning these, to specialist and nonspecialist audiences clearly and unambiguously
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.
B1	The students will understand in a detailed and based form the theoretical and practical aspects and the work methodology of the oceanography
B2	The students will interpret the behaviour of the global oceanic system and their controlling factors.
B3	The students will be able to deepen in the main oceanographic processes and their spatiotemporal scales
B4	The students will be able to analyse oceanographic databases and obtain skills for their treatment.
B5	The students will be able to develop the sufficient autonomy to participate in research projects and scientific collaborations, especially in interdisciplinary contexts
C1	The students will be able to obtain advanced and relevant knowledge, of skilled and multidisciplinary character, in the field of the oceanography and their application to the marine environment
C2	The students will be able to schedule, design and execute original applied investigations from the stage of recognition until the evaluation of results and discoveries.
C3	The students will analyse situations and specific oceanographic conditions related with the global change
C4	The students will be able to apply in the practice the obtained knowledge and issue resolutions and judgments in the different oceanography fields
C5	The students will be able to draft scientific articles and present their results with clarity, using solid arguments in the development of their conclusions
D1	The students will know and will be able to apply the scientific method in the academic and research fields.
D2	The students will possess the handle skills in the laboratory that allow them to develop autonomous work.
D3	The students will be able to communicate the obtained information and their conclusions in a effective way to the general public, to other scientists and to the competent authorities, listening and answering of effective form and, using an appropriate language to the audience and to the context
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

Endow to the students of the competences, knowledges, skills and tools, in order to qualify them, from a technical-scientific point of view, for the realisation, presentation and defence of a research work.	A1
This work will facilitate that the student have a taking of direct contact with the instrumentation, methodological techniques and methods for interpretation of data used in scientific-technical studies in the ocean. Likewise, it will give him the opportunity to work in a consolidated group of research. Hence, they are initiating their scientific work in an individual way and/or in a group.	A2
	A3
	A4
	A5
	B1
	B2
	B3
	B4
	B5
	C1
	C2
	C3
	C4
	C5
	D1
	D2
	D3
	D4

Contents

Topic

The student will be able to make the Work End of Máster in the following big areas:

- Biological oceanography
- Physical Oceanography
- Chemical Oceanography
- Geological Oceanography
- Other disciplines related with the half marine and that are inside the contents given in the máster.

The lines of investigation or thematic fields offered are the following:

- Marine geology
- Coastal Geology
- Carbon dioxide, global Change and temporary series
- chemical Processes of metals traces with ligandos organic.
- Global changes in the oceanographic chemistry and biogeochemical cycles.
- Ecology and physiology planctónica.
- Oceanography Pesquera
- Effects of global changes in the biological oceanography.
- Global changes in the circulation to wide, meso- and sub-meso scale.
- Fronts, twists and systems of afloramentos.
- Hydrodynamic modelling.
- Biology larvaria of marine invertebrates.
- Effects of physical processes and chemists in the cycles bioxeoquímicos and answer of the biological communities.
- Analysis sedimentario, micropaleontológico and isotopic of oceanic polls.
- Ecology bentónica.
- Analysis of oceanographic temporary series.
- Resulted of oceanographic Campaigns.
- Marine geochemistry.
- Ways of climatic variability.
- Interaction ocean-atmosphere.
- Modelling of the ocean.
- Climatic change in the ocean.
- Energy in half marine (aeolian, maremotriz, currents).
- Identification in analysis of registers paleoclimáticos.
- Dynamic of gases invernadero in the coastal systems.
- Diagénesis Of the organic matter and flows bentónicos.
- Influence of the activity antrópica on the biogeochemical processes in the coastal systems.
- Recent tectonic activity in coastal zones.
- Stratigraphy of coastal zones and his relation with the changes of the level of the mar.
- Geomorfología of continental margins.
- Biological oceanography: Biology and Ecology of the Plankton.
- Ecophysiology of macroalgas and ficología applied.
- Microbial and biogeochemical ecology of the interfase waters-sediment.
- Hydrodynamic modelling in coastal zones.
- Operational oceanography in coastal zones.
- Applications of the teledetection to the coastal oceanography.

Planning			
	Class hours	Hours outside the classroom	Total hours
Mentored work	0.25	354.5	354.75
Presentation	0.25	20	20.25

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

Methodologies	
	Description
Mentored work	Significant construction of knowledge through the interaction between the tutor and the student by means of tutorial sessions which can be personalised or carried out in very reduced in groups. In these season, the professor orients and resolves doubts.
Presentation	It consists in obtaining the keys for the preparation of the presentation of the work at the end of the master course.

Personalized assistance

Methodologies	Description
Mentored work	The tutors and the works will be offered and assigned to beginning of the master course. The student will have to enter into appointments with his tutor when was required, in order to go advancing in the development of the work.

Assessment		Qualification	Training and Learning Results			
	Description					
Mentored work	The scientific content and quality of the written document will be evaluated by the designed evaluating committee.	70	A1 A2 A3 A4 A5	B1 B2 B3 B4 B5	C1 C2 C3 C4 C5	D1 D2 D3 D4
Presentation	The evaluating committee will evaluate the oral presentation and defense of the work.	30	A1 A2 A3 A4 A5	B1 B2 B3 B4 B5	C1 C2 C3 C4 C5	D1 D2 D3 D4

Other comments on the Evaluation

There will be two ordinary announcements to proceed to the defense of the master's degree dissertation, one in June and another in July. The rules, the calendar of procedures, the evaluation guidelines, and another relevante information will be published in the following link <http://masteroceanografia.com/trabajo-fin-de-master/>.

Students are strongly requested to fulfil a 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

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in

advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

In the case of no face-to-face teaching the contents of the work will be adapted and the defense will be via the Campus Remoto. Evaluation criteria will not change.

IDENTIFYING DATA				
Physical Oceanography				
Subject	Physical Oceanography			
Code	V10M153V01CF101			
Study programme	University Master's Degree in Oceanography			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	1st	1st
Teaching language	Spanish			
Department				
Coordinator	Varela Benvenuto, Ramiro Alberto			
Lecturers	Castro Rodríguez, María Teresa de Costoya Noguerol, Jorge Gómez Gesteira, Ramón Varela Benvenuto, Ramiro Alberto			
E-mail	rvarela@uvigo.es			
Web	http://masteroceanografia.com/			
General description	Acquisition of basic knowledges for the understanding of the main physical processes that occur in the oceans, attending especially to the different scales space-temporary in which they operate said physical processes in the field of the physical oceanography.			

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.
B1	The students will understand in a detailed and based form the theoretical and practical aspects and the work methodology of the oceanography
C6	The students will be able to understand the controlling processes of the water masses, species and organisms distribution in the open ocean and in regions of special interest that capacite them for a oceanographic competitive research
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.
D1	The students will know and will be able to apply the scientific method in the academic and research fields.
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
Acquire basic knowledges to understand the physical processes that occur in the ocean.	A1 A5 B1 C6 C7 D1 D4
Capacity to understand the different scales space-temporary in which they operate the physical processes in the field of the physical oceanography.	A1 A5 B1 C6 C7 D1 D4
Matlab initiation level procedures	A5

Contents
Topic

Equation of state of seawater	Seawater physical properties. EOS-80 and TEOS-10 conventions.
Continuity equation	Boussinesq approximation, geostrophic balance, Ekman balance and transport.
Navier-Stokes equations	Understanding potential and total vorticity. Effects
Ocean vorticity	Main concept of wind waves. Classification of the oceanic waves.
Waves in the ocean	Tide origin. Tidal harmonic components
	Gravity waves in fluids. Deep and shallow water waves
CLIMATOLOGY	Electromagnetic radiation
	Simple heat balance in a water reservoir
HYDROGRAPHY	Surface distribution of salt and temperature
	Thermal and salt profiles in the water column
	Water masses. TS diagrams.
	Static and dynamic stability. The Richardson number
CURRENTS	Surface currents and the wind system. systems of winds. Western intensification.
	Geostrophic flow. Barotropic and baroclinic regimes. Dynamic topography.
	Ekman pumping. Convergences and divergences. Upwelling and downwelling.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	13	25	38
Seminars	16	15	31
Autonomous problem solving	1	5	6

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

Methodologies

	Description
Lecturing	Classical theoretical explanation/lecture.
Seminars	Real world examples questions and exercises to be solved with the teacher's help and by group discussion.
Autonomous problem solving	Exercises and problems to be solved individually at home

Personalized assistance

Methodologies	Description
Lecturing	Teacher's lecture on the corresponding subject, with a continuous interaction of the students to solve doubts about subjects of interest that can arise in this regard Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Seminars	Resolution of exercises and problems (all they extracted from real situations)
Autonomous problem solving	Reports, exercises and complementary problems to be individually fulfilled

Assessment

Description	Qualification	Training and Learning Results
LecturingExamination	60 A1 B1	D1
	A5	D4
SeminarsReports to be evaluated individually.	40 A1 B1	D1
	A5	D4

Other comments on the Evaluation

Students are strongly requested to fulfil a 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

Sources of information

Basic Bibliography

VARELA R.A. y ROSÓN, G, **Métodos en Oceanografía Física**, Editorial Anthias,
PICKARD, G.L. y W. EMERY, **Descriptive Physical Oceanography**, Pergamon Press,
Periáñez, Raúl, **Fundamentos de Oceanografía Dinámica**, Univ. de Sevilla,
Malek-Madani, Reza, **Physical Oceanography: A Mathematical Introduction with MATLAB**, Chapman and Hall/CRC,
Complementary Bibliography
TOMCZAK, M. y J. STUART GODFREY, **Regional Oceanography: an introduction**, Pergamon,
BROWN, J., **Ocean circulation. Open University course Team**, Pergamon press,
Stewart, Robert., **Introduction to Physical Oceanography**, Texas A&M University,

Recommendations**Subjects that continue the syllabus**

Atmosphere-Ocean Interaction/V10M153V01207
Physical Processes in the Ocean/V10M153V01101

Other comments

PREVIOUS REQUIREMENTS: The Educational Commission of the Master will evaluate, for each student that do not proceed from the degree in Marine Science, the particular need of receiving this complementary course in view of his/her previous knowledge and experience.

Contingency plan**Description**

The plan of development and evaluation described contemplates the case of a normal development of the theoretical and practical classes in a face-to-face context. If by exceptional circumstances this context varies, having to take into account mixed or telematic teaching, we will proceed as follows:

1. Mixed teaching. The face-to-face classes will be issued in direct with the means that the University of Vigo supply, guaranteeing in all the cases the opportunity to be able to make questions or consult doubts.
2. If the face-to-face or mixed teaching is not possible, we will prepare the necessary videos to cover the theoretical classes, the seminars and the practices and will put to disposal of the students.

In case that the face-to-face teaching was not possible, and given the concrete characteristics of this subject that looks for to supply the basic elements of knowledge of physical oceanography, the relative weight of the different sections will change, suppressing the final examination and evaluating the students by a continuous evaluation system including diverse exercises and seminars.

Previously: examination 60% works 40%

Exceptional circumstances: continuous Evaluation/seminars/exercises: 100%

IDENTIFYING DATA				
Chemical Oceanography				
Subject	Chemical Oceanography			
Code	V10M153V01CF102			
Study programme	University Master's Degree in Oceanography			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	1st	1st
Teaching language	Spanish			
Department				
Coordinator	Nieto Palmeiro, Óscar			
Lecturers	Nieto Palmeiro, Óscar			
E-mail	palmeiro@uvigo.es			
Web	http://masteroceanografia.com/			
General description	This subject is an introduction for those students that do not have previously studied chemical oceanography during the graduate and that will be used as a background for the following subjects in this master.			

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.
B1	The students will understand in a detailed and based form the theoretical and practical aspects and the work methodology of the oceanography
D1	The students will know and will be able to apply the scientific method in the academic and research fields.
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
Establish the chemical composition of the water of sea, determining the mechanisms and factors that compose it.	A1 A5 B1 D1
Describe the balances of the chemical species and gases dissolved in oceanic waters, including climatic and thermodynamic considerations.	A1 A5 B1 D1 D4
Study the mechanisms of transfer between the interphases.	A1 A5 B1 D1 D4
Establish the global cycles of the elements	A1 A5 B1 D1 D4

Contents	
Topic	
Composition and stoichiometry of seawater.	Major components of the water of mar.
Concept of salinity.	Salinity: chlorinity and chlorosity.
Reactivity of the minor elements in seawater: vertical profiles and time of residence.	Classification of elements. Vertical profiles. Time of residence.
Chemical speciation.	States of oxidation. Natural complexes in seawater.

Solubility of the gases in seawater.	Composition of the atmosphere. Dissolved gases in the water column. Dissolved oxygen in seawater.
Chemistry of interstitial water	The diagenetic sequence and redox reactions in sediments. Inputs of chemical elements from the interstitial water to the oceans.
Biogeochemical cycles of the C and of the elements nutrients	Cycle of C

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	0.5	0	0.5
Lecturing	17.5	25	42.5
Laboratory practical	6	0	6
Seminars	4	0	4
Problem and/or exercise solving	2	0	2
Report of practices, practicum and external practices	0	10	10
Essay	0	10	10

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

Methodologies

	Description
Introductory activities	Brief presentation of the educational guide and of the development of the subject.
Lecturing	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 matter.
Laboratory practical	Significant construction of the knowledge through the interaction the 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 the laboratory and the function of the professor is to present the aims, orient the work and realise the follow-up of the same.
Seminars	Significant construction of the knowledge through a skilled meeting, of technical or academic nature, that tries to develop a deep study on the matter in question. The significant construction of the knowledge is active, since the students have to look for and elaborate the information in the frame of a reciprocal collaboration between himself and from the interaction with the professor.

Personalized assistance

Methodologies	Description
Introductory activities	Any doubt that arise to the student can consult it through the forums that enable for this in the platform TEMA or can agree an appointment with the professor to interview in his dispatch.
Lecturing	Any doubt that arise to the student can consult it through the forums that enable for this in the platform TEMA or can agree an appointment with the professor to interview in his dispatch.
Laboratory practical	Any doubt that arise to the student can consult it through the forums that enable for this in the platform TEMA or can agree an appointment with the professor to interview in his dispatch.
Seminars	Any doubt that arise to the student can consult it through the forums that enable for this in the platform TEMA or can agree an appointment with the professor to interview in his dispatch.
Tests	Description
Problem and/or exercise solving	In the review of examinations

Assessment

	Description	Qualification	Training and Learning Results		
Problem and/or exercise solving	The student will have to answer in a succinct way to some questions in which it will evaluate the capacity to comprise and relate the concepts learnt during the subject.	50	A1 A5	B1 D4	D1

Report of practices, practicum and external practices	The students in group will present a memory of the work of practices realised in the laboratory and will be evaluated of agreement to some criteria that will be published as a rubric in the platform TEMA.	25	A1 A5	B1	
Essay	The students in group will present a memory of the work realised in the sessions of seminars and will be evaluated of agreement to some criteria that will be published as a rubric in the platform TEMA.	25	A1 A5	B1 D1 D4	

Other comments on the Evaluation

In order to surpass the whole subject, all and each one of the parts that compose the subject have to be surpassed with a minimum qualification of 5 points.

In case that any of the proofs of short answer and the resolution and of problems and/or exercises do not reach the minimum note, will repeat the examination in the second announcement.

In the case that it do not reach the minimum note in "Reports/memories of practice" and/or the "Jobs and projects", it will present again the work in the term that the professor estimate timely.

Sources of information

Basic Bibliography

Millero F.J. y Sohn M.L., **Chemical Oceanography**, 4ª edición, CRC Press, cop., 2013

Chester R. y Jickells T.D., **Marine geochemistry**, 3ª edición, Wiley-Blackwell, cop., 2012

Complementary Bibliography

Open University course team, **Seawater : its composition, properties and behaviour**, 1ª edición, Pergamon Press, 1991

Recommendations

Subjects that continue the syllabus

Chemical Reactions in the Ocean/V10M153V01103

Contingency plan

Description

=== EXCEPTIONAL PLANNED MEASURES ===

In the face of the uncertain and unpredictable evolution of the health alert triggered by COVID-19, the University establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it based on safety criteria, health and responsibility, and ensuring teaching in a non face-to-face or non face-to-face setting. These already planned measures guarantee, when it is mandatory, the development of teaching in a more agile and effective way to be known in advance (or with a long advance) by pupils and teachers through the standardised and institutionalised tool of the DOCNET teaching guides.

=== ADAPTATION OF METHODOLOGIES ===

Not applicable

* Teaching methodologies to be modified

- Laboratory practice

Laboratory practices that cannot be done in face-to-face mode will be done in the form of a simulation through the virtual classroom (Remote Campus) that the University of Vigo has the disposition of teachers and students. After the virtual classroom session, they will have to present the corresponding report according to the criteria and indications of the trainee teachers.

- Introductory activities:

- Master Lesson: The

The sessions of these activities that cannot be done in person, will be carried out through the virtual classroom that the University of Vigo has the disposition of teachers and students.

* Off-site student care (tutoring)

Students can consult their questions by appointment in the teacher's virtual office: Room 1752, access code coDC4elw

On the TEMA platform is enabled the Forums section, where a forum will be open for each classroom topic taught, as well as

several forums for laboratory practices, problem classes and seminars. In this way, students will be able to ask questions that can be answered by both teachers and/or classmates/classmates.

* Modifications (if applicable) of the contents to be imparted

* Additional bibliography to facilitate self-learning

Websites and related videos will be used to complement the training of students, which will be made available to students on the TEMA platform.

* Other amendments

=== ADAPTATION OF THE EVALUATION ===

* Tests already carried out

Test *XX: [Previous Weight 00%] [Proposed Weight 00%]

Not applicable

* Evidence pending and ongoing

Test *XX: [Previous Weight 00%] [Proposed Weight 00%]

- Practice report

- Work

- Problem solving and exercises

Does not change the weighting in the final note

* Tests to be modified

[Previous test] => [New test]

Not applicable

* New evidence

* Additional information

IDENTIFYING DATA				
Biological Oceanography				
Subject	Biological Oceanography			
Code	V10M153V01CF103			
Study programme	University Master's Degree in Oceanography			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	1st	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Teira Gonzalez, Eva Maria			
Lecturers	Lastra Valdor, Mariano Martínez García, Sandra Teira Gonzalez, Eva Maria			
E-mail	teira@uvigo.es			
Web	http://masteroceanografia.com/			
General description	The subject tackles the study of communities, food webs and the main oceanographic processes that take place in the ocean. We will present basic notions on the cycle of the organic matter in the marine environment. We will do special emphasis on microbial plankton communities, as they play a predominant role in marine biogeochemical cycles. The fundamental aim is to acquire basic knowledge on the communities of organisms, their interactions and the oceanographic processes in order to understand the role of the biology of the ocean in the Earth system functioning.			

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.
B1	The students will understand in a detailed and based form the theoretical and practical aspects and the work methodology of the oceanography
D1	The students will know and will be able to apply the scientific method in the academic and research fields.
D2	The students will possess the handle skills in the laboratory that allow them to develop autonomous work.

Learning outcomes

Expected results from this subject	Training and Learning Results
Students will be able to use the terminology and concepts related with the biological oceanography scientific field	A1 B1
Students will be able to apply the scientific methodology and the basic technics related with the biological oceanography research field	A1 A5 B1 D1 D2
Students will be able to analyse and explain the relationship between the organisms and the environmental factors	A1 B1
Students will recognize the diversity and function of the main planktonic and benthonic marine groups	A1 B1
Students will be able to comprehensively describe the processes of circulation of the organic matter in the marine environment	A1 B1
Students will be able to evaluate, formulate, and resolve problems related with the oceanography	B1 D1
Students will be able to demonstrate advanced oral and written communication skills	D1

Contents

Topic	
Lesson 1. The marine environment.	Classification of marine environments and organisms. Abiotic conditions: solar radiation, temperature, salinity, density, pressure. Oceanic circulation.
Lesson 2. Phytoplankton and primary production.	Main groups of phytoplankton. Photosynthesis and primary production. Factors that control primary production. Spatial and temporal variability.

Lesson 3. Microbial plankton: decomposition of organic matter.	Bacteria, archaea, virus and heterotrophic protists. Biomass, production and bacterial growth efficiency. Factors that control the bacterial growth: resources versus predation.
Lesson 4. Zooplankton and pelagic food webs.	Main groups of zooplankton. Transfer of energy and trophic chains. Types of pelagic food webs.
Lesson 5. Benthonic Organisms.	Main groups of benthonic plants and animals. Factors that determine the structure of benthonic communities.
Lesson 6. Benthonic communities.	Benthonic communities of shallow rocky and sandy environments. Benthonic communities of deep systems.
Lesson 7. Human impact on the marine environment.	Overexploitation. Invasive species. Destruction and alteration of habitats. Climate change.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	18	31	49
Studies excursion	5	4	9
Laboratory practical	4	7	11
Presentation	2	4	6

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

Methodologies

	Description
Lecturing	In-person presentation of subject contents supported with graphic material.
Studies excursion	Application of methodologies for field sampling in biological oceanography.
Laboratory practical	Study of the effect of temperature or nutrients on the microbial plankton metabolic rates.
Presentation	Oral presentation of the results obtained by the students in the field and laboratory practices.

Personalized assistance

Methodologies	Description
Lecturing	Doubts about theoretical and practical contents will be resolved through on-line or in-person tutorials.
Studies excursion	Doubts about theoretical and practical contents will be resolved through on-line or in-person tutorials.
Laboratory practical	Doubts about theoretical and practical contents will be resolved through on-line or in-person tutorials.
Presentation	Doubts about theoretical and practical contents will be resolved through on-line or in-person tutorials.

Assessment

	Description	Qualification	Training and Learning Results	
Lecturing	Contents will be evaluated through a written exam.	60	A1 A5	B1
Studies excursion	Field work will be evaluated through attendance and participation.	10	A1	B1
Laboratory practical	Laboratory work will be evaluated through attendance and participation. Technical skills, cleanliness and preciseness will be specifically valued.	10		B1 D1 D2
Presentation	The quality of the presentation as well as the clarity of the exposition and the capacity to communicate of the student will be specifically valued.	20	A5	D1

Other comments on the Evaluation

The official dates of evaluation tests will be available at: <http://masteroceanografia.com/horarios/>

Sources of information

Basic Bibliography

Lalli CM, **Biological oceanography. An introduction**, Elsevier,
Miller, CB, **Biological oceanography**, Wiley-Blackwell,

Complementary Bibliography

Kaiser, MJ, **Marine ecology. Processes, systems, and impacts**, Oxford University press, New York,
Kirchman DL, **Microbial ecology of the oceans**, Wiley-Liss, New York,
Reynolds C, **Ecology of Phytoplankton**, Cambridge University,
Castellani, C & Edwards, M, **Marine Plankton**, Oxford University press, New York,

Recommendations

Subjects that continue the syllabus

Subjects that are recommended to be taken simultaneously

Design and Carrying out of Oceanographic Campaigns/V10M153V01301
Oceanography of Ecosystems/V10M153V01102

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 a 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 ===

Due to the uncertain and unpredictable evolution of the sanitary alert caused by the COVID- 19, the University establishes an extraordinary planning that will be activated in 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 no totally face-to-face.

=== ADAPTATION OF The METHODOLOGIES ===

*** Educational methodologies that change**

In the situation of no face-to-face teaching the lessons will be imparted using the Virtual Classrooms of the Remote Campus, following the official calendar and would be complemented with the uploading of presentations in FAITIC and with questionnaires of self-evaluation.

In the situation of no face-to-face teaching the field excursion and the practice of laboratory would be substituted by practical exercises of analysis of field sampling data and of an experiment, respectively. The follow-up of the work will be done using the email, the platform FAITIC and the Virtual Classrooms.

*** Mechanism for no face-to-face of attention to the students (tutorials)**

In the no face-to-face modality personal attention would be by telematic means (email, teacher virtual rooms of the remote campus, or through the forums of FAITIC). Tutorials must be scheduled in advance.

*** Modifications of the contents**

The contents will not be modified.

*** Additional bibliography to facilitate self-learning**

-An introduction to the world's oceans: http://highereducation.mheducation.com/sites/0073376701/student_view0/index.html
-Aranguren-Gassis, M., Teira, E., Serret, P., Martínez-García, S., & Fernández, E. (2012). Potential overestimation of bacterial respiration rates in oligotrophic plankton communities. *Marine Ecology Progress Series*, 453, 1-10.
-Martínez-García, S., Fernández, E., Álvarez-Salgado, X. A., González, J., Lønborg, C., Marañón, E., ... & Teira, E. (2010). Differential responses of phytoplankton and heterotrophic bacteria to organic and inorganic nutrient additions in coastal waters off the NW Iberian Peninsula. *Marine Ecology Progress Series*, 416, 17-33.
-Martínez-García, S., Fernández, E., Aranguren-Gassis, M., & Teira, E. (2009). In vivo electron transport system activity: a method to estimate respiration in natural marine microbial planktonic communities. *Limnology and Oceanography: methods*, 7(6), 459-469.

*** Other modifications**

No other modifications are contemplated.

=== ADAPTATION OF The EVALUATION ===

In the case of no face-to-face teaching the types of proofs of evaluation will not be modified, and will take place through the remote campus or FAITIC.

IDENTIFYING DATA				
Geological Oceanography				
Subject	Geological Oceanography			
Code	V10M153V01CF104			
Study programme	University Master's Degree in Oceanography			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	1st	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Nombela Castaño, Miguel Angel			
Lecturers	Alejo Flores, Irene Francés Pedraz, Guillermo Mena Rodríguez, Ángel Nombela Castaño, Miguel Angel Pérez Arlucea, Marta María			
E-mail	mnombela@uvigo.es			
Web	http://masteroceanografia.com/			
General description	It is a complement formative that they will have to follow the students that do not proceed of the degree in Marine Sciences. The Educational Commission of the Master will study for each case, in sight of the training and previous experience of each student, the need of follow this subject			

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.
B1	The students will understand in a detailed and based form the theoretical and practical aspects and the work methodology of the oceanography
D1	The students will know and will be able to apply the scientific method in the academic and research fields.
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
Purchase basic knowledges to understand the internal and external geological cycles in the frame of the Plate Tectonic.	A1 B1 D1
Capacity to take consciousness of the different scales space-temporary in which the geological processes operate in the field of the geological oceanography.	A1 A5 B1 D4
Understand the importance for the human being of the geological processes and products in the field of the marine geology.	A5 B1 D1 D4

Contents

Topic	
The Earth System	The Earth as a dynamic system. Fundamental Principles of the Geology and concept of geological time. The geological cycle. Sources of energy of the external system and of the internal system. Scale space-temporary of the terrestrial processes.
Introduction to the Plates Tectonic	The continental drift and the ocean expansion. Continental margins: active and passive. Plate edges: convergent, divergent and transformation The cycle of Wilson. Tectonic and climate: processes cyclicity in the geological record.

Basic concepts of sedimentology	Fundamental principles. Sedimentary structures. Facies and facies analysis.
Coastal and marine sedimentary environments.	Processes and products. Sedimentary environments.
Georesources and marine geological risks	Types of marine georesources. Natural risks. Induced risks.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	18	31.5	49.5
Laboratory practical	9	11.25	20.25
Seminars	3	2.25	5.25

*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 main concepts of each topic will be explained by the teacher and the students will be involved by asking questions.
Laboratory practical	Resolution of maps and simple geological sections. Use of basic techniques in sedimentology. Recognition of visu of the main groups of rocks.
Seminars	The students will present in small groups doubts that will be solved by the teacher and the rest of the students of the group.

Personalized assistance

Methodologies	Description
Lecturing	The students can be personally assisted both in the development of the lectures and in the hours of individual tutoring reserved for that purpose.
Laboratory practical	The students can be personally attended both in the development of laboratory practices and in the hours of individual tutoring reserved for that purpose.
Seminars	Students can be personally attended both in the development of group tutoring and in the individual tutoring hours reserved for this purpose.

Assessment

	Description	Qualification	Training and Learning Results		
Lecturing	It will consist in a proof written.	60	A1 A5	B1	D1 D4
Laboratory practical	For each one of the practices the students will have to present a memory that will be evaluated.	40	A5	B1	D4

Other comments on the Evaluation

The date, time and place of the evaluation tests will be published on the official website of the Faculty of Marine Sciences.

Students who study this subject are responsible and honest behavior. Any form of fraud (copy or plagiarism) aimed at distorting the level of knowledge and skills reached in any type of test, report or work will be considered inadmissible. Fraudulent behaviors may involve suspending the subject during a full course. An internal record of these proceedings will be kept so that, in case of recidivism, request the opening of a disciplinary file to the Rectorate.

Sources of information

Basic Bibliography

Leeder, M.R., Pérez Arlucea, M., **Physical processes in Earth and Environmental Sciences**, Blackwell Publishing, 321 pp.,
Tarbuck, E.J., Lutgens, F.K., **Ciencias de la Tierra. Una introducción a la Geología Física**, 10th Edition. Prentice Hall. Madrid. 710 pp.,

Recommendations

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

* Teaching methodologies maintained

- 1.- Mixed teaching: they keep
- 2.- Teaching no face-to-face: they will adapt to the available resources.

* Teaching methodologies modified

- 1.- Mixed teaching: they do not modify
- 2.- Teaching no face-to-face: practices of laboratory will treat of virtualize the most possible. Likewise they will propose activities that stimulate his self learning.

* Non-attendance mechanisms for student attention (tutoring)

- 1.- Mixedteaching: previous concertation by email, face-to-face and/or virtual through Remote Campus.
- 2.- Teaching no face-to-face: previous concertation by email, virtual through Remote Campus

* Modifications (if applicable) of the contents

- 1.- Mixed teaching: it does not have the intention to change the contents
- 2.- Teaching no face-to-face: it does not have the intention to change the contained

* Additional bibliography to facilitate self-learning

Is not necessary

* Other modifications

=== ADAPTATION OF THE TESTS ===

* Tests already carried out

Test XX: [Previous Weight 00%] [Proposed Weight 00%]

- 1.- Mixed teaching: they conserve the weights of the face-to-face situation.
- 2.- Teaching no face-to-face: Practical Laboratory (40%)/(50%); Exam (60%)/(50%)

* Pending tests that are maintained

Test XX: [Previous Weight 00%] [Proposed Weight 00%]

...

* Tests that are modified

[Previous test] => [New test]

- 1.- Mixed teaching: they do not modify
- 2.- Teaching no face-to-face: face-to-face examination ==> virtual examination with Fatic and Remote Campus.

* New tests

* Additional Information

During the no face-to-face teaching, requires of the students that, in these exceptional circumstances, face this matter with a responsible and honest behaviour. It will consider inadmissible any form of copy directed to false the level of knowledges and skills reached in the preparation of the homeworks, as well as during the virtual examination. If there is some suspicion of some type of fraudulent behaviour, will be able to subject to the students to an additional control to check his veracity.
