UAB
Universitat Autònoma de Barcelona

Atmospheric Science

Code: 106773
ECTS Credits: 6

2024/2025

Degree	Type	Year
2504604 Environmental Sciences	OB	3

Contact

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Teaching groups languages

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Prerequisites

The student must have achieved the objectives of the first-year Physics subject. Throughout the course, the developed topics will be based on physical phenomena explained in this subject.

Objectives and Contextualisation

In environmental impact studies of projects and activities, meteorological risks and impacts must be studied, and environmental experts must be familiar with their consequences and causes. Likewise, given the growing human concentration in urban areas, topics such as the analysis of air quality in urban environments are of utmost importance and therefore studied in this course.

The course aims to be a simple yet rigorous introduction, both quantitative and qualitative, to atmospheric phenomena. By the end of the course, students should be able to understand different basic meteorological phenomena, the reliability of weather predictions, and their consequences. The objective of this course is to provide basic insights into how the Earth's atmosphere functions and how its functioning affects and is affected by human activities.

Learning Outcomes

1. CM36 (Competence) Incorporate the use of environmental tracers or basic analytical techniques into the characterisation of specific processes of hydrology, oceanography, or pollutant dispersion.
2. CM38 (Competence) Distinguish the most appropriate mathematical tools and models to describe the dynamics of specific environmental processes.
3. CM39 (Competence) Transmit general scientific information associated with an environmental problem to a general audience appropriately.
4. KM46 (Knowledge) Identify the most important chemical and geological processes in the different environmental compartments (hydrosphere, soil and atmosphere).
5. KM47 (Knowledge) Recognise the way in which human activity has an impact on the function of physical vectors (water, soil, oceans, atmosphere) in the natural environment.
6. KM48 (Knowledge) Compare the basic principles of science (hydrology, marine sciences, climatology, soil sciences, etc.) that constitute the basis for the study of the Earth system from an environmental perspective.

7. KM49 (Knowledge) Recognise the techniques and tools for sampling, analysis and environmental tracers.
8. SM44 (Skill) Characterise the main consequences of pollution in the natural environment and associated transport mechanisms.
9. SM45 (Skill) Apply basic mathematical tools and models to describe the dynamics of environmental processes.
10. SM46 (Skill) Characterise the main processes of natural environments (marine, soil, atmosphere), including aspects of physics, chemistry, geology, biology and their interaction.
11. SM47 (Skill) Analyse changes in the physical environment caused by natural or anthropogenic action based on the data available.
12. SM48 (Skill) Apply the main stages of the analytical procedure, including the collection and analysis of samples, for the study of the physical environment.

Content

1. Una breve visión de la atmósfera
    1. Origen y constituyentes
    2. Distribución de temperaturas
    3. Fundamentos del análisis climático
    4. Clima observado: red de observación. Balances
    5. Cambio climático. Variaciones de Milankovitch. Actividad solar.
3. Termodinámica atmosférica
    1. Aire seco y aire húmedo
    2. Equilibrio hidrostático. Perfiles verticales.
    3. Procesos adiabáticos
    4. Estabilidad vertical. Radiosondeos
5. Dinámica atmosférica
    1. Fuerzas en la descripción dinámica de la atmósfera
    2. Viento geostrófico, viento del gradiente, viento térmico
    3. Vorticidad. Ondas baroclínicas
    4. Tormentas
7. Aerosoles
    1. Partículas naturales y antropogénicas en la atmósfera
    2. Nucleación, condensación, coagulación, difusión, sedimentación
    3. Condensación homogénea y condensación heterogénea
    4. Nubes
    5. Precipitación
9. La difusión de la contaminación en la atmósfera
    1. Difusión versus advección
    2. Ley de Fick
    3. Modelo gaussiano

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical sessions	8	0.32	CM38, CM39, KM46, KM47, SM44, SM45, SM46, SM47
Proble-solving classes	8	0.32	CM38, KM46, KM48, SM45, SM46, SM47
Theoretical Classes	32	1.28	CM38, CM39, KM46, KM47, KM48, SM44, SM45, SM46, SM47

Type: Autonomous			
Practical sessions	20	0.8	CM38, CM39, KM46, KM47, SM44, SM45, SM46, SM47
Reading and study of texts	53	2.12	
Written work	20	0.8	

The course consists of theoretical classes (about 3 hours per week) and solving practical problems (in principle, 1 hour per week). Lists of problems will be posted on the virtual campus and their resolution will be discussed in class.

The course includes practicals that students will have to do in small groups, with compulsory attendance. You will need to prepare for these practices. The aim of these practical classes is to learn and practice the skills of communicating scientific aspects.

At least two written tests must be prepared. Both tests have a retireval test at the end of the course.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
First part assessment	40%	2	0.08	CM38, CM39, KM46, KM47, KM48, KM49, SM44, SM45, SM46
Second part assessment	40%	2	0.08	CM38, CM39, KM46, KM47, KM48, KM49, SM44, SM45, SM46
Written practical work and/or Moodle practices	20%	5	0.2	CM36, CM38, CM39, KM46, KM47, KM48, KM49, SM44, SM45, SM46, SM47, SM48

It is mandatory to get more than a 3.5 in the average of the evaluation activities in order to pass the subject taking into account the written work and/or practices. Otherwise, each assessment with a grade lower than 3.5 must be retaken in the retake test. The assessment of both the first part and the second part will consist of a theoretical part and the resolution of two practical problems.

For those people who do not pass the minimum mark of an evaluation there will be a retrieval test. To be able to attend the retrieval, the student must have previously been assessed for continuous assessment activities that are equivalent to 2/3 of the final grade of the subject.

If the written work is not presented and/or the laboratory practices are not attended, the student will be classified as "NOT ASSESSABLE", regardless of the grade of the partial exams.

UNIQUE ASSESSMENT

Students who have accepted the single assessment modality will have to take a final test, where the content of the entire subject will be assessed.The exam grade must be at least 3.5, and will have a weighting of 80%. On the same day of the exam (which will be held on the same day that the continuous assessment students are

assessed for the 2nd partial) you will need to hand in the practical written work and the practices (which in this case will be individual), and you will have the same weighting as for the rest of the students (20%). Internships are also compulsory attendance.

If the final grade does not reach 5.0, the student will have another opportunity to pass the subject through the make-up exam that will be held on the same day as the make-up exam for the rest of the students.In view of the recovery, the notes of the written practical work and of the practices remain unchanged.

Bibliography

Basic References

C.Donald Ahrens Meteorology Today Thomson (Paraninfo), Madrid 2003
Roland Stull Meteorology for Scientists and Engineers Thomson 2002
J.Martín Vide, Mapas del tiempo: Fundamentos, interpetración e imágenes de satélite, Oikos-tau, Vilassar de Mar, 1991
Jordi Mazón, Mariano Barriendos, Marcel Costa, El temps a Catalunya dia a dia, Ara llibres, 2009
J.M.Wallace i P.V. Hobbs, Atmospheric Science, Academic Press, New York, 1977
Gerard Conesa Prieto, Anàlisi meteorològica a la mar, Edicions UPC, Barcelona 1993

Advanced References

W. Cotton, R. A. Pielke, Human Impacts on Weather and Climate, Cambridge, 1995.
R. G. Fleage, An Introduction to Atmospheric Physics, Academic Press, New York, 1980
V. Espert, P. Amparo, Dispersión de contaminantes en la atmósfera, Universidad Politécnica de Valencia, Valencia, 2000
M.R.Estrela i M.M.Millán, Manual práctico de introducción a la meteorología, CEAM, 1994.
M. Grimalt, J. Martin-Vide i F.Mauri et. al., Els núvols, Edicions El Mèdol, 1995
J.T.Houghton et al. (ed.),Climate Change, Cambridge University Press, Cambridge, 1996.
J.E.Llebot, El canvi climàtic, Rubes Editorial, Barcelona, 1998
J.E.Llebot, Els fluids de la vida, Biblioteca Universitària n. 29, Ed. Proa. 1996
J.E. Llebot El temps és boig? i 74 preguntes més sobre el canvi climàtic, Rubes editorial, Barcelona 2005

Software

There is no specific software.

Language list

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	1	Catalan/Spanish	second semester	morning-mixed
(PAUL) Classroom practices	2	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	1	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	2	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	3	Catalan/Spanish	second semester	morning-mixed

(PLAB) Practical laboratories	4	Catalan/Spanish	second semester	morning-mixed
(TE) Theory	1	Catalan/Spanish	second semester	morning-mixed