Universitat de Lleida

DEGREE CURRICULUM

WEATHER FORECAST APPLIED TO ENVIRONMENT

Coordination: VILLAR MIR, JOSEP MARIA

Academic year 2023-24

WEATHER FORECAST APPLIED TO ENVIRONMENT 2023-24

Subject's general information

<table>
<tr><td>Subject name</td><td>WEATHER FORECAST APPLIED TO ENVIRONMENT</td></tr>
<tr><td>Code</td><td>102472</td></tr>
<tr><td>Semester</td><td>2nd Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td><table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Forest Engineering</td><td>4</td><td>OPTIONAL</td><td>Attendance-based</td></tr>
<tr><td>Double degree: Bachelor's degree in Forest Engineering and Bachelor's degree in Nature Conservation</td><td>4</td><td>OPTIONAL</td><td>Attendance-based</td></tr>
</table></td></tr>
<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>Query has returned no results</td></tr>
<tr><td>Coordination</td><td>VILLAR MIR, JOSEP MARIA</td></tr>
<tr><td>Department</td><td>ENVIRONMENT AND SOIL SCIENCES</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>The ratio is about 2 h master class / 0.5 own work</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Distribution of credits</td><td>About 60 % theory and 40% activities (lab).</td></tr>
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WEATHER FORECAST APPLIED TO ENVIRONMENT 2023-24

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
BOSCH SERRA, ÁNGELA DOLORES	angela.bosch@udl.cat	1	To be agreed
VILLAR MIR, JOSEP MARIA	josepmaria.villar@udl.cat	5	

Subject's extra information

Possibility to invite a professors from other countries. It depends on the funding available.
The structural constrains derived by COVID- 19 may modify the objectives pursuit in the course.

The University establishes the following regulations (approved on September 4, 2014):

1. It is necessary to carry out all the laboratory practices and work to deserve a continuous evaluation. Otherwise, the student will have to pass a final exam.

2. With regard to practical classes (in the classroom and in the laboratory), it is not allowed to modify the groups.

3. Regarding the evaluation. For assessment and attendance, it is necessary to participate in the 80% of the total teaching load.

Main goals pursuit are the following:

1.- Organization of a large database. Analysis at different scales (spatial and temporal). Capability to take decisions.
2.- Capability to transfer knowledge.
3.- Capability to apply methods and techniques related with processes that can be observed above the canopy and within the atmospheric surface layer. Applications are mainly at local scale tought some inside may be given at regional escale.

Learning objectives

The course aims to achieve skills related to the analysis of climate data, climate simulation, and understanding of man processes involved in the soil - vegetation – atmosphere continuum within the surface boundary layer. The scope of the course are the study of processes of scalar exchange above the canopy top. Some global applications may anialyzed within the framework of remote sensing.

The goal is to achieve the following Learning Outcomes:

LO1. Evaluate orders of magnitude to discriminate phenomena that may be irrelevant.

LO2. Identify situations that are physically different show analogies, allowing the use of known solutions to new problems.

LO3. Correctly interpret fundamental laws or principles.

LO4. Know how to locate the physical phenomenon that can be described through them.

LO5. Interpret the essence of a process / situation.

LO6. Establish a work / work model in order to reduce the problem to a manageable level.

LO7. Interpret scientific texts.

LO8. Summarize and present the information in a concise and clear way.

LO9. Develop the ability to work individually and organize to meet deadlines.

LO10. Gain experience in group work and be able to interact constructively in the team.

Competences

Basic skills

CB1. That students have demonstrated to possess and understand knowledge in an area of study that starts from the base of general secondary education, and is usually found at a level that, while supported by advanced textbooks, also includes some aspects involving knowledge from the forefront of their field of study

CB2. That students know how to apply their knowledge to their work or vocation in a professional way and possess the skills that are usually demonstrated through the development and defense of arguments and problem solving within their area of study

CB3. That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant social, scientific, or ethical issues.

CB4. That students can convey information, ideas, problems and solutions to both specialized and non-specialized audiences

CB5. That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy

In addition:

CT2. Proficiency in a foreign language

CEFB3. Basic knowledge of the use and programming of computers, operating systems, databases and computer programs with application in engineering.

Subject contents

1. Introduction. General concepts. Warming up. Meteorology and climate. Micrometeorology and microclimate. Global warming and climate change. Terminology.

2. The database and the metadata. Meteorological networks. Free available databases. Quality control of climate time series. Extraterrestrial solar radiation. Estimation of the lobal solar radiation, Rs, the net radiation, Rn, and the soil heat flux, G. Generation of daily precipitation, maximum and minimum air temperatures, and solar radiation. Processes of downscaling to simulate Rs, Rn and G .

3. The atmosphere. General and local circulation. Boundary layers. Thermodynamics of the air. Determination, estimation and measurement of weather variables. Katabatik and anabatic winds, and breezes. Föhn effect. Oasis effect. Properties of the roughness, inertial and mixing sublayers. The Ekman layer. Geostrophic winds. General circulation.

4. The soil – vegetation – atmospheric surface layer continuum. The surface energy balance. The evapotranspiration, ET, as a link between micro-meteorology and hydrology. The potential ET, ETP, and the ET of reference, ETr. Semi-empirical equations and procedures for estimating the ETP, the ETr and the ET. Forest productivity. The Soil heat flux. Instrumentation. The incoming and outgoing long and short wave radiation (the four radiative components). Instrumentation. Temperature of the air and of the canopy elements. Turbulence. Reynolds averaging. The Monin Obukhov Similarity Theory, MOST. Profiles of the horizontal wind speed, the air temperature and the humidity. Limitation of MOST. Measurement of the turbulence. Instrumentation. The Eddy Covariance method. Measurement and estimation of the sensible heat flux, the latent heat flux and carbon dioxide flux using time series of scalars measured at high frequency. Footprint analysis.

5. Remote sensing applications. The land surface temperature, LST. Spatial ET estimation using MOST and the Surface Energy Balance, SEBAL, method. A study case over a mountain meadow.

6. The land and the climate. Phytoclimatic indices. Climate classification. Wind breakers. Climate and comfort. Risk of fire. Precipitation, drought and soil erosion.

Methodology

The lectures are combined with a variety of activities. The latter includes resolution of exercises that are analyzed in class and the use of different packages, elaboration of reports and preparation of short communications.

Development plan

Estimated teachinig loads corresponding to master class, M, and Activities in class, A:

Subject:	M	A
Introduction	4	2
Lecture 2	6	6
Lecture 3	5	2
Lecture 4	10	5
Lecture 5	5	5
Lecture 6	5	5

Evaluation

Provided that the student assists regularly to class (minimum 80% of the total teaching load), the global evaluation is obtained by weighting the marks obtained in different activities. The corresponding weights are the following: 70% for exercises and 30% for reports and oral communications. Activities are made in grup. A grup is formed by 2 - 3 persons. The Table lists the number of activities in class at homework per lecture and the weight per lecture versus the final mark: However, when a student shows up by less than 80% of the classes, the mark correspond to the score obtained in a final exam.

Distribution:	Class	Homework	Weight (%)
Introduction	3	3	9
Lecture 2	3	8	21
Lecture 3	2	7	20
Lecture 4	4	12	30
Lecture 5	2	3	10
Lecture 6	3	3	10
TOTAL	17	36	100

Bibliography

The lectures are available in Sakai (campus virtual).

Complementary material:

Allen, R.G.; Pereira, L.S.; Raes, D., Smith, M. 1998. Crop evapotranspiration. Guidelines for computing crop water requirements. FAO Irrigation and drainage paper n. 56. FAO Roma (Italia). 300 pp.
Campbell G.S.; J.M: Norman. 1998. An introduction to Environmental Biophysics. 2nd Edition. Springer. 286pp.
Critchfield, H.J., 1983: General Climatology. Prentice-Hall.
Elías Castillo, F. y F. Castellvi (coords.), 2001: Agrometeorología. Ed. Mundi-Prensa.

Monteith, J.L.; M.H. Unsworth. 1990. Principles of Environmental Physics. 2nd Edition.Edward Arnold. 291pp.
Rosenberg N.J.; Blad B.; Verma S.B. 1983. Microclimate. The Biological Environment. 2nd ed. John Wiley & Sons.
R.G.Allen, L.S. Pereira, D. Raes, M. Smith., 2006: Evapotranspiración del cultivo. Guías para la determinación de los requerimientos de agua de los cultivos. (Estudio FAO Riego y Drenaje 56), Roma, 323 p (traducción del original en Inglés del año1998).
Foken, T., 2008. Micrometeorology. Ed. Springer.
Hatfield, J.L., Baker, J.M., (Editors)., 2005. Micrometeorology of Agricultural Systems. American Society of Agronomy Monograph Series No. 47. ASA-CSSA-SSSA. Madison, WI. p. 584.