VNIVERSITAT DE VALÈNCIA

Course Guide
47087 Sistemas de observación de la contaminación: teledetección y GIS

COURSE DATA

DATA SUBJECT

Code: 47087
Name: Sistemas de observación de la contaminación: teledetección y GIS
Cycle: Master's Degree
ECTS Credits: 3.5
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
2285 - Máster Universitario en Contaminación Ambiental y Ecotoxicología	Facultat de Ciències Biològiques	1	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2285 - Máster Universitario en Contaminación Ambiental y Ecotoxicología	Cambio climático y contaminación ambiental	COMPULSORY

COORDINATION

ROCA PEREZ LUIS

SUMMARY

The course will address the main environmental parameters that must be monitored according to current sectoral legislation. The recording of these parameters is carried out in both natural and urban environments, using georeferenced databases to ensure proper location and analysis. A thorough analysis of pollution monitoring networks will also be conducted, with particular attention to their design parameters and application in different settings: urban, suburban, rural, and remote background areas. Criteria for determining the number and location of sampling stations will be examined, along with the development and interpretation of pollutant distribution maps.

The spatial and temporal monitoring of atmospheric pollutants will be addressed through remote sensing techniques, based on observations of the electromagnetic spectrum not visible to the human eye (infrared, ultraviolet). Data is recorded using sensors onboard artificial satellites orbiting the Earth. Because satellites provide detailed images of the Earth-atmosphere system with adequate temporal repetition, the images acquired are highly useful for analyzing the spatial and temporal distribution of pollution sources of natural origin (e.g., volcanoes, wildfires) or anthropogenic origin (e.g., industry, road traffic in cities). The processing of these images will enable the detection and control of such pollutants, representing an important tool for environmental planning and decision-making.

Basic geostatistical knowledge will be provided for the assessment of soil parameters and pollutants, including: types of data to be used, georeferencing, GIS representation, study of spatial structure, semivariogram, spatial variability analysis, model fitting, interpolation, map generation, etc.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

Basic knowledge of Environmental Information Systems, GIS software such as ArcGIS or QGIS, as well as programming languages like Python, is recommended.

COMPETENCES / LEARNING OUTCOMES

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Acquire the capacity for autonomous and organised learning and for adapting to new situations.

Contribute to the design, development and implementation of solutions that respond to social demands, considering the Sustainable Development Goals as a reference.

Create georeferenced databases of pollutants, apply geostatistics and produce thematic maps. Use remote sensing techniques in environmental studies.

Develop the ability to work in multidisciplinary teams and to cooperate effectively.

Develop the capacity for analysis, synthesis and critical thinking in applying the scientific method.

Evaluate and assess the impact of human activities on pollution in the atmosphere, inland waters, marine waters and soils.

Evaluate the behaviour of pollutants and their interactions in different environmental compartments.

Handle atmospheric dispersion models and pollutant monitoring networks.

Learn how to write scientific articles in the fields of environmental pollution and ecotoxicology.

Understand and interpret the processes of atmospheric, aquatic and soil pollution and their effects.

Understand the natural world as a product of evolution and its vulnerability to human influence.

Use computer tools, statistical methods and data simulation appropriately, applying software and statistics in ecotoxicology and in issues arising from environmental pollution.

Use different bibliographic sources and biological databases.

DESCRIPTION OF CONTENTS

Topic 1. Environmental parameters subject to monitoring according to sectoral legislation. Recording of environmental parameters in natural and urban environments: Georeferenced databases. Pollution control networks: design parameters, application in urban, suburban, rural, and remote background areas. Stations: number and spatial location. Pollutant mapping.

Topic 2. Theoretical framework for satellite-based pollutant detection: Review of remote sensing techniques. Pollutants observable through remote sensing. Space missions dedicated to pollution measurement: Key characteristics of orbiting sensors. Databases of pollutants recorded by different sensors. Data processing and analysis.

Topic 3. Geostatistics: concept and origin. Objectives of spatial analysis. Types of spatial data. Exploration of spatial correlation. Experimental variogram. Geostatistical interpolation methods. Geostatistics applied to soil pollution studies.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	15,00
Computer classroom practice	20,00
Total hours	**35,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	3,00
Individual or group project	10,00
Independent study and work	24,00
Preparation of lessons	8,00
Preparation for assessment activities	15,50
Resolution of case studies	27,00
Total hours	**87,50**

TEACHING METHODOLOGY

Theoretical classes in which the instructors will present the key concepts for each topic. Before each class, audiovisual materials will be made available to students via the university¿s online learning platform.

Guest lectures by national or international experts in subjects related to the course.

Computer-based practical sessions: Practical exercises will be based on real case studies of soil, air and water

pollution, using different software depending on availability: mainly ArcGIS, QGIS, Access, Isatis, RStudio, and Python.

EVALUATION

Assessment will take place at the end of the course, and a minimum score of 5 out of 10 will be required to pass. Preferably, the assessment will be through a written exam, but oral or computer-based evaluations may be used if considered more appropriate by the instructors. Continuous assessment through the completion of tests, exercises and practical computer work.

Students will present a brief report on one of the practical exercises, describing the work carried out and detailing the results obtained. This will be used to evaluate the competences acquired by the students.

- SE1. Continuous assessment = 20%
- SE2. Assessment of non-presential activities = 20%
- SE3. Written exams = 55%
- SE4. Assessment of activities related to transversal skills = 5%

REFERENCES

- Introducing geographic information systems with ArcGIS a workbook approach to learning GIS. Kennedy, M. Hoboken: John Wiley & Sons, 2009.

- Iniesto, M. y Núñez, A. 2014. Introducción a la infraestructura de datos espaciales. Foro de Ingeniería en Geomática y Topografía del Grupo de Trabajo de la IDEE. Descarga gratuita en:

http://www.ign.es/ign/layoutIn/libDigitalesPublicaciones.do#resp-libro-IDEE

- Navarro Jover, J.M. 2005. Prácticas de SIG con Arcview. Editorial Universidad Politécnica de Valencia.

- Navarro Jover, J.M. 2009. Prácticas de SIG con ArcGIS. Universidad Politécnica de Valencia. Servicio de Publicaciones, 2009

- SIG sistemas de información geográfica. Gutiérrez Puebla, J., Gould, M. Madrid : Síntesis, D.L. 1994

- SIG y localización óptima de instalaciones y equipamientos. Bosque Sendra, J. Paracuellos de Jarama: RaMa, D.L. 2004

- E. Chuvieco.Teledetección ambiental. Ed. Ariel, Barcelona, 2008.

- José A. Sobrino. Teledetección. Universitat de València, 2001.

- Guía didáctica de Teledetección y Medio Ambiente. Editores Javier Martínez Vega y M. Pilar Martín Isabel. CCHS-IEGD. 2010. Descarga en:

http://digital.csic.es/bitstream/10261/28306/2/guia_papel.pdf

COMPLEMENTARIOS:

- Morillas López, C. (2025). Análisis de datos satelitales de NO¿ en entornos urbanos: estudio de caso en la ciudad de Madrid. REVISTA INTERNACIONAL MAPPING, 34(217), 62¿72. https://doi.org/10.59192/mapping.463

https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas.html

http://centrodedescargas.cnig.es/CentroDescargas/

https://browser.dataspace.copernicus.eu/

https://www.tropomi.eu/