INSTRUCTOR-LED TRAINING

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Remote Sensing and GIS of the Marine Environment

Overview and goals

This course provides an overview of all fundamental Remote Sensing science concepts, including notions about the electromagnetic spectrum and the interaction of the electromagnetic radiation with the atmosphere, water and different targets. It also gives an insight on the different type of sensors, satellites and current applications of remote sensing. It then goes into the aspect of image acquisition, processing and analysis with particular attention to image visual interpretation and supervised and unsupervised classification methodologies. Accuracy assessment concepts and methods are also presented as an essential aspect. The final part will focus on the application of Remote Sensing and GIS to marine science topics including habitat identification and fauna and flora abundance assessment and mapping. Each section is followed by practical exercises, part of a complete real case study during which the students will put into practice the concepts learned to create maps of marine habitats from visual interpretation of aerial images of the Marine Protected Area, to investigate the interaction with flora and fauna diversity and abundance distribution assessed during the field surveys and to estimate the accuracy of the final product using ground truth data collected on the field.

Detailed contents

Chapter 1: Introduction

- Remote Sensing definition
- Electromagnetic radiation
- Frequency and wavelength
- The electromagnetic spectrum – Visible, Infrared, Microwaves etc
- Interaction with the atmosphere, Atmospheric Windows
- Absorption, Transmission and reflection
- The spectral signature (response)
- Spectral response of vegetation and water
- Passive and active sensors
- Digital images
- Image representation in bands

- Spatial resolution
- Spectral resolution
- Radiometric resolution
- Across-track and along-track scanners
- Remote sensing applications examples: Weather, Land and Marine Observations, Ocean remote sensing, Ocean Color, Oil Spill, SAR, AVHRR, Sea Surface Temperatures.

Chapter 2: Case study step 1

- Georeferencing a raster image of the Marine Protected Area

Chapter 3: Image processing

- Preprocessing: Radiometric and geometric correction
- Image enhancement: linear contrast stretching, histogram equalized stretching, spatial filtering, sun specular reflection (sun glint) removal
- Image transformation: subtraction, spectral ratioing and principal components analysis (PCA)
- Visual interpretation
- Patterns, texture, shadows, tone, time, shape, association
- Interpretation of water features

Chapter 4 : Case study step 2

- Processing of an image of the Marine Protected Area

Chapter 5: Case study step 3

- Visual interpretation of habitat types in the Marine Protected Area

Chapter 6: Image classification

- Supervised classification
- Unsupervised classification
- Generalization

Chapter 7: Case study step 4

- Supervised and unsupervised classification of an image of the Marine Protected Area

Chapter 8: Accuracy assessment

- Sampling design: random, stratified and systematic sampling
- Confusion matrix

- User and producer's accuracy
- Omission and commission errors
- Kappa coefficient
- Accuracy assessment examples

Chapter 9: Case study step 5

- Accuracy assessment of habitats identification

Chapter 10: Habitat metrics

- Habitat models
- Habitat parameters: bathymetry,slope, aspect, rugosity, benthic position index (BPI), substrate type
- Map algebra
- Suitability models: binary, ranking, rating, weighted

Chapter 11: Marine flora and fauna abundance surveys

- Species abundance surveys
- Quadrats
- Transects
- Visual census
- Photos and videos methods
- Biodiversity index

Chapter 12: Case study step 6

- Create maps of benthic cover and species abundance from field data

Further Information

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