



### REMOTE SENSING

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| Enrollment year     | 2021/2022                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Academic year       | 2021/2022                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Regulations         | DM270                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Academic discipline | GEO/04 (PHYSICAL GEOGRAPHY AND GEOMORPHOLOGY)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Department          | DEPARTMENT OF EARTH AND ENVIRONMENTAL SCIENCES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Course              | GEOSCIENCES FOR SUSTAINABLE DEVELOPMENT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Curriculum          | PERCORSO COMUNE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Year of study       | 1°                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Period              | 1st semester (04/10/2021 - 14/01/2022)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| ECTS                | 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Lesson hours        | 60 lesson hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Language            | English                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Activity type       | WRITTEN AND ORAL TEST                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Teacher             | ZUCCA FRANCESCO - 6 ECTS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Prerequisites       | <p>Basic computer skills: management of files and directories: creation, copy-transfer-download, compacting-unpacking; use of office automation tools (spreadsheets) and text editing; keyword searches on the Internet</p> <p>Basic statistics: means, variance, standard deviation, distribution concept and ability to visualize data (histograms, scatter plots, boxplots)</p> <p>Basic cartography: the concepts of cartographic projections, reading skills of topographic and thematic cartography, measurements of plano-altimetric distances and extraction of topographic elements (profiles)</p> <p>Knowledge of the principles of physics of electromagnetic waves and basic knowledge of geophysics</p> |

Ability to survey on land and development of a minimum cartography

#### Learning outcomes

The aim of the course is to present and promote the application of Remote Sensing (RS) to a topic of absolute importance such as that of the Critical Zone (CZ) the "heterogeneous, near surface environment in which complex interactions involving rock, soil, water, air, and living organisms regulate the natural habitat and determine the availability of life-sustaining resources" (National Research Council, 2001). In particular, we will deal with developing in-depth knowledge of the applications of RS to mapping and monitoring the CZ, with particular regard to geological and geomorphological applications and training skills oriented to the solution of CZ problems, which are typically characterized by a heterogeneity of spatial and temporal scales. It will therefore develop a perspective of integration of the knowledge obtained in different fields of the course with those of remote sensing to create even complex applications.

#### Course contents

Introduction to the concept of Critical Zone (CZ), its components and dynamics; its importance for geosciences in s.l. in the context of climate change.  
Remote sensing, introductory concepts.  
Electromagnetic radiation and the terrestrial environment.  
Spectral characters of terrestrial surfaces and materials in the Visible, Near Infrared and Medium Waves.  
Mid-infrared interactions with the environment.  
Thermal remote sensing in the earth sciences.  
Optical sensors.  
the types of optical data (high resolution, medium and small).  
Image spectrometry.  
Active remote sensing: SAR and LIDAR.  
Applications of remote sensing to earth and geo-environmental sciences and for CZ  
Laboratory:  
Pre-processing of optical images.  
Spectral data collection.  
Image classification.  
RS and GIS integration.  
Accuracy Assessment.  
Study cases.

#### Teaching methods

Lectures dedicated to the introduction of the concepts of the Critical Zone (CZ) and its components and dynamics and on issues of Remote Sensing applied to the mapping and monitoring of the CZ, with particular relevance to those of geosciences.  
Laboratories on specific GIS programs, image processing and RS, with the development of complex projects or their components.  
Integration with interactive workshops and seminars on Remote Sensing and / or Critical Zone issues.  
On the field activities for measurements and mapping of relevant elements of the CZ.  
Reading, criticism and synthesis of specific scientific literature.

#### Recommended or required

The texts in the list are available from the teacher:

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| <p><b>readings</b></p>                                    | <p>Principles and Dynamics of the Critical Zone<br/>John Garden-Cris Houser</p> <p>Introduction to the Physics and Techniques of Remote Sensing, Charles Elachi-Jakob J. van Zyl</p> <p>Remote Sensing of Geomorphology, Volume 23, Paolo Tarolli - Simon M Mudd</p> <p>Quantitative Remote Sensing of Land Surfaces, Shunlin Liang</p> <p>Any other titles will be announced by the teacher during class.</p> <p>Students will be provided with materials, handouts and case studies.</p> |
| <p><b>Assessment methods</b></p>                          | <p>The final exam will consist in verifying the learning relating the concepts presented in the theoretical part as well as in the practical part of the course to be carried out with an oral discussion, and the combined with the presentation of an operational project that explores issues addressed in the course using papers and data selected with the teacher; the two marks obtained, mediated, will constitute the final mark.</p>                                            |
| <p><b>Further information</b></p>                         | <p>Non-attending students are required to contact asap the teacher to define a specific training course and the sharing of teaching materials.</p>                                                                                                                                                                                                                                                                                                                                         |
| <p><b>Sustainable development goals - Agenda 2030</b></p> | <p><a href="#">\$lbl_legenda_sviluppo_sostenibile</a></p>                                                                                                                                                                                                                                                                                                                                                                                                                                  |