University of Gdańsk

Subject card

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|---|---|---|---|
| Subject name and code | Satellite Information Systems - lecture, PG_00204950 | | |
| Field of study | Oceanography | | |
| Date of commencement of studies | October 2026 | Academic year of realisation of subject | 2027/2028 |
| Education level | Master's studies | Subject group | Obligatory subject group in the field of study<br>Optional subject group<br>Subject group related to scientific research in the field of study |
| Mode of study | full-time studies | Mode of delivery | at the university |
| Year of study | 2 | Language of instruction | Polish |
| Semester of study | 4 | ECTS credits | 1.0 |
| Learning profile | academic | Assessment form | credit |
| Conducting unit | Laboratory of Physical Oceanography -> Department of Physical Oceanography and Climate Research -> Faculty of Oceanography and Geography -> Rector | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | dr Maciej Markowski | |
| | Teachers | | |

**Lesson types**

| Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|
| Number of study hours | 15.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15 |

E-learning hours included: 0.0

Additional information:

Multimedia-based lecture. If necessary, the lecture can be conducted by using on-line method.

**Learning activity and number of study hours**

| Learning activity | Participation in didactic classes included in study plan | Participation in consultation hours | Self-study | SUM |
|---|---|---|---|---|
| Number of study hours | 15 | 1.0 | 9.0 | 25 |

**Subject objectives**

Introducing students with the physical and technical foundations of acquiring information from satellite-based techniques. Particular emphasis will be placed on satellite systems used for Earth observation in the context of conducting environmental analyses.

## Learning outcomes

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| [OCEANMU2-W01] knows and understands in-depth specialized terminology used in oceanography and related sciences (in Polish and a selected foreign language) | The student knows and understands in-depth specialized terminology related to satellite remote sensing methods used in oceanography, in particular microwave techniques. | [SW4] test/exam - oral or written |
| [OCEANMU2-W03] has an in-depth understanding of research methods used in oceanography and related sciences, and interprets their mechanisms and interrelationships across different spatial and temporal scales | The student knows and understands in-depth research methods used in the work of an oceanographer to describe and interpret phenomena and processes occurring in the aquatic environment using satellite data | [SW4] test/exam - oral or written |
| [OCEANMU2-W04] has an in-depth understanding of the latest research trends in oceanography, as well as the possibilities for practical application of related achievements; evaluates their usefulness and limitations in solving scientific research problems, and critically analyzes and assesses their applicability | The student knows and understands in-depth the latest trends in oceanographic research using satellite remote sensing devices and systems | [SW4] test/exam - oral or written |

## Subject contents

**1. Physical fundamentals of electromagnetic wave interaction with the sea surface and water column**
- Interaction of electromagnetic radiation with the sea surface: reflection, scattering, absorption, and the impact of sea state on the satellite signal.
- Influence of the marine atmosphere (aerosols, water vapour, clouds) on the propagation of solar and microwave radiation in oceanographic observations.

**2. Remote sensing of the marine environment and development of remote sensing methods**
- History and evolution of marine and oceanographic satellite observations: from optical radiometry to radar interferometry and altimetry.
- Scope and capabilities of modern satellite systems in sea monitoring.

**3. Optical methods and remote sensing instruments in marine research**
- Optical and hyperspectral radiometers used in coastal waters observations: characteristics, sensitivity, limitations in the marine environment.
- Acquisition of satellite and aerial imagery over the sea: impact of viewing angle, surface noise, and optical variability of water.

**4. Thermal, radar, and lidar sensors used in physical oceanography**
- Application of thermal and microwave sensors in the analysis of sea surface temperature, evaporation, frontal structures, and current dynamics.
- Radar SAR systems and lidar bathymetric techniques in monitoring wave activity, sea currents, sea ice, and characterising the coastal zone.

**5. Preparation, analysis, and interpretation of satellite data for marine and coastal areas**
- Processing and analysis of satellite imagery: creation of spatial layers, spectral feature extraction, identification of water masses, blooms, and hydrodynamic phenomena.
- Classification of marine imagery (supervised and unsupervised) and comparison of methods in the context of change detection in the marine environment.

## Prerequisites and co-requisites

Knowledge of the basics of satellite remote sensing and GIS

## Assessment methods and criteria

| Subject passing criteria | Passing threshold | Percentage of the final grade |
|---|---|---|
| | 51.0% | 100.0% |

## Recommended reading

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|---|---|
| Basic literature | • Robinson I., 2010. Discovering the Oceans from Space: The unique applications of satellite oceanography, Springer-Verlag, Berlin and Heidelberg<br>• Emery W., Camps A., 2017, Introduction to Satellite Remote Sensing. Atmosphere, Ocean, Land and Cryosphere Applications, Elsevier<br>• Hejmanowska B., Wężyk P. (red.), 2020, Dane satelitarne dla administracji publicznej, Polska Agencja Kosmiczna |
| Supplementary literature | • Berizzi F., Martorella M., Giusti E., 2016, Radar Imaging for Maritime Observation, CRC Prss, Taylor & Francis Group 348 s.<br>• Martin S., 2004, An introduction to Ocean Remote Sensing, Cambridge University Press, 426 s.<br>• Chapman R., Gasparovic R., 2022, Remote sensing physics: an introduction to observing earth from space, Wiley, Hoboken USA, 468 ss.<br>• Chang N.-B., Bai K., 2018, Multisensor data fusion and machine learning for environmental remote sensing, CRC Press, Boca Raton, 508 ss.<br>• Adamczyk J., Będkowski K., 2007, Metody cyfrowe w teledetekcji. Wyd. SGGW, Warszawa<br>• Sanecki J. (red.), 2007, Teledetekcja: pozyskiwanie danych, Wydawnictwa Naukowo-Techniczne, Warszawa |
| eResources addresses | |

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|---|---|
| Example issues/ example questions/ tasks being completed | Assessment criteria: Knowledge of<br><br>• physical processes occurring in the sea that can be studied using satellite methods<br>• satellite techniques used to study specific processes in the sea sea<br>• surface properties that enable remote detection of the phenomena discussed in the lecture<br>• satellite data processing stages necessary to obtain specific environmental information from satellite data<br>• spatial data analysis methods used in the analysis of satellite data in oceanography |
| Work placement | Not applicable |

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