University of Gdańsk

Subject card

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 Optional subject group 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-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
[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-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

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
test	51.0%	100.0%

Recommended reading

Basic literature	• Robinson I., 2010. Discovering the Oceans from Space: The unique applications of satellite oceanography, Springer-Verlag, Berlin and Heidelberg • Emery W., Camps A., 2017, Introduction to Satellite Remote Sensing. Atmosphere, Ocean, Land and Cryosphere Applications, Elsevier • 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. • Martin S., 2004, An introduction to Ocean Remote Sensing, Cambridge University Press, 426 s. • Chapman R., Gasparovic R., 2022, Remote sensing physics: an introduction to observing earth from space, Wiley, Hoboken USA, 468 ss. • Chang N.-B., Bai K., 2018, Multisensor data fusion and machine learning for environmental remote sensing, CRC Press, Boca Raton, 508 ss. • Adamczyk J., Będkowski K., 2007, Metody cyfrowe w teledetekcji. Wyd. SGGW, Warszawa • Sanecki J. (red.), 2007, Teledetekcja: pozyskiwanie danych, Wydawnictwa Naukowo-Techniczne, Warszawa
eResources addresses	

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

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