University of Gdańsk

Subject card

Subject name and code	Natural extreme phenomena (Laboratory classes), PG_00201215		
Field of study	Physical geography and geoinformation		
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 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	3	ECTS credits	2.0
Learning profile	academic	Assessment form	credit
Conducting unit	Climate Research Laboratory -> Department of Physical Oceanography and Climate Research -> Faculty of Oceanography and Geography -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr Mirosława Malinowska	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	0.0	0.0	30.0	0.0	0.0	30

E-learning hours included: 0.0

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	30	4.0	16.0	50

Subject objectives

To familiarize students with the following contents:1. Types, causes and locations of natural extreme phenomena (meteorological, hydrological and geomorphological).2. Selected social, economic and ecological aspects of the occurrence of natural extreme phenomena and their risk reduction.3. The organization of systems of assessment and risk reduction of hazards.4. Methods of risk analysis of the occurrence of natural extreme phenomena and the implementation of practical skills in the application of advanced statistical techniques used in analyses of this type.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[GFGMU2_W01] knows and understands to a deepened extent the specificity of Earth sciences in the field of physical geography, its internal structure, research subject and main research directions, the methods applied, conceptual apparatus, as well as practical applications of scientific achievements	He knows and understands the conceptual apparatus, as well as the practical applications of scientific achievements in the analysis of the theory of analysis of extreme phenomena	[SW4] test/exam - oral or written [SW3] text preparation/written work
[GFGMU2_U05] is able to integrate knowledge from the discipline of Earth and environmental sciences, explaining and interpreting the interrelationships between environmental processes and phenomena in order to solve research problems in physical geography and geoinformation	Is able to integrate knowledge from the discipline of earth and environmental sciences, correctly explaining and interpreting the interrelationships between environmental processes and phenomena in order to solve research problems of modern climatology, hydrology and geomorphology in the context of the analysis of natural extreme phenomena	[SU3] text preparation/written work [SU4] test/exam - oral or written
[GFGMU2_U02] is able to precisely and appropriately use terminology in the field of physical geography and geoinformation in oral statements and written works	Able to proficiently and appropriately apply terminology from the analysis of natural extreme phenomena in written work	[SU3] text preparation/written work [SU4] test/exam - oral or written
[GFGMU2_W02] knows and understands to a deepened extent issues in the field of exact sciences enabling the understanding of complex processes and phenomena occurring in the Earth's natural environment, and in their interpretations consistently relay on empirical foundations, using qualitative and quantitative methods	He knows and understands the issue of the formation of natural extreme phenomena as a consequence of the occurrence of complex processes and phenomena occurring in the Earth's natural environment, and in their interpretation consistently relies on empirical foundations, using qualitative and quantitative methods	[SW4] test/exam - oral or written [SW3] text preparation/written work
[GFGMU2_K01] is able to behave appropriately in the workplace and in everyday life by critically evaluating information received in the light of their existing knowledge, recognising the importance of knowledge in solving cognitive and practical problems, and, when faced with difficulties, drawing on expert knowledge	He is ready to critically evaluate his knowledge of natural extreme phenomena, to supplement it and to verify his knowledge and skills through critical reading of the literature on the subject	[SK3] text preparation/written work [SK8] observation of student's independent or team work
[GFGMU2_K02] is prepared to undertake or co-organise initiatives in the public interest, fulfil its social responsibilities and organise activities promoting sustainable development	He is ready to be active in raising awareness about natural extreme phenomena and their consequences in human life	[SK8] observation of student's independent or team work
[GFGMU2_U04] is able, either independently or as part of a group, to formulate and test hypotheses regarding the causes and progression of physical-geographical processes and phenomena; selects and applies advanced research methods and tools, including statistical and geoinformatics methods, adapting them to the context where necessary; skilfully visualises the results of spatial data analysis, critically interprets the findings, and formulates conclusions and their own position based on these, which they justify in debate	Able to describe and analyze the causes and course of natural extreme phenomena, skillfully selecting and applying advanced techniques and research tools from the field of statistical methods, interpreting the results obtained as a consequence, and then using theoretical knowledge to formulate their own opinions and conclusions	[SU3] text preparation/written work [SU4] test/exam - oral or written
[GFGMU2_U03] is able to use academic literature in the fields of physical geography and geoinformation in Polish and English, selecting it appropriately for the research objective	Can effectively use skillfully selected for the purpose of application scientific literature in the field of analysis of natural extreme phenomena both in Polish and in English	[SU3] text preparation/written work

Course outcome	Subject outcome	Method of verification
[GFGMU2_W08] knows and understands in a deepened extent the most important contemporary problems in the field of contemporary climate change and environmental crises on a regional and global scale, their essence, genesis and possible consequences	Knows and understands the problem of occurrence of natural extreme phenomena on a regional and global scale, their essence, genesis, possible consequences and techniques for analyzing their occurrence,	[SW4] test/exam - oral or written [SW3] text preparation/written work

Subject contents

1. Introduction to the theory of analysis of extreme phenomena and risk assessment of their occurrence.

2. Review of statistical methods used in the analysis of extreme phenomena.

3. Probabilistic approach - analysis of high-order quantiles.

4. Modeling the probability of occurrence of extreme phenomena using GEV distribution.

5. Modeling the probability of extreme phenomena using the GP distribution.

6. Modeling the probability of extreme events with additional explanatory variables.

7. Methodology for assessing the risk of extreme events.

8. Climate change adaptation strategies,

9. Benefit and loss analysis of construction of large dam reservoirs

10. Guide to good practices.
11. information for flood victims - sanitation management, food safety, prevention of infectious diseases, the process of decontamination of water in wells.
12. Application of remote sensing data and GIS software to analyze the conditions, course and effects of selected extreme phenomena
13. Discussion of selected extreme phenomena that occurred on Earth in historical times

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Evaluation of stage works	51.0%	100.0%

Recommended reading	Basic literature	Falarz M., (red.), 2021, Climate Change in Poland. Past, Present, Future, Springer Keller E.A., DeVecchio D.E., 2011, Natural Hazards; Earths Processes as Hazards, Disasters, and Catastrophes. Pearson Prentice Hall. Kundzewicz Z.W., Matczak P, 2010, Threats of natural extreme events, Nauka 4/2010.Rucińska D., 2012, Extreme natural phenomena and social awareness, UW, Warsaw. Sun, X., Armstrong, M., Moradi, A. et al. 2025. Impacts of climate-induced drought on lake and reservoir biodiversity and ecosystem services: A review. Ambio, 54: 488504. https://doi.org/10.1007/s13280-024-02092-7. Źródła internetowe, np. Portal Gov.pl, Gdańskie Wody.pl
	Supplementary literature	Ciurean R.L., Schröter D., Glade T., 2013, Conceptual Frameworks of Vulnerability Assessments for Natural Disasters Reduction. Approaches to Disaster Management - Examining the Implications of Hazards, Emergencies and Disasters. Coles A., 2001, An Introduction to Statistical Modeling of Extreme Values, Springer. Cyberski J. (ed.), 2003, Flooding in Gdańsk 2001, GTN Wydz. V, Gdańsk. IPCC, 2012, Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. Special Report of the IPCC Technical Summary. Cambridge University Press, Nowy Jork. Rosenzweig C., Solecki W.D., Hammer S.A., Mehrotra S., 2011, Climate change and cities. First Assessment Report of the Urban Climate Change Research Network. Soczyńska U. (ed.), 1997, Prediction of precipitation and floods with a given recurrence time, UW, Warsaw.Walmsley D.J., Lewis G.J, 1997, Human geography. Behavioral approaches, PWN, Warsaw, Poland. Wilks D., 2011, Statistical methods in the atmospheric sciences. Academic Press.
	eResources addresses	
Example issues/ example questions/ tasks being completed	Assess the risk of extreme meteorological events in Gdansk.Based on a case study, select a district of Gdansk for pilot implementation of adaptation and mitigation solutions to climate change.	
Work placement	Not applicable	

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