

## Subject card

|                                             |                                                                                                                                                                                                                                                                                                   |                                                          |                                         |                                     |                                                                                                                      |            |     |
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| Subject name and code                       | Synoptic climatology, PG_00135499                                                                                                                                                                                                                                                                 |                                                          |                                         |                                     |                                                                                                                      |            |     |
| Field of study                              | Physical geography and geoinformation                                                                                                                                                                                                                                                             |                                                          |                                         |                                     |                                                                                                                      |            |     |
| Date of commencement of studies             | October 2025                                                                                                                                                                                                                                                                                      |                                                          | Academic year of realisation of subject |                                     | 2025/2026                                                                                                            |            |     |
| Education level                             | Master's studies                                                                                                                                                                                                                                                                                  |                                                          | Subject group                           |                                     | Obligatory subject group in the field of study<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                               | 1                                                                                                                                                                                                                                                                                                 |                                                          | Language of instruction                 |                                     | Polish                                                                                                               |            |     |
| Semester of study                           | 2                                                                                                                                                                                                                                                                                                 |                                                          | ECTS credits                            |                                     | 2.0                                                                                                                  |            |     |
| Learning profile                            | academic                                                                                                                                                                                                                                                                                          |                                                          | Assessment form                         |                                     | exam                                                                                                                 |            |     |
| 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                                                                                                                                                                                                                                                                                |                                                          | prof. dr hab. Mirosław Miętus           |                                     |                                                                                                                      |            |     |
|                                             | Teachers                                                                                                                                                                                                                                                                                          |                                                          | prof. dr hab. Mirosław Miętus           |                                     |                                                                                                                      |            |     |
| 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                                                                                                                                                                                                                                                                    |                                                          |                                         |                                     |                                                                                                                      |            |     |
| 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                                                       |                                         | 15.0                                |                                                                                                                      | 30.0       | 60  |
| Subject objectives                          | Familiarization with the physical basis of atmospheric processes, particularly at the synoptic scale.<br><br>Familiarization with the methods of synoptic analysis.<br><br>Identification of the role of regional atmospheric circulation in shaping local climatic and oceanographic conditions. |                                                          |                                         |                                     |                                                                                                                      |            |     |

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| Learning outcomes               | Course outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Subject outcome                                                                                                                                                                                                                                                                                                                                                                                                 | Method of verification                                                            |
|                                 | [GFGMU2_U02] precisely and appropriately use terminology in the field of physical geography and geoinformation in oral statements and written works                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Student is able to proficiently and appropriately apply the terminology of synoptic climatology in oral statements and written works.                                                                                                                                                                                                                                                                           | [SU1] oral statement/conversation/discussion<br>[SU4] test/exam - oral or written |
|                                 | [GFGMU2_K01] critical assessment of knowledge in the field of Earth and environmental sciences and geoinformation, its completion and verification through critical analysis of scientific literature                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Student is ready to critically evaluate his knowledge of the temporal and spatial relationships of atmospheric processes and phenomena, to supplement it and to verify his knowledge and skills through critical reading of the literature on the subject.                                                                                                                                                      | [SK1] oral statement/conversation/discussion<br>[SK4] test/exam - oral or written |
|                                 | [GFGMU2_W02] 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                                                                                                                                                                                                                                                                                                                                                                           | Student knows and understands the issues in the field of atmospheric dynamics with particular emphasis on geophysics allowing to understand the complex processes and phenomena occurring in the Earth's atmosphere, their essence, genesis and possible consequences, manifested, among other things, by the influence of atmospheric circulation on the variability of climatic and oceanographic conditions. | [SW4] test/exam - oral or written<br>[SW1] oral statement/conversation/discussion |
|                                 | [GFGMU2_U04] describe and analyze the causes and course of physical and geographical processes and phenomena, selecting and applying advanced techniques and research tools in the field of statistical and geoinformation methods, interpreting the results, using theoretical knowledge to formulate own opinions and conclusions                                                                                                                                                                                                                                                                                                                           | Student is able to describe and analyze the causes and course of atmospheric processes and phenomena, skillfully selecting and applying research techniques and 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.                                                          | [SU1] oral statement/conversation/discussion<br>[SU4] test/exam - oral or written |
| Subject contents                | 1. Theoretical basis of synoptic climatology: functions in multiple dimensions, gradient.<br>2. Physical description of particle motion: advection, particle trajectories, scale analysis, hydrostatic and geostrophic equilibrium, thermal wind.<br>3. Fundamentals of dry and moist thermodynamics: thermodynamic diagram, stability, fundamentals of convective cloud physics.<br>4. Elements of synoptic meteorology: synoptic analysis, air masses, atmospheric fronts, baric systems.<br>5. Dynamics of the atmosphere.<br>6. Development of extratropical cyclones.<br>7. Classification systems of atmospheric circulation forms.<br>8. Case studies. |                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                   |
| Prerequisites and co-requisites | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                   |
| Assessment methods and criteria | Subject passing criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Passing threshold                                                                                                                                                                                                                                                                                                                                                                                               | Percentage of the final grade                                                     |
|                                 | obtaining a passing grade on the written test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 51.0%                                                                                                                                                                                                                                                                                                                                                                                                           | 100.0%                                                                            |
| Recommended reading             | Basic literature<br>Holton, J., 2004, An introduction to dynamic meteorology, Elsevier, Amsterdam.<br>Yarnal B., 1994, Synoptic climatology in environmental analysis. A primer. Wiley, 256pp.<br>Yarnal, Brent et al., 2001, Development and Prospects in Synoptic Climatology. International Journal of Climatology 21: 1923-1950.<br>Zwieriew, A., 1965, Meteorologia synoptyczna, WKiŁ, Warszawa.                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                   |

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|                                                                | Supplementary literature                                                                                                                                                    | <p>Barry R.G., Carelton A.M., 2001, Synoptic and Dynamic Climatology, Routledge.</p> <p>Bluestein, H., 1992-1993, Synoptic-dynamic meteorology In midlatitudes. Vol. I, II, Cambridge University Press, Cambridge.</p> <p>Marosz M., Wójcik R., Pilarski M., Miętus M., 2013, Extreme daily precipitation totals in Poland during summer: the role of regional atmospheric circulation, Climate Research, Vol. 56: 245259, 2013, doi: 10.3354/cr011155.</p> <p>Miętus M., Filipiak J., Wojtkiewicz A., Malik P., Jakusik E., 2008, Warunki termiczne na obszarze Polski w świetle modelu statystyczno-empirycznego [w:] M. Miętus (red.) Statystyczno-empiryczny model warunków termicznych w Polsce, Monografie, Instytut Meteorologii i Gospodarki Wodnej, s. 9-65.</p> <p>Pettersen, S., 1956, Weather analysis and forecasting. Vol. I, II., McGraw-Hill, New York.</p> <p>WMO, 1975. Compendium of meteorology: Vol. I, Part I: Dynamic Meteorology, WMO No. 364, Genewa.</p> <p>WMO, 1978. Compendium of meteorology: Vol. I, Part III: Synoptic Meteorology, WMO No. 364, Genewa.</p> |
|                                                                | eResources addresses                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Example issues/<br>example questions/<br>tasks being completed | Various approaches to the development of extratropical cyclone model - Norwegian school and Shapiro - Keyser: philosophy of approach, theoretical and practical differences |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Work placement                                                 | Not applicable                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

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