



ЦЕНТЪР ЗА ОБУЧЕНИЕ – БАН

1000 София
ул. „Сердика“ № 4
<http://edu.bas.bg>

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Basic Information

Course Title: Coastal and Marine Geomorphology (with Emphasis on Coastal Zone Dynamics)

Lecturers: Assoc. Prof. Bogdan Prodanov, PhD, Eng. / Prof. Lyubomir Dimitrov, PhD, Eng.

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Total Teaching Hours: 20 hours of lectures, 10 hours of seminars; Total: 30 academic hours.

Annotation (up to 150 words)

The course aims to provide doctoral students in Oceanology and Geology of Oceans and Seas with advanced knowledge in marine and coastal geomorphology, focusing on coastal zone dynamics and the processes shaping marine and coastal landforms. The course examines the fundamental principles governing coastal evolution, sediment transport, lithodynamic and morphodynamic processes, and the interactions between geological, climatic and anthropogenic factors. Special attention is paid to the geological and geomorphological development of the Black Sea Basin, the Bulgarian continental shelf, and the Bulgarian Black Sea coast. Contemporary methods for investigating, mapping and monitoring the seafloor and coastal zone are presented, including geophysical, geodetic, remote sensing and GIS-based approaches. The course develops skills for the analysis and interpretation of geomorphological data, assessment of natural hazards and risks, and the application of science-based approaches to the management and conservation of marine and coastal systems.

Course Content (Brief Description by Topics or Modules)

MODULE I. THEORETICAL FOUNDATIONS OF MARINE AND COASTAL GEOMORPHOLOGY

Topic 1. Marine and Coastal Geomorphology – scope, objectives, position within Earth sciences, and fundamental concepts. Morphography, morphometry, morphogenesis, morphochronology and morphodynamics.

Topic 2. Endogenic and exogenic geomorphic processes. Morphostructures and morphosculptures. Geological, climatic and hydrological controls on landform development.

Topic 3. Relief of the World Ocean. Geotectonic controls on the formation of ocean basins, mid-ocean ridges, deep-sea trenches and continental margins.

Topic 4. Marine hydrodynamic processes and their geomorphological significance. Waves, currents, tides, storm surges and atmosphere–ocean–coast interactions.



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Topic 5. Coastal lithodynamics. Sediment sources, transport mechanisms, sediment budget and coastal sediment cells.

Topic 6. Coastal morphodynamics and dynamic equilibrium of coastal systems. Concepts of resilience, threshold sensitivity and geomorphological adaptation to natural and anthropogenic forcing.

Topic 7. Genesis, classification and evolution of coastlines. Erosional, depositional, structural, ria, liman, lagoon and barrier coasts.

Topic 8. Beach systems and coastal depositional landforms. Beaches, spits, tombolos, barriers, lagoons, limans and related sedimentary bodies.

Topic 9. Coastal dunes and beach-dune systems. Genesis, morphology, classification, evolution and ecological functions.

Topic 10. Coastal hazards and risk – coastal erosion, flooding, landslides, dune dynamics, extreme storm impacts and sea-level rise.

Topic 11. Contemporary methods for geomorphological investigation and monitoring of the seafloor and coastal zone. Geodetic, hydrographic, geophysical, remote sensing and GIS technologies.

MODULE II. GEOLOGICAL AND GEOMORPHOLOGICAL DEVELOPMENT OF BULGARIA AND THE BLACK SEA BASIN

Topic 12. Geological development of Bulgaria. Major structural-tectonic units and stages of geodynamic evolution of the territory.

Topic 13. Relief of Bulgaria. Morphostructural framework, morphographic characteristics and contemporary geomorphological regionalization.

Topic 14. The Black Sea Basin within the Tethys and Paratethys systems – geodynamic evolution, palaeogeographic relationships and its position within the Alpine-Himalayan Orogenic Belt.

Topic 15. Origin, geology and geotectonics of the Black Sea. Principal structural elements and present-day architecture of the Black Sea Basin.

Topic 16. Geological and tectonic structure of the Bulgarian continental shelf. Moesian Platform, Lower Kamchia Depression, Stara Planina Segment and Burgas Basin.

Topic 17. Geological and geomorphological characteristics of the Bulgarian Black Sea shelf and the Exclusive Economic Zone of the Republic of Bulgaria. Coastal zone, shelf zone and outer shelf zone, continental slope and continental rise.



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Topic 18. Palaeogeographic evolution of the Black Sea during the Late Pleistocene and Holocene. Sea-level fluctuations, phases of isolation and connections with the Mediterranean system. Transgressions, regressions, palaeoshorelines and submerged landscapes of the Black Sea.

Topic 19. Continental shelf, continental slope and deep-sea domain of the Black Sea. Geomorphological characteristics and contemporary processes.

MODULE III. THE BULGARIAN BLACK SEA COAST

Topic 20. Geomorphological subdivision of the Bulgarian Black Sea coast. Northern, Central and Southern sectors of the Bulgarian Black Sea coast – natural differences and regional characteristics.

Topic 21. Contemporary geomorphological processes along the Bulgarian Black Sea coast. Coastal abrasion, landslides, erosion, sediment accumulation and anthropogenic impacts.

Topic 22. Beach-dune systems along the Bulgarian Black Sea coast – distribution, typology, habitats, ecological status and conservation significance.

Topic 23. Natural hazards and contemporary environmental problems of the Bulgarian Black Sea coast. Coastal vulnerability and risk assessment – coastal erosion, flooding, landslides, extreme storm impacts, sea-level rise, sediment budget deficits and methodologies for risk assessment in the coastal zone.

Topic 24. Monitoring, management and sustainable development of the coastal zone – Integrated Coastal Zone Management (ICZM), climate change, adaptation of coastal systems, national legislation, the Water Framework Directive (WFD) and the Marine Strategy Framework Directive (MSFD).

Teaching and Assessment Methods

Teaching methods: lectures, seminars, laboratory exercises and field investigations.

Assessment: written and/or oral examination, or preparation and public presentation of a seminar paper or presentation related to the doctoral student's research interests and the course topics.

Competencies Acquired as a Result of Training

1. Advanced theoretical knowledge of geomorphological processes and factors controlling the formation and evolution of marine and coastal landforms.
2. Understanding of the geological, geomorphological and palaeogeographical development of the Black Sea Basin and the Bulgarian Black Sea coast.
3. Ability to apply modern methods for investigation, mapping and monitoring of the seafloor and coastal zone, including geophysical, geodetic, remote sensing and GIS technologies.
4. Skills in analysing and interpreting geomorphological, sedimentological and spatial datasets related to coastal processes.



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5. Ability to assess coastal vulnerability, hazards and risks and to apply science-based approaches for the management and conservation of marine and coastal systems.

Literature

1. Dimitrov, L., Valcheva, N., Prodanov, B. General Characteristics of the Black Sea and Its Bulgarian Sector. In: *Geography of Bulgaria. Volume 1: Physical Geography and Geoinformation Technologies*. Sofia, Prof. Marin Drinov Publishing House of the Bulgarian Academy of Sciences, 2025.
2. Dimitrov, L., Prodanov, B., Kotsev, I. Geological and Geomorphological Characteristics of the Bulgarian Coast, Continental Shelf and Exclusive Economic Zone. In: *Geography of Bulgaria. Volume 1: Physical Geography and Geoinformation Technologies*. Sofia, Prof. Marin Drinov Publishing House of the Bulgarian Academy of Sciences, 2025.
3. Kanev, D. General Geomorphology. Sofia, Nauka i Izkustvo Publishing House, 1984.
4. Krastev, T. Structural-Geomorphological Development of the Continental Margin of the Bulgarian Sector of the Black Sea. Extended Abstract of a Doctor of Geographical Sciences Dissertation. Varna, Institute of Oceanology – Bulgarian Academy of Sciences, 1993.
5. Krastev, T. Morphosculpture of the Bulgarian Black Sea Coast. In: *Geography of Bulgaria*. Sofia, ForKom Publishing House, 2002.
6. Leontyev, O. K., Rigachov, G. I. General Geomorphology. Moscow, Vysshaya Shkola, 1988.
7. Peichev, V. Geological Structure and Geomorphology of the Bulgarian Black Sea Coast. In: *Morphodynamic and Lithodynamic Processes in the Coastal Zone*. Varna, Slavens Publishing House, 2004, pp. 29–69.
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9. Peichev, V., Peev, P. Evolution of the Bulgarian Black Sea Coast. Varna, Slavens Publishing House, 2006.
10. Popov, V., Mishev, K. Coastal Geomorphology. In: *Geomorphology of the Bulgarian Black Sea Coast and Continental Shelf*. Sofia, Bulgarian Academy of Sciences, 1974.
11. Keremedchiev, S., Peichev, V. Contemporary Geomorphodynamic Activity and Stability of the Coastal Slope between Cape Galata and Sakama Dere. *Proceedings of the Union of Scientists – Varna*, 2001, pp. 67–71.
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14. Bird, E. Coastal Geomorphology: An Introduction. Wiley, Chichester, 2011.
15. Davidson-Arnott, R. Introduction to Coastal Processes and Geomorphology. Cambridge University Press, Cambridge, 2010.
16. De Clippele, L. H., Aguilar, R., Canals, M., Chimienti, G., Martín-García, L., Kotsev, I., Prodanov, B., Poursanidis, D., Vinha, B. Tools and Approaches for Mapping Marine Animal Forests: A Practical Overview for Researchers and Conservationists. *Open Research Europe*, 5:272, 2025.
17. Kotsev, I., Prodanov, B., Dimitrov, L. Geomorphology of the Bulgarian Black Sea Coastal Zone. In: *Landscapes and Landforms of Bulgaria*. World Geomorphological Landscapes. Springer, 2026.



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18. Masselink, G., Hughes, M., Knight, J. Introduction to Coastal Processes and Geomorphology. Routledge, London, 2014.
 19. Prodanov, B. Geological Basis for Mapping Benthic Habitats on the Bulgarian Continental Shelf off the Avren Coast. PhD Thesis. Institute of Oceanology – Bulgarian Academy of Sciences, Varna, 2017.
 20. Prodanov, B., Dimitrov, L., Kotsev, I., Bekova, R., Lambev, T. Spatial Distribution of Sand Dunes along the Bulgarian Black Sea Coast: Inventory, UAS Mapping and New Discoveries. *Nature Conservation*, 54: 81–120, 2023.
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 22. Treatise on Geomorphology. Volume 10: Coastal Geomorphology. Elsevier, Amsterdam, 2013.
 23. Woodroffe, C. D. Coasts: Form, Process and Evolution. Cambridge University Press, Cambridge, 2002.

Additional Information (optional)

Basic knowledge of geology, geomorphology, oceanology and geographic information systems is recommended. Subject to availability, the course may include demonstrations of contemporary field and expedition methods for investigating the seafloor and coastal zone.