Application of satellite data and surveying to detect changes in the coastline and seabed evolution in the spit coast as a element of hydromorphological characteristics

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Spit coast is not a common type of Baltic Sea coast. The most numerous of this coastal type is found in Poland, and the largest form is the Hel Peninsula. This spit, which is a scytheshaped sand barrier, is exposed to shore erosion due to the exposure of waves and dominant longshore currents. The sensitivity of this area, resulting mainly from the geological structure constituting a narrow spit and increased hydrodynamic conditions, determine the need for observations and the development of new complementary methods to support decisions on the protection of the shore and habitat. The Hel Peninsula was formed at the turn of the Pleistocene and Holocene and is constantly subject to geomorphological changes. Thanks to the marine transgression, a sandy underwater dike was formed, which rose to the surface during the withdrawal of the sea (regression), giving rise to the formation of the Hel scythe. The spit is an extension of the beach (land), which accrues due to the movement of sandy material along the shore. Coastal currents and wave action are responsible for the transport of material. An important element of marine environmental monitoring is the analysis of bathymetric-orographic conditions of the coast in the form of geodetic field measurements of the coastal zone and sonar measurements of the seabed. Detection and identification of geomorphological changes in both the shore and the seabed are important for shore protection, land reclamation, ongoing and planned investment activities, and marine flora and fauna habitat. Due to the field surveys conducted in 2019 and 2022, it was possible to compare the variability of transects in terms of the increase or decrease in the ordinate of the seabed and its association with erosion or shore accumulation compare the results obtained in this way with high-resolution (30-50 cm) Neo Pléiades satellite images. Using Matlab's Image Processing Toolbox and a library of high-resolution Neo Pléiades satellite images, shorelines were delineated, which further enabled the Haversine method to calculate the distance of the shoreline from the reference line. This made it possible to identify regression or shoreline growth and, consequently, the growth or lowering of the seabed, according to Bruun's theory. The main objective of the research is to demonstrate the applicability of high-resolution satellite data for detecting and identifying changes in seafloor geomorphology and to determine the horizontal length of the sedimentologically active seabed as an alternative method for hydromorphological monitoring studies.