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Identification of the Sediment Deposited Environments Using Chirp Sonar Profilers

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The aim of this study is to obtain the vertical and horizontal sediment characteristics using the power coefficients (PC) and the similarity index (SI) estimated from the chirp sonar data. Seabed texture, physical, and geotechnical properties are critical information to assess the seabed stability for civil engineerings, such as wind farms building and cable laying. Collecting chirp sonar sub-bottom profiles is a commonly used method to survey geological structures of the seafloor. Compared with the coring survey at several sites, the sub-bottom profiling technique is relatively low-cost and efficient to obtain the seafloor information from points, lines, even to the entire area. Based on the obtained values of PC and SI, the seabed sediments can be classified into the following four types. (A) the hard bottom in an erosion environment of homogeneous hydration dynamics; the time series of waveforms showing transparent and very consistent top reflections; (B) the hard bottom in an erosion environment of inhomogeneous hydration dynamics; the waveforms showing sharp top reflections followed by bedding planes; (C) the soft bottom in a deposited environment of homogeneous hydration dynamics; the waveforms showing parallel and continuous internal reflectors; (D) the soft bottom in a deposited environment of inhomogeneous hydration dynamics; the waveforms showing bedding planes with a surficial chaotic or transport reflectors. Furthermore, the type-D is developed by the mass transport deposit features and can be clearly observed in chirp sub-bottom images. To verify the method, we also conducted the core analysis using the samples from eight different sites in the study area. These results indicate that our technique is an effective method to study mass movement processes and deposits such as debris or turbidity flow.