



Full-scale integration of geological, geophysical and geotechnical methods for characterization of marine and coastal environments

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Characterizing marine environments typically rely on the integration of geological and geophysical data such as sediment cores, petrophysical well logs, acoustic and seismic data. Offshore construction work have further sparked the needs for integrating geotechnical data such as cone penetration tests (CPTs). Similarly, the combination of intensified human usage of the shallow marine and coastal regions and future climate-adaption challenges, have raised the needs for integrating data that transect the coast, such as airborne LiDAR data and photogrammetric investigations. Based on four case studies we present a synthesis of the current methodologies applied when performing a full-scale characterization of shallow marine and coastal environments using geological, geophysical and geotechnical data.

Subsurface characterization in the marine realm have been assessed using 2D and/or 3D seismic and acoustic data of varying resolution in combination with geological data from boreholes. Mapping seismic morphologies, stratigraphic context and lithological units from these data provide information of the geology and geological processes in the investigated areas and form the basis for defining a subsurface spatial geomodel. The geomodel is then integrated with geotechnical data that investigates the soil properties and allows for identification of soil types. Seafloor morphologies and dynamics are addressed by using multibeam bathymetric, subbottom profiler, and side scan sonar data. For the coastal zone, LiDAR data and drone-based 3D photogrammetric modelling have been applied. A comparison with traditional orthophotos of the coastal zone shows that the photogrammetric model is of higher image and height resolution. This enables a relatively detailed geological description from 2D and 3D imagery of the cliff face.

The relevance of full-scale studies as those describe here are many, ranging from offshore installations of wind-farms, oil and gas platforms, pipes and cables, to assessment of marine raw materials, coastal erosion, marine habitats and paleolandscape evolution.