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Monitoring shoreline and topographic changes using remotely sensed data: Example from east coast of Korea

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Sandy beaches are important habitats for coastal organisms and act as buffer zones during coastal disasters. Along the eastern coast of Korea, most of the coastal zone consists of sandy beaches. However, beach erosion has accelerated in recent years. In this study, we analyzed topographic and shoreline changes in Uljin County on the east coast of Korea. We used remotely sensed data collected from 1971 to 2009, airborne light detection and ranging (LiDAR) data for 2008 and 2010, and terrestrial LiDAR data for 2008 and 2009. Three coastal locations were studied: the area around a nuclear power plant, the area around a stream, and the area around the East Sea Research Institute (ESRI), a branch of the Korea Institute of Ocean Science & Technology (KIOST). Analysis of shoreline changes showed the occurrence of sand deposition, resulting in shoreline movement toward the nuclear power plant by a maximum of 120 m. Deposition also occurred near ESRI, causing shoreline movement of a maximum of 45 m from 1971 to 2003; however, a maximum of 44 m erosion was detected from 2003 to 2009. Topographic changes were determined using the airborne LiDAR data and indicated approximately 1 m of sand deposition in the area around the nuclear power plant. In the area around the stream, both deposition and erosion were found, whereas around the ESRI region, erosion of approximately 3 m was identified. The analysis of terrestrial LiDAR data showed trends in shoreline change that were similar to those obtained from airborne LiDAR. Changes in the shoreline near the stream included sedimentation of approximately 7 m between 2008 and 2009, which was identified by terrestrial LiDAR data. The shoreline around ESRI changed by approximately 15 m owing to erosion. Our results suggest that construction of the nuclear power plant caused topographic and shoreline changes in our study area. Such shoreline changes will influence coastal management and preservation policy, and thus continuous monitoring of changes in coastal areas is required combined with analyses of physical and sedimentary environments.