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The use of airborne laser altimetry for assessing marine flooding risk with sea-level rise on the northern coast of France

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Airborne scanning laser (LiDAR) altimetry data were collected to determine the possible impacts of climate change, notably sea-level rise, on the coastal zone west of Calais in the Dover Strait, Northern France, which consists of wide sandy macrotidal barred beaches backed by coastal dunes. In the study area, the coastal dunes are 2.5 to 16 m high and 30 to 250 m wide, and constitute a natural barrier protecting low-lying reclaimed land in the backshore that are located down to 0.5 to 1 m below high spring tide level. Along this coast, strong onshore-blowing winds can induce significant positive surges that may result in coastal erosion and marine flooding. In response to major storm surges, the backshore zone has been inundated by marine waters seven times during historical times, including the dramatic 1953 storm surge event that originated from the North Sea. The LiDAR data were first used to generate high-resolution Digital Elevation Models (DEM) of the coastal zone. The ground DEMs were adjusted to hydrographic chart datum and used to model flood extent for three water levels representing scenarios under rising sea-level. The DEMs were used to produce a series of potential flood maps for extreme water levels with return periods of 10, 50 and 100 years by the year 2050 yielding values of 854, 880 and 892 cm above local hydrographic datum by the year 2050. This study demonstrates that DEMs derived from airborne LiDAR data are efficient and adequate tools for accurate mapping over extensive areas and for determining zones that can be potentially affected by coastal hazards. This method can be very valuable for the management and prevention of natural hazards in the coastal zone, notably marine flooding that may increase during the next decades with continuing sea-level rise.