

Evolution of the Ostend beach after multiple artificial sand nourishments

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1. INTRODUCTION

Sand nourishments are commonly used at the Belgian coast. Since the early 2000s, Ostend beach has been artificially nourished to improve safety against storm flooding. Expansion of the port of Ostend in the period 2009-2012 caused a blocking of the west-to-east oriented sediment circulation along the coast. Also, it has led to an accumulation of large amounts of sand in front of the city of Ostend (Figure 1). Between 2013 and 2014, a large nourishment was performed in the area Raversijde - Mariakerke (updrift from Ostend) whereby approximately 2 million m³ was placed both on the beach (dry and intertidal) and on the shoreface, at depths between -1 and -5 m TAW. The nourishment was performed to test the most efficient way to maintain the sandy sea defences on the long term (Dan *et al.* 2021). In early 2018, a new nourishment took place at Ostend beach whereby a volume of approximately 741 000 m³ was placed both on the beach and on the shoreface. The beach profile was leveled after every nourishment, but as expected local reorganization occurred within the active beach section, creating a complex pattern of sand ridges and channels.

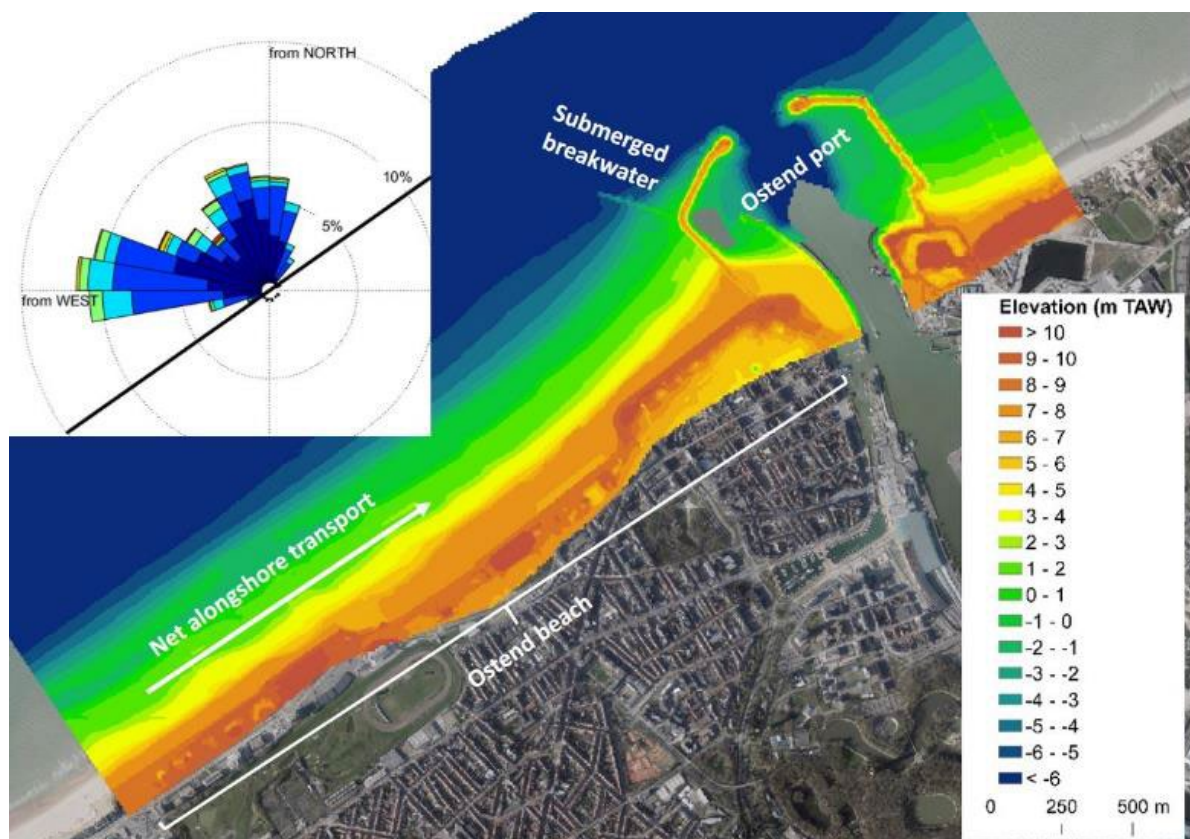


Figure 1: Digital elevation model of Ostend beach (2021)

2. METHOD

The main method for investigation of the beach evolution was building digital elevation models (DEM) based on topographical and bathymetric measurements carried out yearly by Coastal Division. Comparison of successive DEMs, interpretation and sand budgets were also used to understand the local active beach dynamics.

3. EVOLUTION OF THE COAST IN THE LAST YEARS

The evolution of Ostend beach between 2013 and 2021 is dominated by the re-organization of the sand both alongshore and cross-shore under the influence of wave, tides and currents. The erosive trend observed before 2013 was interrupted by the nourishments. The dry beach increased in volume while a decrease in volume was observed for the intertidal beach. The shoreface area retains much of the nourished sand by consolidation of the sand bars. The combination of the net alongshore transport and local configuration (the port and the submerged breakwater) (Figure 1) plays an important role for the sand accumulation at Ostend beach. After the nourishment in 2018, similar re-distribution of sand occurred with loss of sand in the intertidal area but with gains in the shoreface and dry beach areas (Figure 2). This evolution is partially natural due to inherent re-organization of the nourishments mostly for the shoreface area, but also due to human activities related to summer beach activities, especially for intertidal and dry beach. However, much of the sand nourished between 2013 and 2018 is still present in the area. It is expected that the eventual losses are surpassed by the net alongshore transport from southwest to northeast (average magnitude of 200 000 m³ per year) which will continue to supply Ostend beach with sand. A bypass system to transfer part of the accumulated sand northeast of the port would contribute to restoration of a dynamic equilibrium for Ostend beach and additionally to nourish the downdrift beaches.

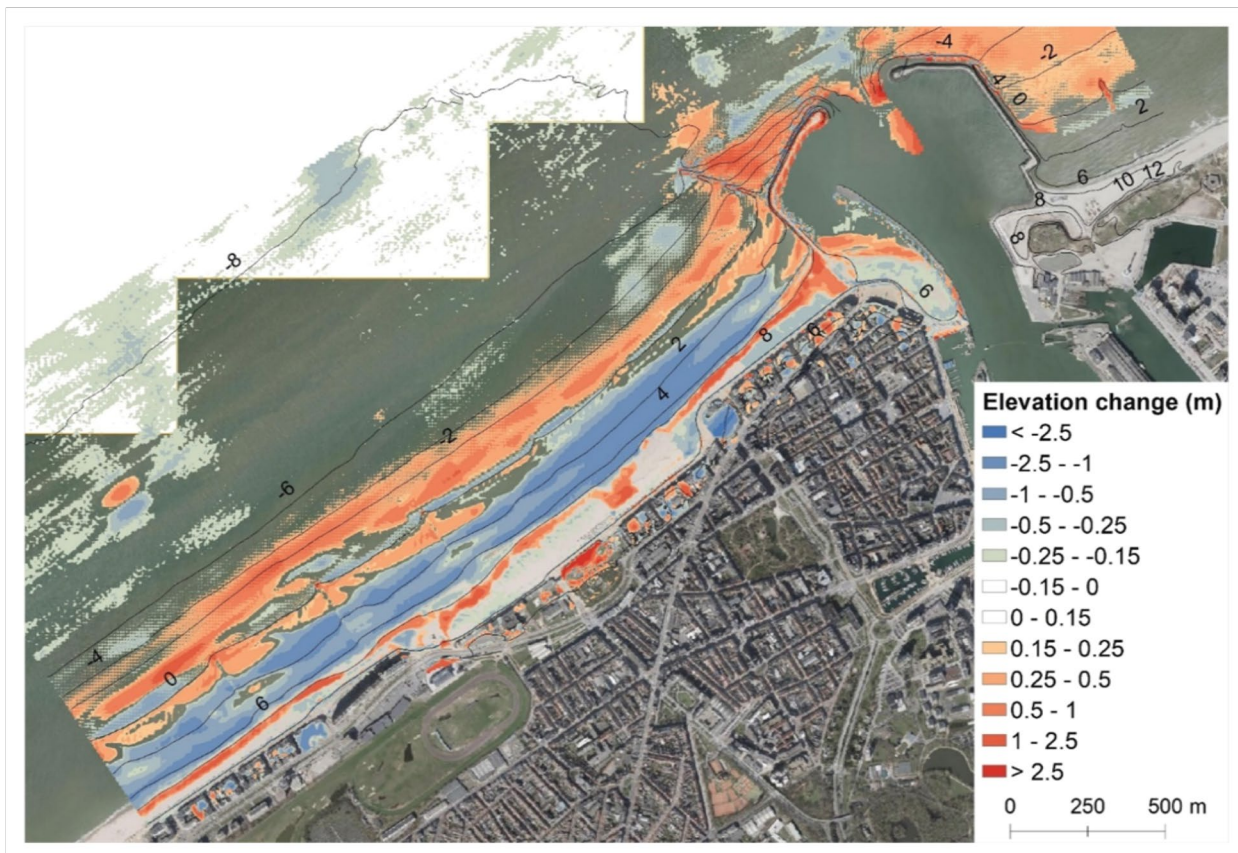


Figure 2: Difference of digital elevation models between 2021 and 2018 at Ostend beach.

4. ACKNOWLEDGEMENTS

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5. REFERENCE

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