Analysis of the Ciara storm impact on a multibarred beach at the Belgian coast

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Ciara storm took place between the 8th and 12th of February 2020 in Belgium and lashed with significant economic and environmental damages. The aim of this study was to analyze the effect of the Ciara storm on the morphodynamical and volumetric changes of the intertidal bars at Groenendijk beach, Belgium.

Ciara event was one of the strongest storms recorded in the recent years. During this storm, the meteo-marine conditions were recorded with a maximum water level of 5.78m (TAW) and a maximum wave height of 2.80m with a wave direction approaching from the South-West, a maximum wind speed of 23.18 m/s blowing from the west and an average wave period of 4.5 s.
To investigate the impact of this storm, an intensive daily cross-shore profiles monitoring campaign after Ciara storm was carried out with a Real Time Kinematic GPS (RTK-GPS) from 22/02/2020 till 26/02/2020. Also, a pre-storm Light Detection And Ranging (LiDAR) topographic survey on 13/01/2020 and post-storm airborne LiDAR survey on 28/02/2020 were performed. They were both provided by the Coastal Division.

The acquired cross-shore profiles were re-projected and interpolated at 1 m interval. Then morphological analyses were carried out to determine bar dynamics over the study period. Bar parameters were obtained such as the different bars width and height, distance between adjacent bars, seaward and landward bar slopes, bar volume etc.

A high difference of elevation in the crest and troughs of the bars between pre- and post-storm was found with values up to 0.3m and up to 0.15m by focusing only on the post-storms daily campaign with SD higher values on the seaward slopes of the bars.

A high difference of elevation between consecutive days was of 0.15m while it was up to 0.30m between the pre- and post-storm surveys. The most significant changes occurred on the seaward slope of the bar. Interestingly, the most inner bars were dynamics while the bar near the mean low water level was stable. Furthermore, the results indicate that the storm impacted the beach and produced an overall loss of sand (up to 0.5 m^3/m).

This study has provided insight into post-storm bar behavior which can be beneficial for coastal management and future research.

Keywords: Intertidal bar; Storm impact; Morphodynamical changes; Coastal erosion