Human Interference along the Belgian Coast

Evelien Brand*

Vrije Universiteit Brussel, Pleinlaan 2, 1050 Elsene, Belgium

Within the context of coastal research, our experimental setting is often a public place and people walk in and out of our *laboratory* all the time. Unless we are allowed to close off a part of the beach, we can only hope that passersby disturb our experiment as little as possible. Thankfully, the impact of people on the beach is often much smaller than the impact that we are investigating, such as the impact of breaking waves. Sometimes we are unlucky though.

In 2017 and 2018, I carried out six fortnight campaigns along the Belgian coast for my Ph.D. research at the Vrije Universiteit Brussel (Brand, 2019), supervised by Professor Margaret Chen and carried out within the CREST project: a project that aimed to investigate the resilience of the Belgian coast. The Belgian coast is situated in the southern part of the North Sea basin and is subject to a large tidal range and limited wave energy. The aim of my Ph.D. research was to investigate the role of tide in the intertidal beach morphodynamics for this tide-dominated, sandy coast. During each campaign a measuring frame was placed on the low water line to continuously measure the hydrodynamics and suspended sediment transport (Figure 1). Every day during low tide I went to the beach to measure the beach topography of five cross-shore profiles with an RTK-GPS (Real Time Kinematic GPS) in order to determine daily beach volume changes. I aimed to relate these to the hydrodynamic conditions and the daily net sediment transport, assuming that all topographic changes on the beach resulted from natural processes.

Figure 1. The measuring frame that was placed on the low water line. (Photo: E. Brand.)

DOI: 10.2112/JCR-SI101-072.1
***Corresponding author: evelien.brand@vub.be**

Each day I would arrive at the beach a few hours before low tide. The field campaigns never took place during the touristy summer season, so the beach was generally quite empty. However, one day when I arrived, I found the beach as shown in Figure 2a: bulldozers had re-arranged the entire beach overnight! The previous day the beach was gradually sloping, but now the upper beach was completely flattened and the transition to the intertidal zone was a 1.5 m high cliff. You can imagine that this was not beneficial for my aim to attribute beach volume changes to waves and tidal currents. Another day I arrived at the beach to find the man in Figure 2b, who was building a massive maze in the intertidal zone. The children on the beach very much enjoyed his effort. The researcher on the beach enjoyed it a little less: the maze covered three of my five topographic profiles.

Figure 2. (a) The beach after the bulldozers. (b) The beach after the maze-building. (Photos: E. Brand.)

The battery capacity and data storage of the equipment on the low water line allowed for measurements over 14 days per campaign. It was quite costly and labour-intensive to place this equipment, so each day of measurements was valuable. Both the bulldozers and the maze-man made me delete quite a few days from the survey, because it rendered the daily intertidal beach volume changes unreliable. Besides these very large disturbances, I had to remove more profiles because small, but strange, topographic changes had happened, that were most likely not due to natural processes.

Thankfully, CoastScan, who work on continuous monitoring of coastal change using terrestrial laser scanning (Vos, Lindenbergh, and de Vries*,* 2017), wanted to collaborate with us and they installed a permanent terrestrial laser scanner to survey the full beach topography. The University of Ghent processed all the data and provided half-hourly beach surveys of the research area. This data was much denser, both in space and time, than the RTK-GPS data, which made it easier to understand topographic changes and to remove data that was disturbed by human activities. Also, disturbances that happen in one or more of the cross-shore profiles, such as the maze, would not influence the measurements anymore. Furthermore, the laser scan measurements were generally much more accurate than the RTK-GPS measurements.

Thanks to the laser scanner I managed to relate daily intertidal beach volume changes to the hydrodynamic conditions and sediment transport rates in a quantitative way (Brand *et al.,* 2019) and I found that the impact of tidal currents on the beach was large and even of a similar magnitude as the effect of waves. The bad luck with the topography measurements also motivated me to review all the available measuring techniques for topography and sediment transport in the intertidal zone (Brand, Chen, and Montreuil, 2019).

ACKNOWLEDGEMENTS

This research was part of the CREST project, funded by the SBO program of IWT. The permanent laser scan measurements were performed by Dr. Sander Vos within the CoastScan project funded by the European ERC-Advance NEMO grant and the Dutch NWO CoastScan project. I want to thank Professor Margaret Chen and Dr. Anne-Lise Montreuil (VUB), Professor Alain De Wulf and Lars de Sloover (UGent) for their help with the field campaigns and VLIZ and FHR for the use of their equipment and the help with the deployment of the frame.

LITERATURE CITED

Brand, E., 2019. Intertidal Beach Morphodynamics of a Macro-tidal Sandy Coast (Belgium). Brussel, Belgium: Vrije Universiteit Brussel, Ph.D. dissertation, 148p.

Brand, E.; Chen, M., and Montreuil, A-L., 2019. Optimizing measurements of sediment transport in the intertidal zone. *Earth-Science Reviews*, 200, 1-10.

Brand, E.; De Sloover, L.; De Wulf, A.; Montreuil, A-L.; Vos, S., and Chen, M., 2019. Cross-shore suspended sediment transport in relation to topographic changes in the intertidal zone of a macro-tidal beach (Mariakerke, Belgium). *Journal of Marine Science and Engineering*, 7(172), 1-16.

Vos, S.E.; Lindenbergh, R.C., and de Vries, S., 2017. Coastscan: Continuous monitoring of coastal change using terrestrial laser scanning. *In:* Aagaard, T.; Deigaard, R., and Fuhrman, D. (eds.), *Proceedings of Coastal Dynamics 2017* (Helsingør, Denmark), pp. 1518-1528.