THE EFFECT OF BUILDING GEOMETRY ON AEOLIAN DEPOSITION AND EROSION PATTERNS: A FIELD EXPERIMENT

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INTRODUCTION

Worldwide, people enjoy recreating at the beach. As a result, they have built buildings like restaurants and (holiday) homes at the land-sea interface. These buildings affect the wind-driven sand transport in their surroundings, thereby shaping the development of the beach-dune system. This can have implications for the flood protection offered by the dunes. Currently, we are facing an increasing demand for sea-side buildings on the beach and a lack of knowledge on the effect of buildings on the beach-dune system. Therefore, this research aims to understand the effect of buildings at the beach-dune interface on sediment transport and beach-dune morphology. In this contribution we present the results of a field experiment which focused on the effect of building size and geometry on the size and location of the deposition patterns directly around buildings.

METHODOLOGY

During the experiment, cuboid boxes were placed on the beach at the Sand Motor (the Netherlands) as scale models of houses (figure 1). The deposition and erosion patterns around the boxes were measured using structure-from-motion photogrammetry. A telescopic stick and drone were used to take photos all around the boxes, from a height of approximately 5 metres. These photos were computationally combined to form a digital elevation model (DEM) and orthophoto (a distortion-free top view). In addition, the wind speed and direction were recorded, along with the occurrence of sand transport at different elevations above the bed.

The cuboid boxes were used as scale models and varied in size, shape and formation. Firstly, individual boxes, 0.3 to 2 m long and 0.3 to 1.2 m wide and high, were placed parallel to the wind direction on 7 different days, for a total of 59 observations. Secondly, boxes of 1x0.5x0.5 m were placed individually and in small groups in varying orientations to the wind, to test the effect of orientation, distance between boxes, group size and group orientation, with in total over 8 days 63 observations.

Figure 1 – Photo of one of the set-ups, with scale models of houses to test the effect of building width and height

RESULTS

The experiments showed the various kinds of deposition and erosion patterns that can be found around buildings at the beach (Poppema et al., 2019). For the size and location of deposition patterns, the results show that the building height and especially width are more important than the length parallel to the wind. This is consistent with literature on air flow around bluff bodies (e.g. Fackrell, 1984). Figure 2 shows an example of the observed deposition patterns.

At the conference we will present a quantitative analysis of the experimental results, relating the extent and location of deposition/erosion patterns to various building configurations. This will provide insight in the spatial extent to which buildings disturb the aeolian transport in a beach environment.

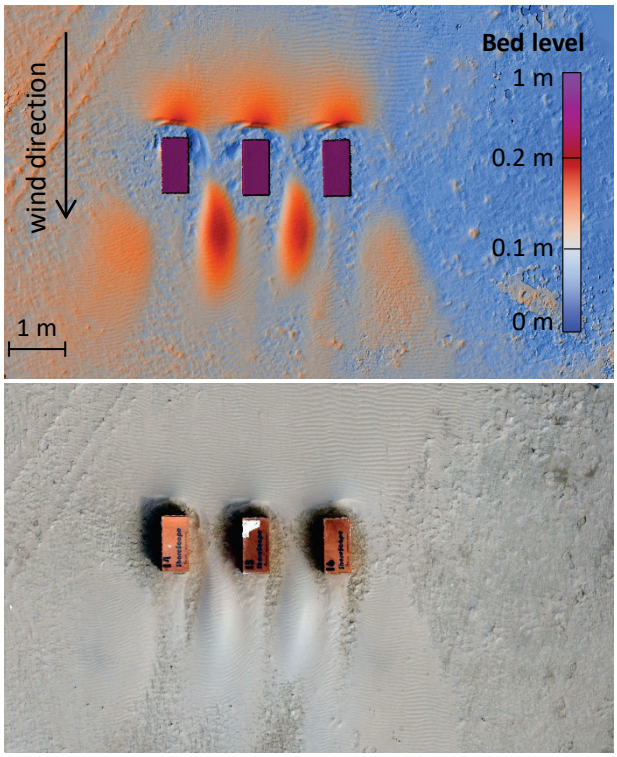

Figure 2 – A DEM (top) and orthophoto (bottom) of the deposition around a row of 3 boxes (size 1x0.5x0.5m)

REFERENCES

Poppema, Wijnberg, Mulder & Hulscher (2019): Scale experiments on aeolian deposition and erosion patterns created by buildings on the beach, Coastal Sediments 2019, 1693-1707

Fackrell (1984). Parameters characterising dispersion in the near wake of buildings. Journal of Wind Engineering and Industrial Aerodynamics, 16(1), 97-118.