Universiteit Utrecht

Faculty of Geosciences
Physical Geography

Dune erosion: observations and modelling

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Introduction

XBeach[1] has shown potential in predicting dune erosion under controlled laboratory conditions; however, it is essential that quantitative field-scale validations are performed too. The aim of this research is to validate XBeach using recent dune-erosion data collected at Egmond aan Zee and to explore its capability to predict the observed erosion and its alongshore variation.

Methodology

- Hydrodynamic calibration and validation based on intertidal field data collected near Egmond during October 2011 (Figure 1)
- Morphologic validation on dune erosion event January 2012

Figure 1 Measurement array in intertidal zone

Dune Erosion Event

- The dunes at Egmond aan Zee eroded in response to large waves and high surge levels that occurred from 2-6 January (Figure 2)
- Surveys performed pre- and post storm with a terrestrial laser scanner show strong alongshore variability in dune erosion (Figure 3a)
- The maximum vertical erosion varied between 4 and 12.5 m with a mean horizontal recession of 7.8 m

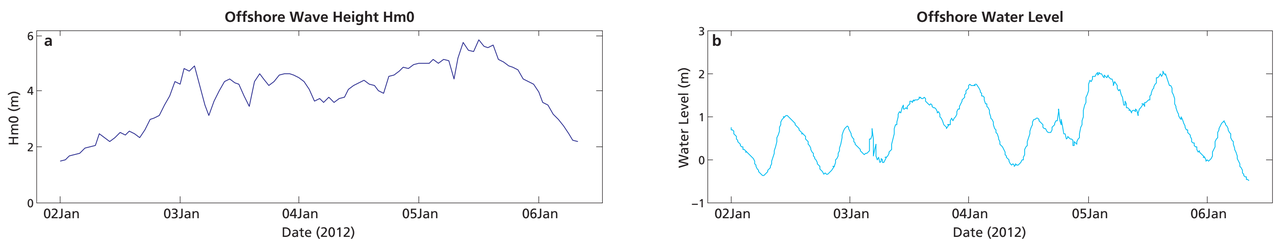

Figure 2 (a) Offshore wave height and (b) surge level during the 2-6 January 2012 dune erosion event.

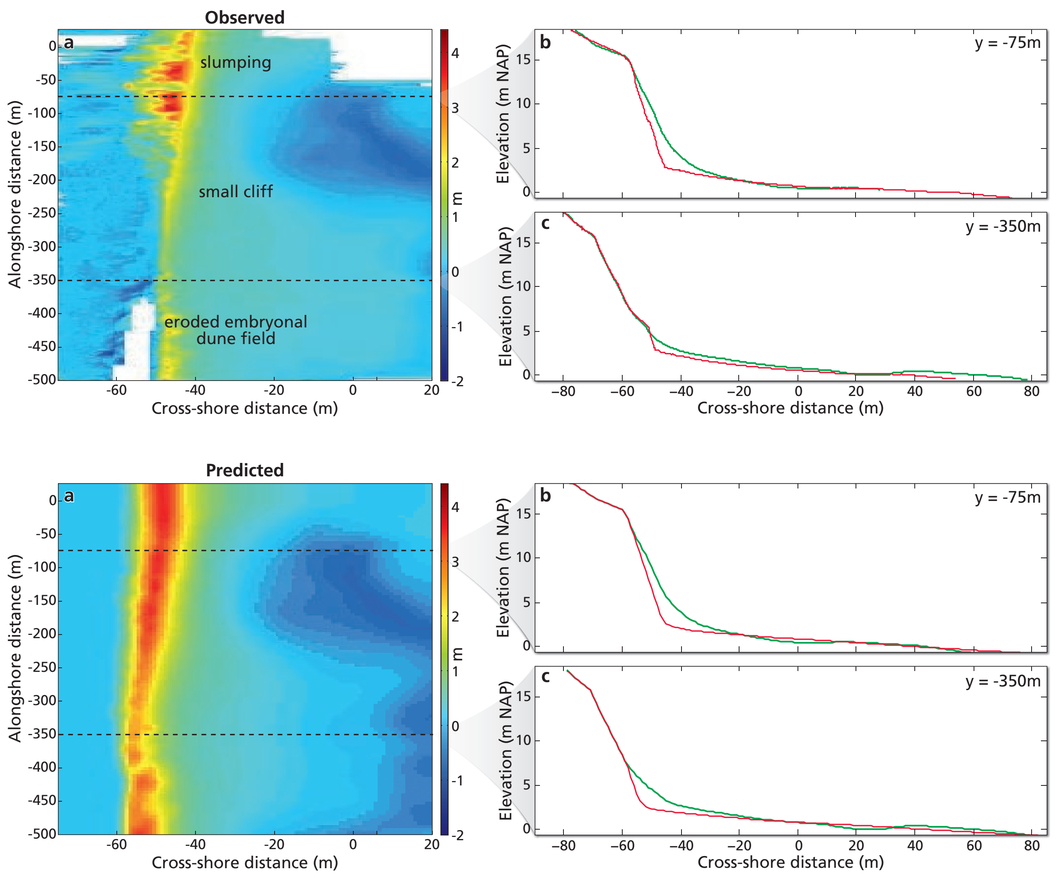

Figure 3 (a) Observed topographical difference map and, on the right, measured cross-shore profile before (green) and after (red) the dune erosion event at (b) y = -75 m and (c) at y = -350 m.

Figure 5 (a) Predicted topographical difference map and, on the right, predicted cross-shore profile before (green) and after (red) the dune erosion event at (b) y = -75 m and (c) at y = -350 m.

Model Results

- XBeach predicted infragravity-wave height reasonably well, but somewhat overpredicted sea-swell wave height (Figure 4)
- XBeach reasonably reproduced alongshore variability in dune erosion, but erosion as a whole was over-predicted (Figure 5). We are currently exploring the reasons for the observed and predicted alongshore variation in dune erosion

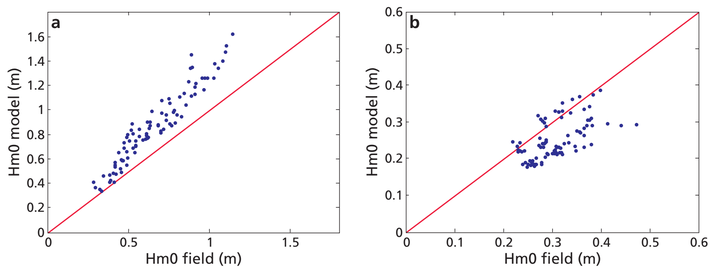

Figure 4 Predictions compared to measurements of (a) sea-swell wave height and (b) infragravity wave height.

Reference

1 Roelvink, D., A. Reniers, A. van Dongeren, J. van Thiel de Vries, R. McCall, J. Lescinski, 2009. Modelling storm impacts on beaches, dunes and barrier islands. Coastal Engineering, 56, 1133-1152.

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