Observations of Beach-Dune Interaction in Man-Made Trough Blowouts

Main findings

UAV-derived orthophotos (Figures 2a and b) and elevation difference data (Figure 2c) illustrate unprecedented wind-induced geomorphological changes.

- (Figures 2c and 3) Notch cross-section has become more U-shape because of sidewall erosion. Notch width and depth have remained largely unaltered.
- (Figures 2 and 4) Large depositional lobes have developed landward of the notches, locally exceeding 7 m in thickness and 50 m in length. Additionally, some sand has been deposited on the foredune between the notches.
- (Figure 2c) In total, some 24,000 m$^3$ of sand was eroded from the five notches after 2 years, while about 44,000 m$^3$ of sand was deposited further landward. This suggests that 20,000 m$^3$ of beach sand was blown through the notches, corresponding to roughly 12.5 m$^3$/myear.

Methodology

Digital Elevation Models (DEMs) with a 1x1 m resolution were obtained using:
- Airborne laser scanning (ALS): 1 pre-survey (February 2012) and 4 post-surveys (February 2013-March 2015).
- UAV photography: 5 post-surveys (May 2013-April 2015). The typically 500-1000 aerial photographs obtained during a flight were processed using the Structure-from-Motion workflow in Agisoft Professional. The resulting 3D point cloud was georeferenced using 40 ground control points with known coordinates and then processed into a DEM. While ALS can detect the terrain surface beneath vegetation, UAV DEMs contain the top of the vegetation. Here, vegetation was detected using the E&G-ExR methodology (Meyer and Neto, 2008; Computers and Electronics in Agriculture) from the UAV orthophotos and replaced by elevation data from the nearest (in time) ALS survey.

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