



Supplementary Materials for

Detection and characterization of aeolian sand strips on the beach using permanent laser scanning

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As one of the pre-processing steps of the laser scan data (Section 3.2), the area of interest is clipped from each laser scan (Section 3.2.2). In alongshore direction, the point density determines the extent of the area of interest. In cross-shore direction, the dunes determine the landward extent of the area of interest at $x = -150$ m and the shoreline determines the seaward extent. The shoreline is detected per scan based on the presence of points along cross-shore profile lines that are drawn every 20 m. All points within 0.15 m distance of each cross-shore profile line are recorded. When the point density seaward of $x = -200$ along the profile line is relatively high (i.e., > 20 points), the most seaward point is marked as the shoreline location along that line. When the point density along the profile line is relatively small (i.e., < 20 points), the median location of the points along the profile line is marked as the shoreline location. Ultimately, the median location of all shoreline locations is selected and used as the seaward extent of the area of interest. Figure 1 shows an example of the clipping of the area of interest from a laser scan.



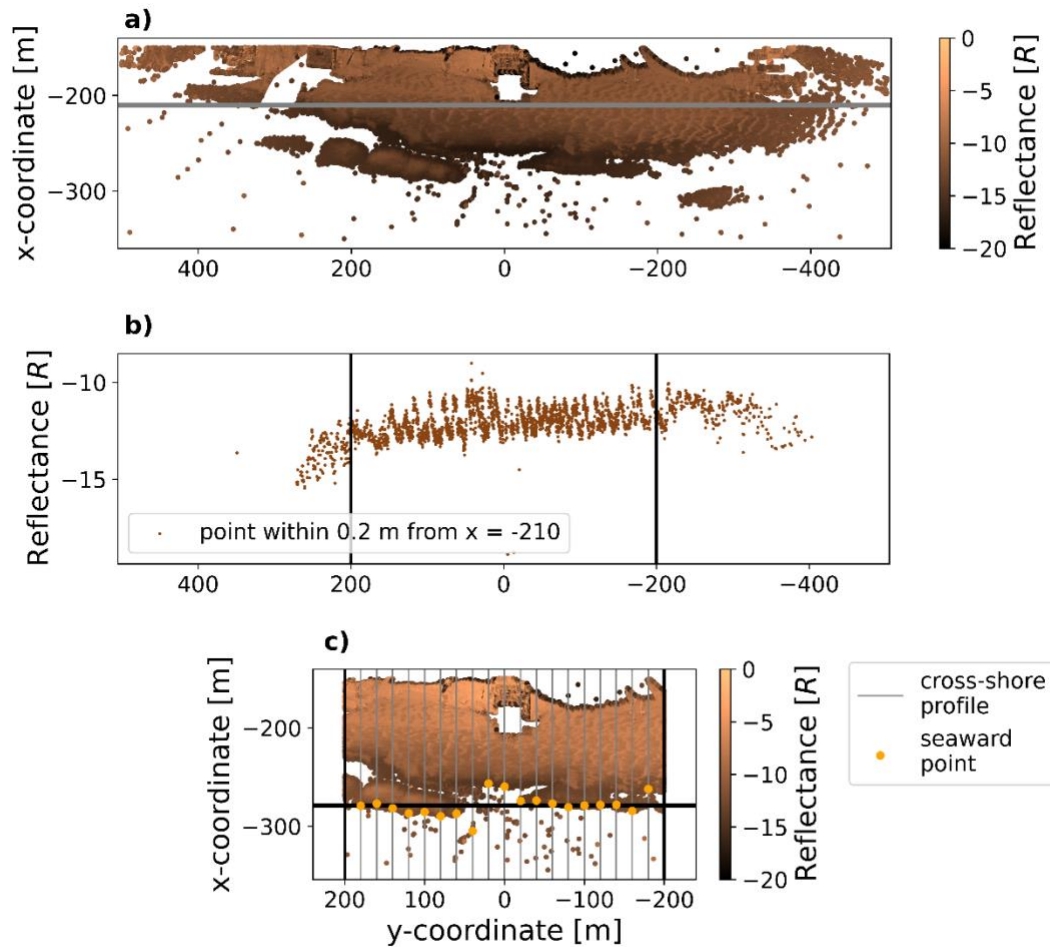


Figure S1.

Overview of the clipping workflow that is based on the alongshore point density and the cross-shore location of the shoreline. a) Point cloud of the beach with a horizontal line at $x = -210$ m (grey) where the alongshore point coverage is best. b) The reflectance values of all points that are within 0.20 m of the line at $x = -210$ m. Boundaries are drawn at $y = 200$ and -200 m, as the point density deteriorates beyond these lines. c) Cross-shore profile lines are drawn every 20 m and for each line the most seaward point is indicated (orange dots). The shoreline location (horizontal black line) is set at the median location of all seaward points. The clipped area of interest is present within the black lines.

As part of the pre-processing for the detection of sand strips (Section 3.3), the point cloud in each window is sampled to a grid (Section 3.3.2). The optimal grid size was selected based on the footprint size of the laser pulse and the percentage of interpolation needed to create the grid. The estimated footprint was 0.09 m^2 which would indicate a grid size of 0.30 m. However, a grid size of 0.40 m was found to be the optimal grid size as it greatly reduced the required percentage of interpolation. For example, the interpolation in a window of a scan with good coverage (24 April 2022 at 13:40) reduced from 35% to 14% with a grid size of 0.3 and 0.4 m, respectively (Figure 2).

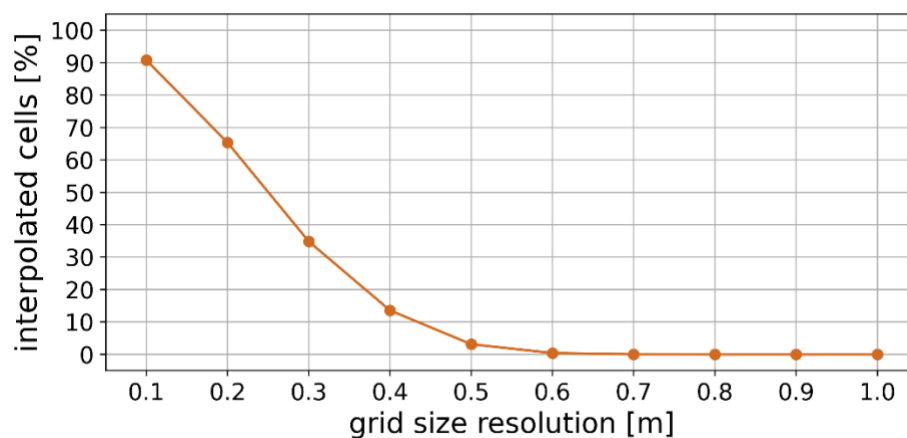


Figure S2.

The effect of grid size on the amount of interpolation needed for a window in the scan of 24 April 2022 at 1:40 a.m. A grid size of 0.4 m was chosen based on the decrease in interpolation between a grid size of 0.3 and 0.4 m.

