FIELD MEASUREMENTS OF MORPHOLOGIC VARIATIONS DURING AN OVERWASH EVENT

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1. INTRODUCTION

Many studies about overwashes have been performed, especially since the 70’s. Most of them analyze overwash processes in relation to its medium to long-term importance for the morphology and evolution of barrier islands. However, the short-term analysis of this process has been studied less because it is frequently associated with major storms, which make fieldwork conditions rather difficult. Measurements of flow and sediment transport during overwash were carried out by Leatherman (1976, 1977) and Bray and Carter (1992). The objectives of the present work are the quantification of morphological changes, volumetric sedimentary balance and mixing depth determination during overwash events.

The study area is located at the western part of Barreta Island, at the Ria Formosa barrier island system (Figure 1). This system is composed of five islands and two peninsulas with a roughly scalene triangular form. The study area is under mesotidal conditions and is located on the western more energetic flank of the barrier islands system. This area is on the historical migration path of the Ancho Inlet, and is less than 50 years old (Vila-Concejo et al., 2002).

![Figure 1: Location of Barreta Island in the Ria Formosa.](image)

2. MATERIAL AND METHODS

To measure the morphology and mixing depth during overwash a two day fieldwork was carried out, called GO.1. This fieldwork occurred on the 9th and 10th February, 2001. During fieldwork a variety of measurements were taken, namely waves, tide, and currents, along with associated sedimentary characterization and transport pattern definition. For the present work, only the morphology and mixing depth methods will be described.

A 10 m x 10 m grid of rods was defined on the western part of a large washover terrace, also covering the adjacent oceanic and lagoon beaches. This grid was used as a working base for the field measurements.

For the morphological measurements, the grid was used to quantify the surface elevation variations during the overwash. The rods height on the washover were measured every 30 minutes, during the upper part of the tidal cycle (0h00 to 5h30).

Adjacent to the rods, green colored sand was put inserted using 30 cm corers, on low tide. After the overwash, during the next low tide, the corers were excavated to verify the distance from the corer to the surface. This procedure allowed the quantification of mixing depth.

3. RESULTS AND DISCUSSION

The fieldwork occurred under medium wave energy conditions, with significant breaking height of about 0.98 m. and a maximum tide elevation of 1.7 m above mean sea level (msl). Overwash occurred between 1h30 and 5h30, with overwash penetrating to the lagoon side of the island, during the top part of the tide.

Morphological variations induced by the overwash were especially noted on the washer crest (Figure 2).

![Figure 2: Average profiles from before (0h00) and after (8h30) overwash.](image)

Accretion was noted for all the profiles, and occurred especially at the end of the flood tide. As the tide began to drop, less waves overtop this part of the island crest and overwash flux had smaller velocities. The volume variation of a mean profile, on the washover area, was about +3.4 m³/m. This value is comparable to the 2.7 m³/m to
5.4 m$^3$/min recorded during storms of 1.7 m to 1.8 m breaking waves (Leatherman, 1976, 1977).

In an area of about 2280 m$^2$, the accretion on the seaward part of the washover was about +198 m$^3$, while on the interior part of the washover very small variations were noted, with a small erosion of 13 m$^3$ (Figure 3).

During the studied washover, the mixing depths varied between 5 cm and 30 cm, and were greater on the seaward parts of the washover, where the accretion was also noticed (Figure 4).

Figure 3: Volume variation inside the washover. Scale in m$^3$/m$^2$. The seaward side is to the left lower part of the image.

As expected, the interior parts of the washover were only subjected to washover flow during a short time period (less than 60 minutes), and with minor flow velocities since the percolation and friction decelerated the flow. On the lagoon side of the washover, deepest mixing depths were also noted, but were probably induced by the lagoon channel currents. The average mixing depth, due to washover processes, was about 13 cm, composed of a sediment layer of 378 m$^3$. The mixing depth pattern suggests that on a semi-flat washover terrace there are some preferential flow channels, due to small terrain irregularities. It seems that the middle part of the studied area had a preferential channel, were the flux was concentrated and thus inducing deepest mixing depths.

4. CONCLUSIONS

This study is one of the few in situ measurements of washover morphological variations. It represents a contribution to the determination of mixing depths on washover terraces, which is topic not commonly found in overwash literature.

As a preliminary conclusion, the occurrence of overwash under medium wave energy conditions coupled with low topography, showed a general constructive effect, especially the washover crest accretion. The mixing depth is variable inside the overwashed areas, especially due to different cross-shore flow velocities and preferential flow channels.

Figure 4: Mixing depth map. The seaward side is to the left lower part of the image. Scale in cm.

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REFERENCES


