Beach Rotation Processes: 35 Month Survey of Embayed Beaches of Santa Catarina Brazil

G. Vintém; M. P. Freitas; J. T. Menezes and A. H. Klein

ABSTRACT

The present work shows the beach rotation processes in two beaches of Santa Catarina State, named Praia Brava and Taquaras/Taquarinhas. These beaches have been monitored monthly since January 2000, totaling 35 months of surveys by doing topographic profiles (beach profile) with a theodolite (slope method). Calculation of the morphologic variables (volume and width) and the time/space variations were performed using the survey data while wave climate information was acquired daily from the Internet model available at the CEPETEC/INPE site. During the survey period Brava and Taquaras/Taquarinhas beaches presented different patterns for sediment mobilization; beach rotation processes were clearly evident at Taquaras/Taquarinhas beach, where a magnitude of approximately 35 meters of width was observed. Inverse patterns of erosion and deposition were observed between the extremities of the north/south axis of this beach; deposition periods in the northern extremity and respective erosion in the southern sector were verified during occurrence of strong southern and southeastern waves (146º-123º approach angle), respectively. Periods of erosion in the northern extremity and deposition in the southern extremity were verified during the occurrence of strong eastern and northeastern waves. The results obtained at Brava beach showed different response levels along the beach profiles and no significant volume and length variations evidenced beach rotation. This fact may be attributed to the different characteristics of this beach system (characteristic of intermediate beaches).

ADITIONAL INDEX WORDS: Morphologic analysis, beach profiles, and wave climate.

INTRODUCTION

A study of the beach behavior and its morphologic variations along the times allows a better understanding of the dynamic interactions that take place within the beach system providing a theoretical basis to plan adequate coastal management decisions.

Beach rotation refers to longitudinal sediment transport that alternates towards opposite ends of a beach delimited by promontories. This cyclic sediment transport behavior is attributed to periodical or seasonal variations of approaching waves, specifically wave direction (figure 1). This process can exist in weeks, months or decades without liquid sediment increase or decrease to the system (KLEIN et al., 2002; SHORT and MASSELINK, 1999).

The purpose of this work is to study the morphodinamic behavior of two headland bay beaches with emphasis on the beach rotation process by analyzing of 44 beach topographic surveys. The surveys were carried out in two beaches with different morphodinamic stages: one beach is classified as reflective and the other intermediate.

METHODS

Beach morphology has been obtained through eleven beach transversal profiles (six in Taquaras/Taquarinhas beach and five in Brava beach). The profiles were obtained using a theodolite from an initial point whose quota has been established referenced to the low-tide level rate in the wave sprawling zone upper level.

Topographic profiles have been later analyzed by using the ramp method proposed by BORGES (1977). For each profile obtained volume values through the trapeze rule (Eq. 1), expressed in m³/m. Beach width has been expressed in meters.

Parallel to the topographic surveys we have obtained daily images of incidental wave forecast models available at www.cptec.inpe.br of Instituto Nacional de Pesquisas Espaciais INPE in order to relate wave climate changes to morphologic variations on the studied beaches.

RESULTS AND DISCUSSION

Figure 3 shows the results of morphologic variations verified in Brava and Taquaras/Taquarinhas beaches.

Taquaras/Taquarinhas beach has shown augmentation periods at one end and erosion at the other, reaching maximum values of 56m and 122m³/m in the northern end of the beach and 16m e 28m³/m in the southern end respectively.

Taquaras/Taquarinhas beach has also showed a consistent seasonal beach rotation. For example, from March/April to August positive variation in the sediment volume of profile 1 (northern end) and a negative variation in profile 6 (southern
Figure 1. Representative diagram of beach rotation process (SHORT and MASSELINK, 1999).

Figure 2. South American map showing Santa Catarina State and the beaches studied with their respective profiles.
Figure 3: Volume variation calculated from the 44 surveys for two monitored beaches.
end) is easily observed. This pattern is reversed by September, when those volumetric variations are positive in P6 and negative in P1.

Associated with erosion periods of profile 1 are northeastern and eastern waves. When sedimentation in profile 1 and erosion in P6 was observed, the predominant wave was from the south, therefore the beach rotation process is dependent on the incident wave direction.

At Brava beach there was no classic beach rotation process observed. In general all profiles spread along this beach have showed similar response trends, being differentiated only in magnitude of profile mobility.

CONCLUSIONS

The results obtained throughout this study reflected the different patterns of sediment remobilization between the distinct morph types of beaches studied.

Taquaras/Taquarinhá beach, a reflective beach directly exposed to south waves, deposits most of its sediments on the subaerial beach and exhibits greater profile mobility and morphologic variation in this subaerial section. Beach with a maximum magnitude of about 35 m wide was observed in this beach. Beach rotation was induced directly by change in the predominant direction of incident waves.

Brava beach, an intermediate beach, has sedimentation and erosion patterns distributed across the beach profile with large sand quantities being removed in dynamic submerged bars.

Thus morphologic variations measured on the subaerial section of this beach were not so evident.

The results of this work are similar the ones for KLEIN et al. (2002) that also had studied rotation processes for these beaches.

LITERATURE CITED


