



Estimation of Presídio's Barrier Island (Guamaré-NE/Brazil) Migration by Means of GIS and Remote Sensing.

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Abstract

Coastal zone occupation has been increasing in the last decades, which has caused an expressive rise in the density of coastal zone population. A relative rising in mean sea level has provided a diminution on the coastal zone land area. Barrier islands have been used for habitation and entertainment purposes, and they also represent a natural protection to the coast acting as a shelter for the coastline against wave and tide action.

In this sense a spatio-temporal triennial analysis, using satellite images, was done for NE Brazil. The images were obtained from CBERS, satellite dated from 14/08/2004, 13/08/2005 and 09/03/2006. They main goal of this study is to quantify the progradation of Presídio's barrier island (Guamare-RN, NE Brazil) during the period from 2004 - 2006. Approximately 200m/year was the progradation observed for the referred island, pointing out high morphodynamic process for this region. Attached to the progradation, a shoreline retreat was observed at the area adjacent to the West extremity of the island. The total retreat measured was around 130m.

1 Introduction and objectives

During the last decades coastal erosion has been observed along many coasts around the world. In some cases this occurrence is linked with rise in sea level. However, in the case of the NE-Brazilian coast the erosion is due to the sedimentary budget (Dominguez & Bittencourt 1996). Low sediment availability is attributed to tectonic activities in this region (Bezerra et al. 1998, Vital et al. 2003, Vital et al. 2006). This statement is supported by data from sea level curves which were reconstructed fort this region indicating that around 5000 years B.P. sea level was a few meters above the actual level (and showing a general falling trend during the last 5000 years B.P (Caldas et al. 2006, Bezerra et al. 2003, Peltier 1998).

There are a number of techniques used to measure coastal erosion or coastline retreat and satellite images turned to be very popular during the past decade. This work will focus on the use of this technique on the measurement of the coastal erosion occurring on the N coast of the RN state (NE-Brazil) between 2004 and 2006 by using three images form the satellite CBERS. The images were acquired from INPE (Instituto Brasileiro de Pesquisas Espaciais).

2 Geographical and geological settings

The study area is located close to the city of Guamaré (Brazil-NE) which is approximately 170 km NW of Natal (figure 1), the capital of the State Rio Grande do Norte. The area is inserted on the domains of the Potiguar Basin (Bertani et al. 1990). It is subjected to a semi-diurnal mesotidal regime (Araújo et al. 2004).

Presidio's barrier island is elongated in E-W direction. It is composed of quaternary sediments deposited due to a wave and tide dominated environment.

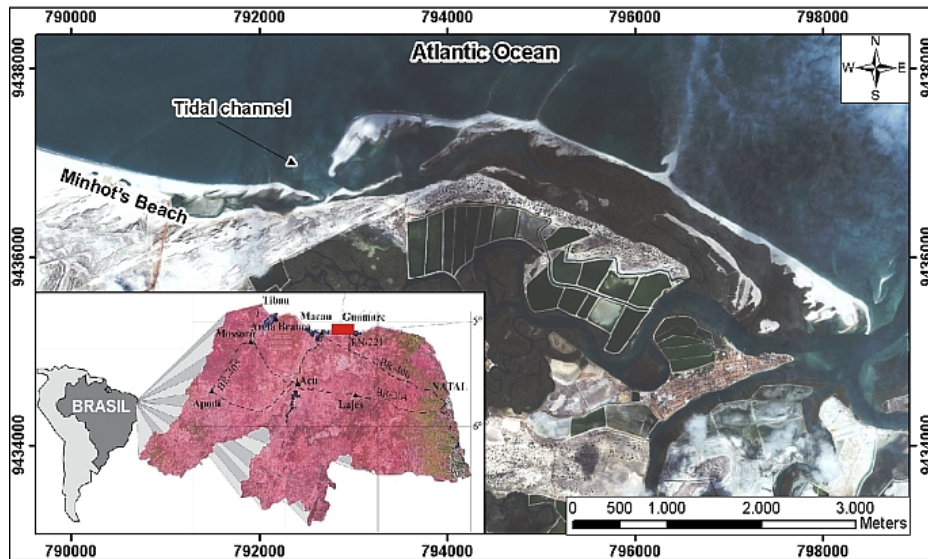


Figure 1: Geographical setting of the study area.

3 Methods

In order to estimate the progradation of the western part of the island, three images (14/08/2004, 13/08/2005 and 09/03/2006) obtained from the satellite CBERS which has 20m spatial resolution were used. Image processing was done using the software ErMapper 6.0 and the spatio-temporal analysis using ArcGIS.

4 Results

From 2004 to 2006 a fast progradation of the West extremity of the island was observed reaching approximately 670 m which results in an average of approximately 423 m/year (figure 2), however, the rate of progradation was not the same along this whole period as between 2004 and 2005 the progradation observed was higher than between 2005 and 2006.

The progradation of the island triggered an intensive coastline retreat on the Minhoto's which was approximately 130 m during this period. This resulted in a rate of retreat of approximately 82 m/year (figure 2).

5 Conclusion and discussions

The sediment from Presidio's barrier island beach is reworked by waves and transported by longshore current and deposited on the westernmost part of Presidio's Barrier Island causing its progradation. In addition during ebb phase the complex of tidal channels placed eastward of the area act as conduits transporting sediment toward the continental shelf. These sediments may also be caught by the longshore current, transported and deposited on the western part of Presidio's barrier island.

The progradation of the island triggered an intense coastline retreat at Minhoto's beach which is located adjacent to the western extremity of the island (figure 1). On this part the water exchange of the back barrier lagoon is done through the tidal channel which separates Presidio's Barrier Island from Minhoto's Beach (figure 1). The narrowing of the tidal channel mouth (caused by the island

progradation) increased the hydrodynamic conditions on this place in order to maintain the balance of sea water going in and coming out of the back barrier lagoon during flood and ebb phases. Therefore, the erosion observed on Minhoto's beach is the result of the new hydrodynamic conditions of the tidal channel mouth.

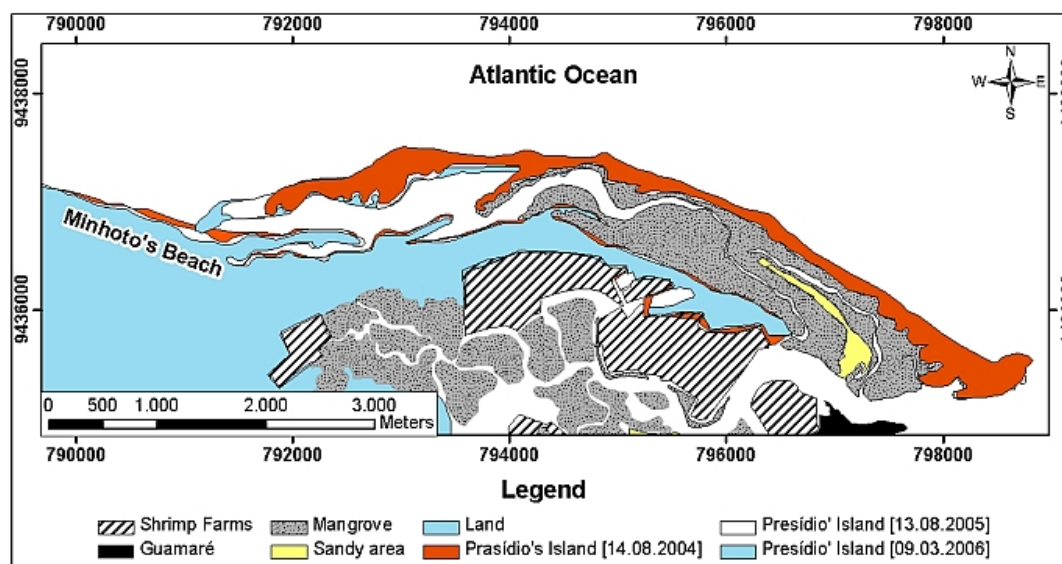


Figure 2: Progradation of the west extremity Presídio's Barrier Island and the resultant coast line retreat on Minhoto's Beach.

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