THE COASTAL GEOMORPHOLOGICAL PROCESSES' LEVELS OF ECOLOGICAL IMPACT ON THE DANUBE DELTA SHORE AREAS

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Abstract

The anthropogenous influences on the North-Western Black Sea Coast having a major effect on the evolution of the littoral processes are represented by decrease of solid discharge of the Danube River, as an outcome of the hydro-technical works/dams extension in the reception basin, as well as in the main course of the river and the perturbation of the longshore sediment transport, due to coastal constructions, especially related to ports developments.

Certain vulnerable areas of the Northern Romanian Littoral Units are strongly influenced by the progress of the inland and coastal works as well as by the status of River Danube flow and sea level rise on a regional and local scale. The sand spits and new formed sand dunes include the sediment changes between submerged shore and dunes system; they are the major issues within the sediment budget of littoral areas.

The paper provides an outline of the outcome of a series of studies carried out for the Danube Delta's coastal area, with a view to providing an assessment of the ecological levels of impact induced by the coastal geomorphological processes and delineation of several coastal protection solutions, all that making a complex approach to the matter at hand. In this respect, we defined and revisited the variability of the sea-land interface for a period of four decades. In our work we relied on historical maps, remote sensing data, coastal survey data and recent GPS measurements conducted on the Romanian Danube Delta littoral.

Specifically, we approached the Sulina arm area, after the extension of the channel jetties which causes a double effect, namely the cut-off of the south coast current, carrying part of the solid load on the Chilia arm, and the removal of its own load out of the coastal circulation in the offshore currents. The induced levels of impact of the geomorphological processes in the area of Danube Delta consider the ecosystem's response to shoreline variability, sediment transport on a local and regional scale, in the case of a river and wave-dominated coastal area.

1. Introduction

The evolution of the deltaic coast in the short and medium run is controlled by the marine factors, as well by the Danube's liquid and solid discharge variability which is induced by the anthropogenic levels of impact, represented by the extension of the regularization, development and dam building of the rivers' course. Such works were started in the XVIIIth century, continued with the Sulina Canal's regularization development aimed at improving navigation conditions in the second half of the XIXth century after the establishment of the European Commission of the Danube in (1856). Works continued with the extension of the hydro-technical development along the Danube in the 1970s and 1980s which brought about a considerable modification of the solid flow of the Danube, (Almazov A.A. *and al*., 1963), [3].

2. Methodology

We developed a geomorphological study of the shoreline changes on short and medium term using remote sensing data, GPS and cross-shore profile data, as well wave data registered on Gloria off-shore platform.

In the case of the sediment transport rate determination we used integrated methods of calculus which relate the long shore sediment transport to the longshore wave energy flux component on the surf line.

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Furthermore, we made certain spatial analyses of the classified Landsat and Aster images, resulting maps in Stereo 70 projections, and with their help the areas that underwent morphological changes were highlighted in the aforementioned interval.

3. Results and Discussions

For the Musura Bay area, after the extension of the jetties from Sulina channel, sedimentation processes intensified mainly because channel jetties blocked the sediment discharge of the Chilia arm. The present tendency is to warp the Bay and in the future to transform it into a lagoon, closing the Musura Bay with a sand spit.

Also, coastal response assessments were made, based on the shoreline variability analysis, induced by the occurrence of the waves frequencies on the Delta coast, it was examined on the concordance tests basis of calculated results vs. shoreline measurements using (D)GPS, represented and analyzed in ArcGIS 10, in the considered time interval.

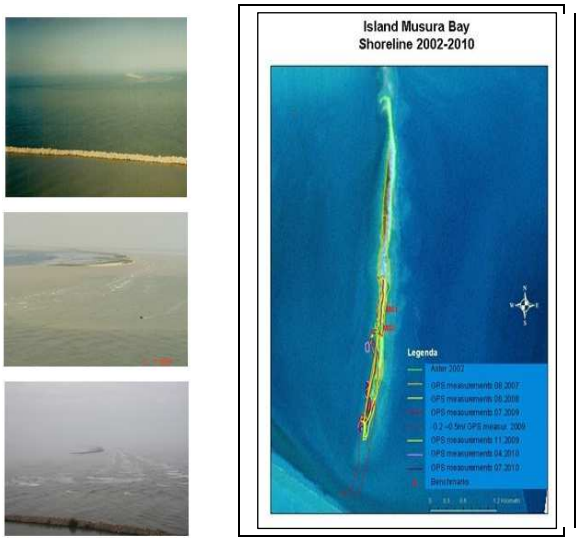

Figure 3. Musura Sand spit (a/08.2001, b/17.07.2009, c/5.11.2009 and d/shoreline variability)

From the GIS layers we could notice, for a length of circa 2 km of shore in the Romanian area (in the case of GPS measurements in 2007, 2008, 2009 and 2010), an average retreats were registered of 20-25 m/yr. at water interface, concurrently with sand belt extensions of 95 m/yr, indicating an intense sand transport and distribution between emerged and submerged beach slope of 0,013, and respectively 0,008.

4. Conclusions

Musura Bay has a direct double water inflow, both from the Danube as well as from the Black Sea. The continental pressure is higher because Chilia Arm carried out 60% from the Danube discharge. The sea water influence become significant only during the big storms with dominant winds from the East or during the drought periods, met specially in the summer season.

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