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The study of the coastline change between Ksser Sghir and Dalya Beach (Nord of Morocco): The tool used is: « Digital Shoreline Analysis System»

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Abstract

Erosion and fattening are the most important factors affecting the movement of most coasts.

This study aims to analyze the role of erosion and accretion in shoreline changes between the city of Ksser Sghir and Dalya Beach (northern Morocco); before and after the construction of the great port of Africa: Mediterranean ports.

The shoreline change analysis was performed using the DSAS extension: DigiItal Shoreline Analysis System, after compiling data from Landsat imagery from 1984, 2002 and 2017.

The study was carried out over two periods: the first period from 1984 to 2002 and the second between 2002 and 2017, in order to compare its results.

1. Introduction

Coasts provide nearby communities with lots of resources such as food, jobs, trade and transportation opportunities from shores to different destinations, tourist business (I. Yow Dadson et al, 2016) However, the coast under research suffers from a chronical human pressure. It is subject to natural processes (courant, swell, tide, waves, storms..) or anthropogenic (civic engineering structures, recharging operation, implementation of harbors…) that leads to a fast developments, characterized notably by notions of submersion chances and erosion (Mellet et al, 2012)

The Mediterranean coast fringe (to the north of Morocco) has undergone since the beginning of the 1970's many major changes, linked to the increasing installation of touristic infrastructures and an important socio-economical growth. Sedimentological researches done over a twenty years period of time (El Moutchou 1995-2002) have showed an annual average of decline of approximately -1.5 to 2 linear meters per year.

2. . Presentation of the study area

the research area is located in the north part of Morocco, between the city of KsarSghir west to Dalya beach east over a 16 km distance (on a birds fly).

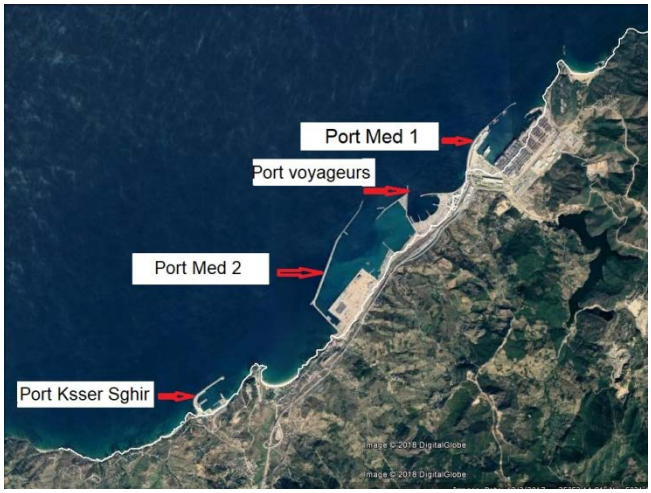


Fig1: Presentation of the studied coast line

3. Methodology

During this research, we have made the coastal lines from satellite pictures called Landsat TM and ETM (1984, 2002, and 2017), these pictures are dealt with through three steps:

The execution of a geo-referential of these pictures in order to render them superposable.

Digitalization of the coastal line using the Arcgis software (Landsat toolbox). Implementation of the tools of the extension DSAS v 4.4.

In the DSAS extension, we have used the tool (EPR) that allowed us the statistical calculation of erosion speed and the (NSM) for the calculation of the coastal lines' changes.

The use of the DSAS extension necessitates the coastal lines' preparation on vector format in a geodatabase That which we should digitize the base line, and from which we create the transects that will cut the different lines of the coast.

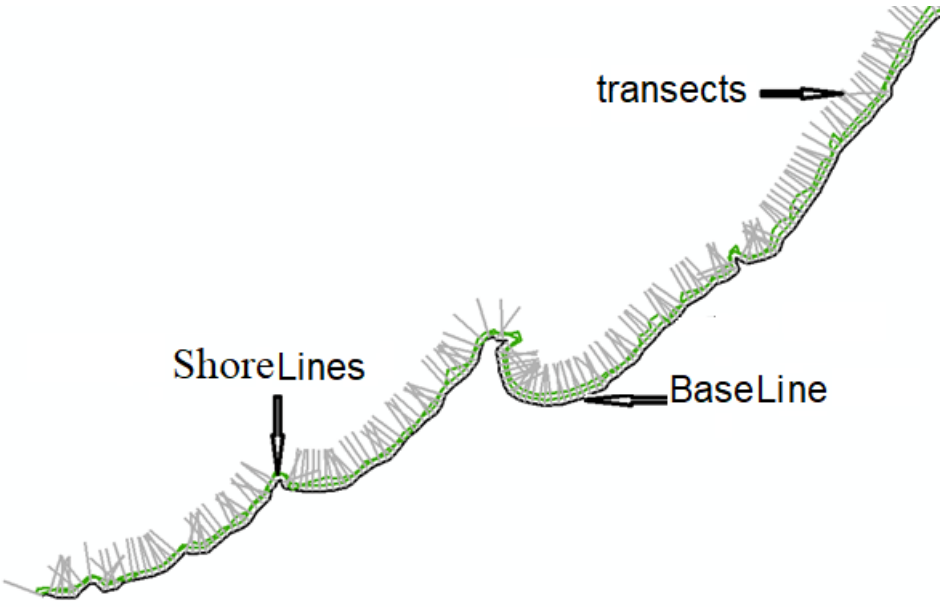


Fig 2: Presentation of the different elements of the DSAS concept.

The DSAS software also allows to choose the mesh between the base lines and the side-lines and between the transects themselves; however, we have chosen a little mesh of 50m for a best appreciation of the littoral development and specification of its behavior.

4. Interpretation results:

The results of the coastal lines changes with DSAS have shown either an erosion or an accretion according to the zones under research and the time spent on it.

The graphics analysis showed us a sharp changing between the two periods of time under research. (1984-2002 and 2002- 2017). However these graphics summary shows that there is an accretion during the first period (see figure 3) and an erosion during the second period (see figure 4).

Tab1: Results of coastal movements between the years 1984 and 2017

	period : 1984-2002	period : 2002-2017
Number of transects corresponds to erosion	73	45
Number of transects corresponds to fattening	321	27
Average erosion in (m)	-15.15	-22.95
Fattening medium in (m)	29.54	15.96
Percentage of erosion in (%)	35	59
Percentage of fattening in (%)	65	41
Average erosion rate in (m / year)	0.85	1.53
Average fattening speed in (m / year)	1.65	1.15

Source: Own work

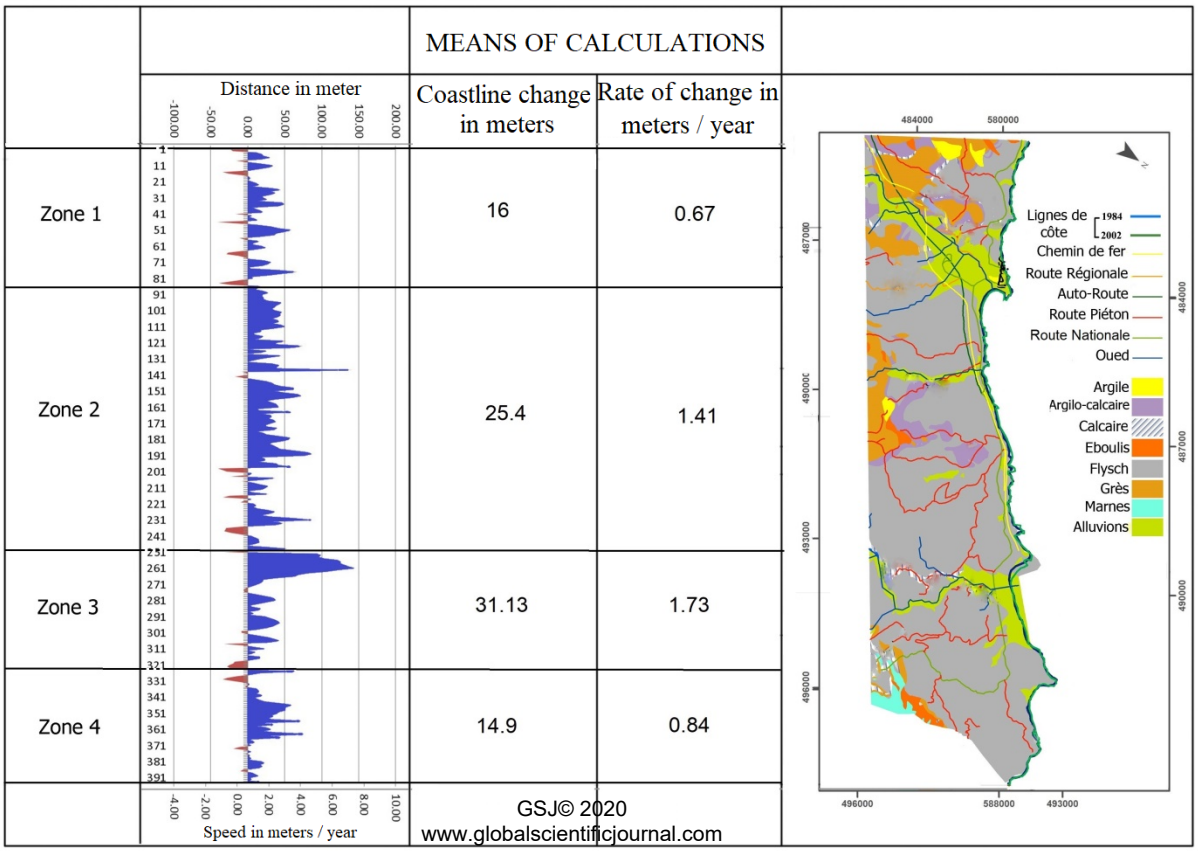
The negative value means erosion and the positive value means fattening

4.1. The side-line graphic development:

a- Period (1984-2002)

The side-line dynamics concerning the studied area is generally identified as an accelerating zone with an average speed of 1.16m/year (see figure3).

Fig 3: Evolution of the coast line during the period 1984 - 2002



b- Period (2002-2017):

During this period of time, the dominant phenomenon is erosion with an average speed of 0.6 m/year (see figure 4).

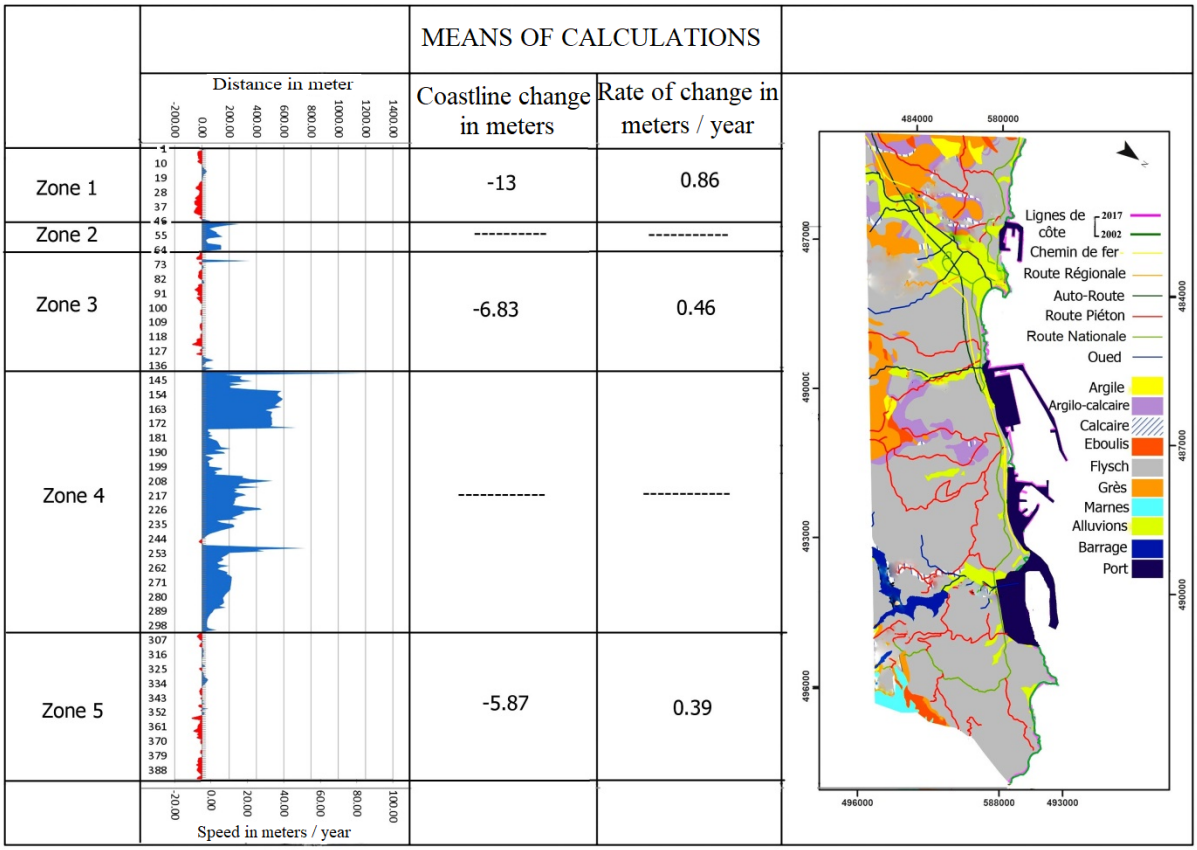


Fig 4: Evolution of the coast line during the period 2002 - 2017

4.2. A comparative study of the two cases:

The graphical pattern shows the side-lines changing based on the tool (EPR) the extreme points method.

The figure allows identifying the areas characterized by the accretion phenomenon and the areas characterized by the erosion one during each period of time.

All through the transects and the results, we can observe that during the first period (1984-2002) (before the implementation of the harbors) there was an accretion, whereas there was an erosion in the second period. This can explain that, before the implementation of the Mediterranean harbors, with a total absence of the human intervention, the coastal parts dealt only with natural dynamics, it host lots of sediments from local rivers, The results show retreat of the sea line in many regions. On the other hand, the second period results show a moving forward of the sea line. That has lots of factors that affect the coastal shaping like the port development, the foretune consolidation, the implementation of dams upstream of the coast that reduces sediment budget and the heavy extraction of the beaches' sand for the construction work.

Conclusion:

The urban planning and the port constructions in the area under research have provoked many changes and dynamics especially the sediment accumulation and erosion zones.

The increasing Urbanism and the population pressure over coastal zones caused a great deterioration of the nearby beaches.

This research work have demonstrated the port construction and tourist business consequences over the coastal line, and they have given a mapping system illustration over the areas that need the governmental intervention in order to minimize the negative effects caused by the sediments on the implemented ports.

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