Monitoring of Costal landforms Changes in North of Persian Gulf (Asaluyeh Region), Iran

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Abstract: Recently develops of civil activities in coastal areas in Iran have destroyed important parts of geomorphologic landforms in beaches and have created considerable changes in beach line. Northern coast of Persian Gulf has many oil and gas reservoirs and relation with free oceans. So, it has intense geomorphologic changes more than other areas. In this coastal part, Asaluyeh area has an important role because of development of oil installations. In this research, we have compared 1990,s TM image, 2006,s IRS image and field observations from sedimentation and erosion in Persian golf's coastal line. Also, we use 2000,s IKONOS image because of higher resolution for designing of its landforms. Finally, we use high and low position technique in ArcGIS Software for detection of changes in coastal landforms. On the basis of these results, the rate of sedimentation is about 50%. Sedimentation is often as sedimentary noses behind of coastal buildings with progressive part in water for example jetties and wave breaks. With detail investigations, we can see that 85% of geomorphologic landforms in Asaluyeh area have changed because of creation of industrial installations in coastal lines. There are only some changeless parts of estuaries and marches in eastern part because of trees and environmental protected areas. Some sedimentary landforms such as deltas and flood plains have destroyed and depositional tails and marches have created in Asaluyeh coastal line.

Key words: *Geomorphologic changes; change detection; high-low position; Asaluyeh; Iran's coastal line.*

Introduction

Development of buildings and installations in southern coasts of Iran not only has destroyed geomorphologic landforms but also has changed the trend of erosion and sedimentation. So, in addition to erosion in channels and mouth of estuaries, increasing in sedimentation was observed in some coasts. Based on evidence, this increasing is about 50 %. Process of sedimentation mainly is behind of wave breaks and buildings in ports that were created from 1990 in Iran's coasts. Asaluyeh area is one of coasts that development in buildings in them increases volume of sediments in coastal line and changes the form of beach and destroys most of landforms.

Among investigations about gradual change in coasts caused by break waves and jetties is Kraus and Rosita's study in 1997. They believe that increasing in sedimentation in upstream and erosion in downstream cause asymmetry in coastal forms. Another research about changes in coastal line in Iran is Riss et al., 1999 work. On the base of geochronology of fossils in different levels of marine terraces and rate of upwelling of them in southern coasts, they considered coastal terraces and calculated the rate of marine terraces. Application of a satellite image in detection of changes in climate and dynamic of coasts was considered by many researchers (Robinson, 2003; Gentemann et al., 2003). Study of changes in coast has considered from various points of view and methods such as component analysis (Anyamba & Eastman, 1996; Eastman & Fulk, 1993; Gurgel & Fereira, 2003), harmonic or fourier analysis (Andres et al., 1994), hierarchical image segmentation (Hermittecal et al., 2008) and change detection (Coppin et al, 2004; Berberoglu & Akin, 2009). Asaluyeh coastal area in north of Persian Gulf was destroyed in short time period. It is located between 52° 32′ to 52° 38′E and 27°27′ to 27° 33′ N. It belongs to Boushehr province and Kangan city. Its neighbors are national

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park of Nayband from east, Shirino village from west and Asalouyeh anticline from north. The length of this coastal line is about 30km (Figure 1.).

Materials and Methods

In this study, we use 1998,s ETM, 2000, 2002, 2006s IRS and 2000,s IKONOS satellite images and digitized topographic maps in scale of 1:25000. For Geo-referencing of satellite images and calculations, we use UTM and metric coordinates. Also, we apply ArcGIS and Erdass software's for preparation of digitized information layers and processing of them. The processing of satellite images was performed in 2 stages. At first, we have compared TM and IRS images and prepared 2 coastal line maps for 2 period's images.

In second stage, for detail detection of changes, we selected smaller area and larger scale for analysis and replace north of Persian Gulf with Asaluyeh area because of more intense changes. At first, we interpreted IRS and IKONOS satellite images from this area and considered development of beach lines and natural and artificial features. Then, we compared them with 1990,s TM image and distinguished and designed coastal landforms such as estuaries marches, lagoons, sand beaches, gravel beaches and human habitations (Fig.4)(A. A. Alesheikh et al.,2007).

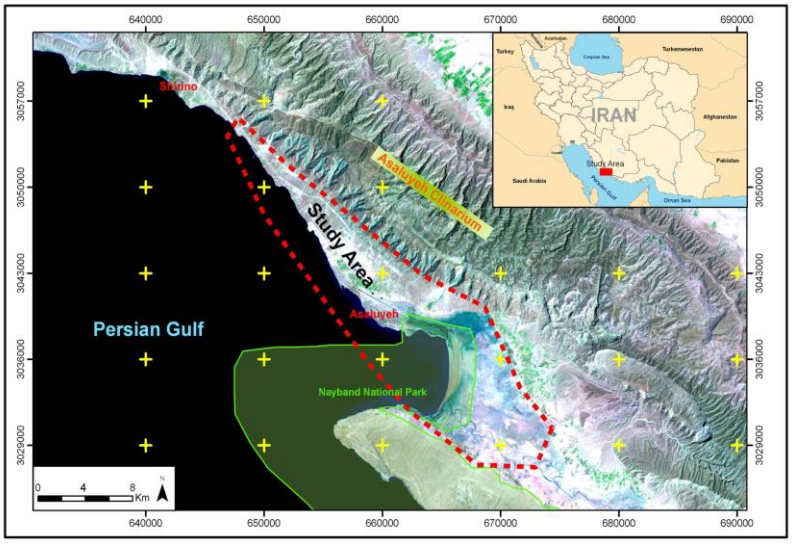

Figure 1. Location of study Area

After removing of geometrical errors in beach line maps, we calculated difference of sedimentation and erosion levels between 2 images and classified areas in 3 classes; eroded, under sedimentation and without change areas (Fig.3). We use from highest and lowest position technique (Upos and Lpos). This method is one of local functions and it works based on maximum and minimum value of one pixel in similar position in several layers. It compares a defined time base multiband raster image with other images and calculates changes in spectral or classified value. This function work in ArcGIS Software by Upos Function.

(Ingrid 1, (Ingrid 2+3 × sin (Ingrid 3), Ingrid 4).

In this function Ingrid 1 contain Raster Map from Coastal Landform in 1998 year. This map product from ETM Satellite image.

Ingrid 4 Contain Raster Map from Coastal Landform in 2006 year. This map produces from IRS Pan Sharpen Satellite image.

Ingrid 2 and Ingrid 3 are containing Coastal landform map from 2000 and 2002 year. This maps produce from IRS pan sharpen Satellite Image.

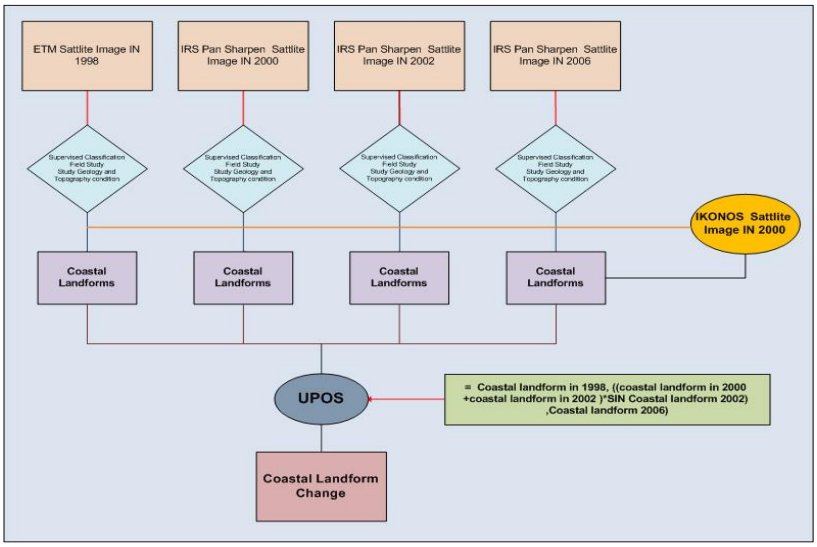

Figure 2. Flowchart Extracting Coastal landforms Change.

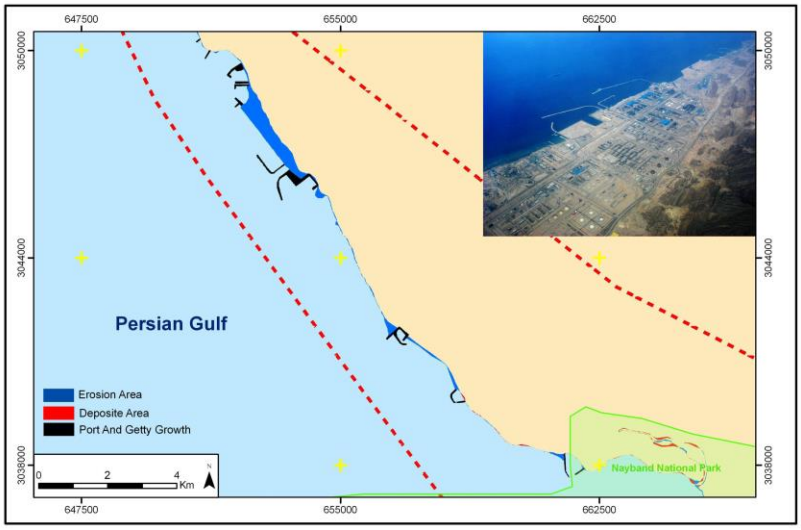

Figure 3. Erosion and deposited Area in Coastal line, study area.

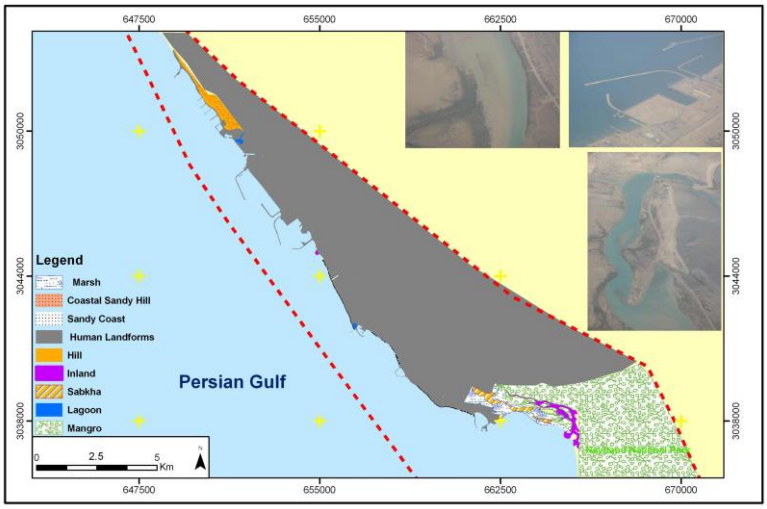

Figure 4. coastal landforms in Study Area

Results

Obtained results show that along northern coast of Persian Gulf, totally, its occurred150 Hec erosion and 52.5 Hec sedimentation in 16 years time period. It contains direct deposition in beach line and filling of channels of estuaries and vallies ended to coast. Erosion mainly has occurred in profile of beach. Development in distortion of channels of estuaries and progression of sea level is also observed. Comparison of figure 2 and geomorphologic map in figure 3 showed that development of buildings have increased the volume of sediments in upstream and erosion in downstream of them. Some features such as jetties have increased the volume of sediments. There is no any increase in sand and gravel beaches and they were destroyed in some places. Creation of noses in 2 different time periods is one of the important geomorphologic landforms. This creation is caused by reworking of sedimentary by coastal current. Delta plains are very frequent along beach line of golf and they are controlled by river-marine processes. Now, these rivers are inactive and cannot create a delta. They have in active flood plains. Sandy barchans are most frequent Aeolian landforms in this area and they cover inner beach plains. They have different distribution in Asaluyeh area. But Aeolian processes are very frequent along beach line. Recently, marches have developed in this area. In addition to dynamic changes of coast, natural land forms were destroyed very intense. So, sandy and gravelly beaches destroyed more than 60% (fig.4) and they have replaced by human habitations and oil and gas installation.

Conclusion

Stability of sedimentary part of beach line depends on equilibrium between the volume of sediment in that part and capacity of transportation of pure sediment in near and distant areas from beach line and along it caused by wave, wind and currents. So, beach line can deposit and eroded or remain without change. In dynamic equilibrium phase, usually beach line change in reaction with winds, waves and currents, continuously. Also, sedimentation in beach lines changes with time and place. Dynamic equilibrium means that the position of beach line is stable for more than several years, although it sometime has short time vacillations (Soreson, 1997). It seems that most important agent for erosional regime in northern coast of Persian Gulf is decreasing in sediment supply for equilibrium on them. Disequilibrium in these coasts, cause replacement of channels and mouths of estuaries and change in width of them. Some beach lines were eroded and some deposited because of this process. As fig.2 show, existence of some buildings and installations such as jetties and wave breaks has caused change in nature of movement in waves and creation of sedimentary noses before coastal buildings. The rate of deposition is about 50%. Deposition mainly occurred behind of wave breaks from 1990. The volume of sedimentation in Asaluyeh has increased and oil installations in this area have changed morphology of it, intensely. Asaluyeh beach line with developed buildings, trap the sediments and create sedimentary terrace levels. So, there are considerable changes compared to 1990.

Although, some land forms have destroyed but other forms replace because accumulation of sediments in new places causes creation of lagoons and marches behind of sandy forms along tidal process and coming up of sea level, while distortion in some parts of coast were observed mainly in deltas and flood plains.

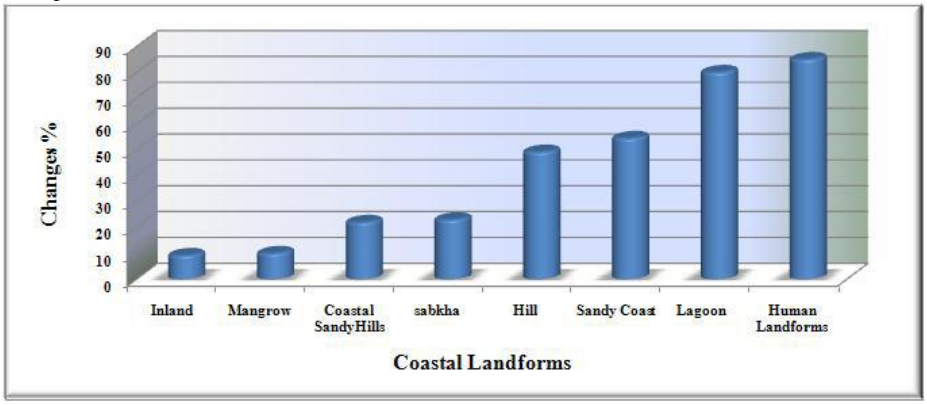

Figure 5: Change of coastal landforms.

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