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RESEARCH ARTICLE

MORPHODYNAMIC CHANGES AROUND SUBARNAREKHA COAST: STUDY USING MULTI CHANGE SATELLITE DATA

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ABSTRACT

The present study area is situated at the low laying coastal alluvial planes of the Subarnarekha delta in tropical region. Subarnarekha delta plain is a depositional coastal sector with active Chenier delta formation. A tremendous amount of sediments carried by river Subarnarekha throughout the year which is more responsible to develop the depositional coast, on the other hand wave reworking is going on with successive dry and wet phases. So many landforms have formed as well as many landform and other land features has been diminished. The formation of sand spits are the result of long shore deposition of the river sands to the south and north depending upon the shore line orientation and direction of dominant wind patterns in the deltaic coast. The removal of sand from sea beach occurs by long shore and off shore transport and by wind erosion. The beach has been eroded due to various coastal processes has been taken place and still they are in on-going process. Such variations in the shorelines of Subarnarekha delta is recorded by LISS-III image and true colour image (Google earth) and also by seasonal field survey at different coastal sectors.

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INTRODUCTION

The coasts constitute one of the most dynamic parts of the earth surface. It is continuously undergoing both gradual and sudden changes with many physical processes, such as tidal flooding, sea level rise, land subsidence, volcanic activity and erosion-sedimentation (Maiti and Bhattacharya, 2009) Each and every coastal sector characterised by several morphogenetic features evolved under the impact of coastal hydrodynamic available sediments supply and transportations part auto compaction of sediments, aerial processes, low laying deltaic and trend plain surface with numbers water course change in the relative level of land see, photo geomorphological and geomorphological factor and finally the human control factor in the delta catchment areas. Morph dynamism of the Balashore (Orissa) coast has been estimate along with the impact of different coastal processes by using multi temporal satellite imageries during the period from 1989-2012, and Toposheet. Shore line change over time to time has been situated to identify the erosion and accretion zones. Wet land Morphology Dune Morphology and Beach Morphology has been analysis in the study area by the field survey and with the help of multi temporal satellite imageries. Spatio temporal data base has been prepared for the study area in order to estimate Morphological change rate precisely along the studies coast. Geomorphologic features of the coastal plain

were identified in the order of hierarchy, viz. chenier plain (first order); beach ridge complex, spit complex, chenier complexes (second order); cheniers (third order); and simplest ridge, spit, wash over beach (fourth order). (Maiti, 2013) The result shows that the seasonal change of coastal morphology considerably significant, but anthropogenic causes had a greater influence in the change of the morphology. Finally study area can be classified into processes response zones such a zonation may be help full to formulate appropriate coastal management strategies.

Objectives

1. To detect Morph dynamic change around Subarnarekha River mouth and environs.
2. To identify accreting, eroding and stable segment along Subarnarekha River mouth and environs.
3. To understand causes of shore line dynamics.
4. To detect hazard zone area.

Study Area

The present study area is situated at the low laying coastal alluvial planes of the Subarnarekha delta in tropical region. Therefore, through a study of coastal morphodynamics, one can interpret palaeo climate and many past geological consequences. In the present study, Subarnarekha estuary situated in the Midnapur–Balasore coast has been considered for detailed understanding of coastal morphodynamics changes. The coordinates for the area are 87°08'44"E,

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21°49'12"N to 87°55'56"E, 21°31'58.82"N. The physical process and the anthropologically processes and also some hydrodynamic. Geomorphic tectonic and climatic processes are responsible for the spatial and temporal changes of the coast over booth long and short term which has an immense impact on both environment and socioeconomic. Coastal morphodynamic is directly related to the coastal geomorphology. (E.C.F. Bird, 1984). There are so many geomorphological processes by which a coast is formed. River, wind, tide, current are always working on the coast. Coastal wash is also a part of morphodynamic and it is a process by which sediment is sifted from seaward side to land ward side and it is usually occurred in the time of monsoon or cyclone. In 1984 pet hick has studied about the coastal wash at coastal belt. Although coastal zone in very hazard prone zone, yet there have some management process which are suitable process to protected the coastal hazards. Coastal zone management, integrated policies were discussed by the organization for economic operation and development (OECD) in 1993.

delta plain is a low lying coastal tract so it is also flood prone area. At the time of flood the fresh water mixes up which cause deposition in the cost.

The Agents of Morphodynamics

Morph dynamics is a dynamic equilibrium system by which beach morphology is developed in coastal sectors. Some agents of Morph dynamics like long shore drift, cross shore drift (Which is coming into the beach) and cliff erosion are carried the sediment into the beach but some agents like wind, long shore drift, cross shore drift (which is going to beach) are carried the sediment from the beach. At the time of monsoon the sediment input rate is very high than the output rate, similarly at the time of storms or cyclones the opposite state is happening. Some sediment sinks like ebb deltas, flood deltas, sand spit off shore bars are also present in Subarnarekha delta plain they play their active role to arrest a huge amount of sediment.

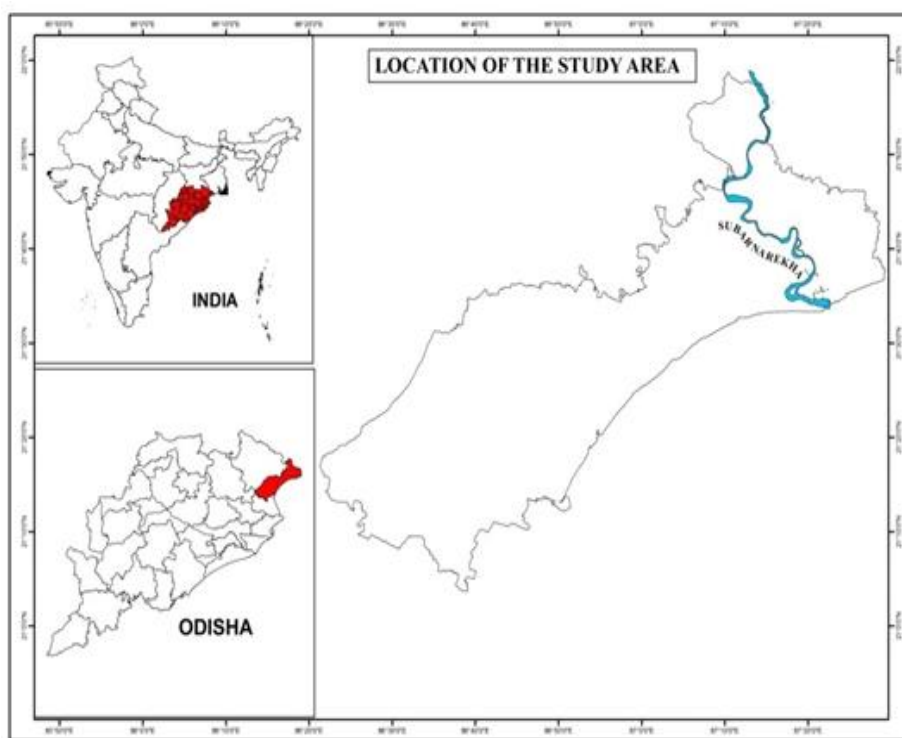


Figure 1. Location Map

Shore line characteristics

Coastal processes

Subarnarekha delta plain is a depositional coastal sector with active Chenier delta formation. A tremendous amount of sediments carried by river Subarnarekha throughout the year which is more responsible to develop the depositional coast, on the other hand wave reworking is going on with successive dry and wet phases. So Chenier delta formation is going on by propagation of delta by river deposition and wave reworking. Now a day the growth of spits and offshore bar is present in the mouth of Subarnarekha River. Subarnarekha deltaic flat is partly covered by the salt marshes and tidal inlet. All the salt marshes are link with the sea by the tidal creak. Subarnarekha

Shore Line Change

Shore line change is considered to be one of the most dynamic processes in the coastal area and the change in shoreline, caused due to physical as well as anthropogenic process, have large environmental significance (Chen *et al.* 2005). These changes occur over both long and short terms and involve hydrodynamic, geomorphic, tectonic and climatic forces (McBride *et al.*, 1995; Scott, 2005; Thom and Cowell, 2005). The rising sea level is a burning question in recent years around the low lying cost of Orissa. The estimated global sea level rise (IPCC,1990) and local rise (Due to subsidence rate) of sea level would increase risks around the low lying cost, various physical and socio-economic uncertainties involved with the sea level rise will heighten those coastal management

THE LITTORAL ENVIRONMENT OBSERVATION OF DIFFERENT STATIONS

	Talasari		Kirtania		Choumukh		Kashafal		Burahbolong	
Date	22.2.2009	08.08.2009	22.02.2009	08.08.2009	22.02.2009	08.08.2009	22.02.2009	08.08.2009	22.02.2009	08.08.2009
	SURFACE OBSERVATION									
Wave period	8.57 sec	10 sec	15 sec	15 sec	10.21 sec	8.58 sec	12 sec	10 sec	15 sec	12 sec
Breaker Height	1.2 mts	1.87 mts	0.8 mts	1.5 mts	1.5 mts	1.8 mts	0.8 mts	2.1 mts	0.7 mts	1.9 mts
Breaker Angle	2°20'	9°	1°30'	13°	1°20'	4°	1°5'	4°	1°45'	19°
Breaker Type	Spilling	Plunging	Spilling	Plunging	Spilling	Plunging	Spilling	Plunging	Spilling	Plunging
	2.4 mts./sec	3.2 mts./sec	2.8 mts./sec	3.2 mts./sec	3.2 mts./sec	3.26 mts./sec	3 mts./sec	3.36 mts./sec	2.5 mts./sec	2.9 mts./sec
Wind Observation (Speed, Direction)	SE	S	S	SW	SE	SW	SE	SW	SE	SW
Foreshore slope	1.5°	4.47°	1°20'	2°30'	2.5°	2.5°	1°	1.5°	2°	2.1°
Longshore current (Speed, Direction)	53cm/sec. SE	1mts/sec. S	45cm/sec. S	2.21 mts/sec. SW	55cm/sec. SE	4.08 mts/sec. SW	42cm/sec. SE	2.14 mts/sec. SW	42 cm/sec. SE	2.5mts/sec SW

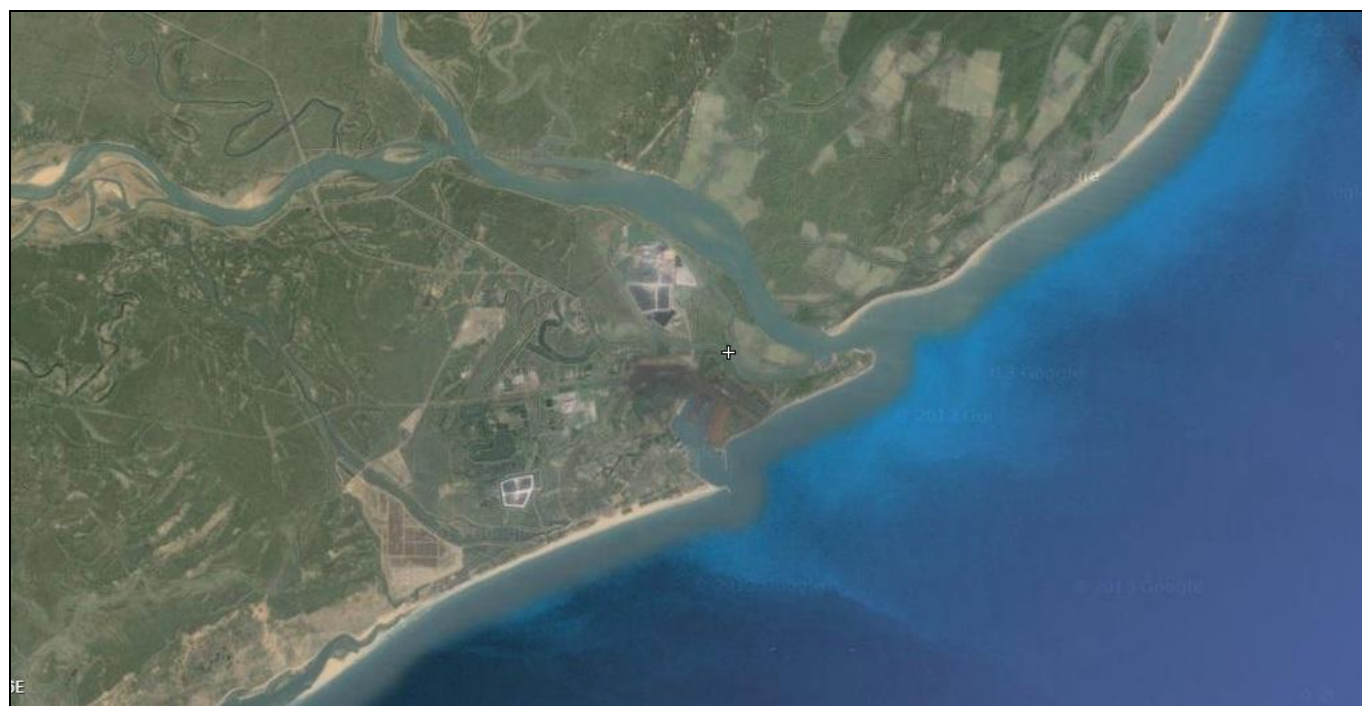


Figure 2. Google earth Image

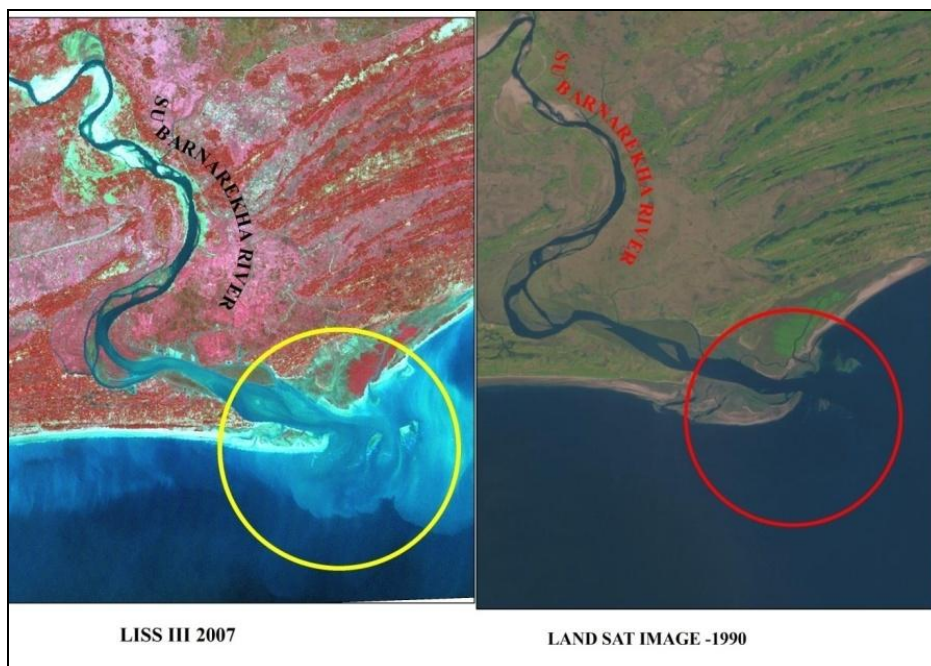
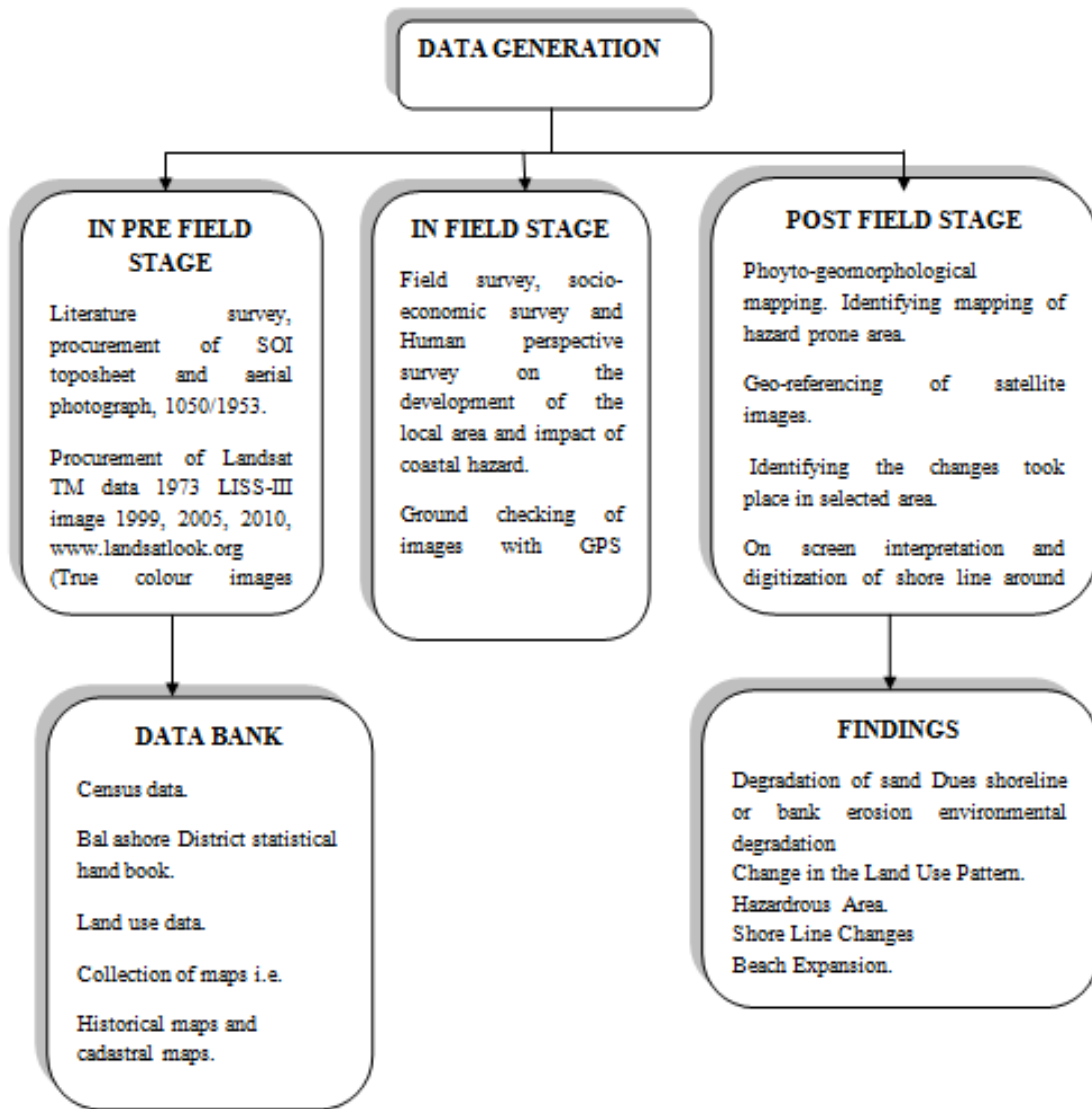


Figure 3. Geomorphology changes of Subarnarekha

problems which are affected by the risk of flooding and erosion. The valuable ecological site might be threatened due to sea level rise in the complex physical settings. Loss of agricultural land, infrastructure built up Environment and increasing production cost for the introduction of new design in coastal defence structure will be increased the socio economics problems around the low lying coast.

MATERIALS AND METHODS

Multidata Satellite data: Landsat TM, Resourcesat-1&2, LISS-IV

Image processing: ERDAS IMAGINE

RESULTS AND DISCUSSION

Strand lines indicating palaeoshorelines around Subarnarekha mouth are distinctly seen on satellite images. Spits and offshore bars and land area near the Subarnarekha river mouth are eroded as observed on multidata satellite image. Creek and intertidal zone on eastern parts of Subarnarekha river mouth are also eroded. Widening of the Subarnarekha river mouth is observed. Changes in the orientation and distance between strand lines or palaeo shore lines are due to change in coastal processes, changes in sea level, delta progradation and tectonic activities. Morphodynamic change around Subarnarekha river mouth due to changes in the land landuse- cover in the catchment area coastal processes. Changes has been detected the field survey and while referring the multidata satellite images. So many landforms have formed as well as many landform and other land features has been diminished. The formation of sand spits are the result of long shore deposition of the river sands to the south and north depending upon the shore line orientation and direction of dominant wind patterns in the deltaic coast. The removal of sand from sea beach occurs by long shore and off shore transport and by wind erosion.

The beach has been eroded due to various coastal processes has been taken place and still they are in on-going process. Such variations in the shorelines of Subarnarekha delta is recorded by LISS-III image and true colour image (Google earth) and also by seasonal field survey at different coastal sectors. The sand budgets of beaches of different shoreline sectors vary over different time scales of seasonal change as climate storm activity vary in the coast line. Smaller inlets transport sediments into their heads across the shoreline at the period of storms and remove sediment from the beaches. The shoreline processes resulted from river input, long shore and offshore input or drift and wind & tidal energy with storm

interactivity produces the deltaic depositional compartments in the form of Chenier mechanisms. Tectonic and sea level rise further modify the coastal features over various time scales to develop as a unique sequence of Chenier delta in the part of Bay of Bengal coast. The major findings are given below

Conclusion

From the above discussion we say that coastal Morph dynamics is a continuous and equilibrium process by which all the coastal feature, sediment deposition, transportation and erosion is taking place. Coastal Morph dynamics is also a complex process which is depends on coastal Morph dynamics, morph-ecological dynamics and also coastal process response morphological system and coastal sedimentary environment. The present study is not so deeply studied due to lack of infrastructure and economic assistance but it is treated as data bank of physical exposure for low lying coastal tract for further study.

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