

# Role of cyclones and other factors in the decline of the ports of northern Orissa

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*The maritime trade of Orissa with transoceanic countries is evident from the early historical period onwards. It has been observed that new ports were set up after the decline of old ports in the nearby vicinity; however, information on the decline of ancient ports is very sparse. The archival and historical records of the 16th and 19th centuries and the writings of contemporary scholars mention the ports of northern Orissa, viz. Balasore, Dhamra, Pipli, Chandbali, Laichanpur, Churamani and False Point, and their decline because of the shifting of the power centre, heavy taxation, bribes and sometimes due to natural forces such as siltation, formation of sandbars and cyclones.*

*The devastating cyclones which occurred along the Orissa coast between 1823 and 1900 caused enormous loss of human lives and property and destroyed the ports and port structures. The role of cyclones in the decline of these ports is scarcely mentioned in contemporary literature. Occurrences of storm surges during cyclonic events combined with the relatively large tidal ranges present along the Orissa coast caused tremendous destruction in the coastal area. In this article, an attempt has been made to study the decline of the ports of northern Orissa between Paradip and Sagar and to understand the various causative factors such as cyclones, storm surges and siltation, besides anthropogenic factors.*

**Keywords:** Cyclones, east coast of India, Orissa, ports, siltation, storm surges, tidal range.

THE ports and trade centres of Orissa played a significant role in the maritime history of India. The region between Paradip and Sagar appears to be important for undertaking research because several ports such as Balasore, Dhamra, Pipli, Chandbali, Laichanpur, Churamani and False Point (Figure 1) were developed by the British, Dutch, Danes, French and Portuguese for trade and commerce along the banks of the rivers Budhabalanga, Suvarnarekha, Brahmani, Baitarani, Gammai, Kamsabamsa and Mahanadi. These ports came into the limelight during the 16th century and some continued to be in prominence till the 19th century; others lost their significance soon and became minor ports. Over a period of time, some of these ports declined due to the formation of sandbars, sedimentation, occurrence of cyclones and storm surges and then, new ports came up in an adjoining region, served for some time and subsequently declined. However, scholars believe that the shifting of the centre of power, neighbour attacks, heavy taxation, bribes and a weak economy are some of the major causes for the decline of the ports and maritime trade activities of northern Orissa. But,

limited studies have been carried out to understand the causes for this decline.

In this article, an effort has been made to understand whether cyclones, sea level rise, siltation and longshore sediment transport or any other factors that are responsible for the deterioration of these ports. These causative factors, singularly or jointly responsible for the decline of ports, are further discussed. Nevertheless, the available information on cyclones and storm surges in the area during the study period has opened up the possibility that cyclones and storm surges could have played a critical role in the decline.

## Ports of northern Orissa

A brief outline of the ports of northern Orissa has been included to understand their role in maritime activity during the period and causes for their decline.

### *Pipli and Balasore*

The Portuguese established their first trade centre at Pipli on the banks of the river Suvarnarekha in 1514. Their monopoly in trade continued from Pipli for more than

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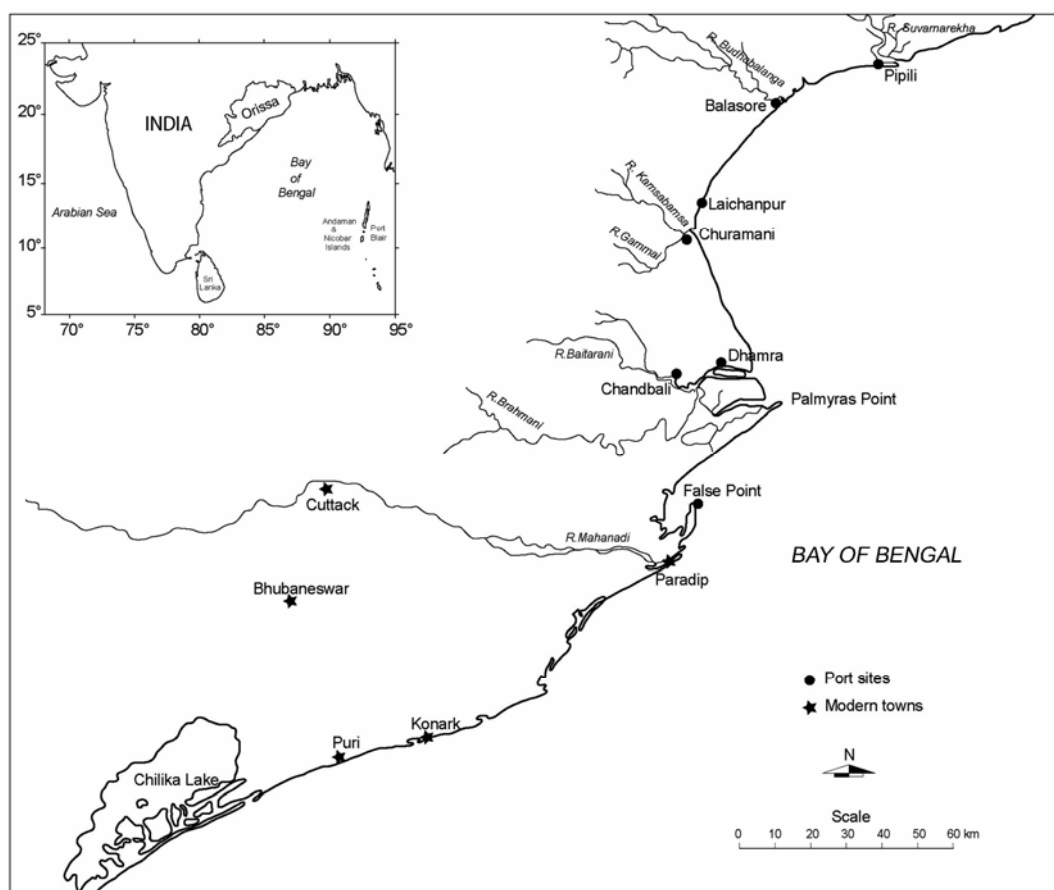


Figure 1. Map showing the location of ports and rivers along the Orissa coast.

hundred years and subsequently the Dutch, French and English entered Pipli for maritime trade. The British also set up their first trade centre at Pipli, which continued up to 1634 (ref. 1). Hamilton describes Pipli as the great centre of European trade in the 17th century, from where the Dutch shipped 2000 tonnes of salt annually. In the later part of the 17th century, the Portuguese settlement at Pipli was deserted owing to the formation of sandbars and sedimentation; the Dutch also demolished their factory at Pipli in 1676.

At Balasore, the Portuguese founded their trade settlement at the mouth of the river Budhabalanga around 1625, and the maritime trade of the Orissa coast was carried out mainly through this Balasore port<sup>2</sup>. Consequently, the Danes established their factory in 1636 followed by the Dutch and French during 1673–1694. Fifty six vessels visited the Balasore port in 1851 and 167 in 1853, but 40 ships were lost in a cyclone in 1851. Fakir Mohan Senapati (AD 1843–1918), a contemporary writer of Orissa, has detailed the maritime activities of Orissa in his autobiography<sup>3</sup>. He has mentioned Balasore as *Bandara Balasore* and the tributary of the river Budhabalanga as *Olanda Nala* because the *Olandaz* (Dutch) ships were anchored in the tributary. The settlements of the Dutch, Danish, French and Portuguese were located at

various places in the *Olanda Sahi* village. Further, Senapati suggests that until 50 years ago, the river was full of ships and now, the tributary is almost extinct owing to cyclones, sedimentation and siltation. There were ship repairing yards (*Bankashala*) and dockyards (*Godi*) on the banks of the *Olanda Nala*, but now no traces are left of their existence.

#### *Dhamra and Chandbali*

The Dhamra port was located on the estuaries of the rivers Baitarani and Brahmani. Being a natural port, it afforded complete protection to ships throughout the year. Because of its safe location, the British were attracted and set up their trade centre and exported rice and salt to Bengal from the Dhamra port. This port declined due to the formation of sandbars at the estuaries. The Chandbali port, located on the banks of the river Baitarani, was known as 'Ravenshaw Port'. Almost 60% of the total trade and commerce between Orissa and Calcutta was carried out through Chandbali and it continued as a flourishing port till 1885. Vessels plied from the Chandbali port to Madras, Bombay, Burma and Ceylon. Cotton and consumer goods were sent to Calcutta from the Dhamra and

Chandbali ports and forest products, oil seeds and rice were brought to Orissa. The Chandbali port declined due to the devastating cyclone of 22 September 1885 when the sea became shallower in the region. However, both Dhamra and Chandbali served as minor ports of Orissa till 1903 because marked buoys and beacons were provided in the mid channel of the rivers for navigation<sup>4</sup>.

### *Churamani and Laichanpur*

The Churamani and Laichanpur ports were on the banks of the rivers Gammai and Kamsabamsa. Of these two ports, the greater volume of trade was carried out through the Churamani port<sup>5</sup>. According to local traditions, Churamani and Laichanpur were formerly the principal ports of Orissa and sailors knew that in the case of storms and cyclones, their roads offered the best protection to ships in distress. Hence, these ports were considered the most safe and convenient along the Orissa coast. In the late 19th century, the rivers became unsuitable even during high tide; crafts exceeding 45 tonnes could not move in these ports. The port Laichanpur was closed, due to non-availability of government aid, in 1888.

### *False Point*

False Point was declared as a port in 1860. The history behind was that in 1828, a lighthouse was built at Palmyras point to direct ships to the coast and initially, ships running northward frequently mistook False Point for point Palmyras, a degree further up the coast. Later, the whole coastal area was surveyed and False Point was found to be the best for setting up a port. After the decline of the Chandbali Port due to the devastating cyclone and shallow depth, False Point served as an important port of Orissa in the later part of the 19th century. Its anchorage was safe and completely landlocked. Large vessels were anchored at some distance from its mouth in an exposed roadstead. It was sheltered from sea winds and vessels could enter in all seasons at any hour of tide. False Point was the best harbour on the whole of the Indian coast between Calcutta and Bombay<sup>6</sup>. This port brought a great change in maritime trade and had trade contacts with Madras, Bombay, Ceylon, Burma, Maldives, Mauritius and England. The services of False Point were highly appreciated during the Orissa famine of 1866 when it was the only means of communication. The cyclones of 1850, 1885 and 1891 brought heavy losses to the False Point port.

### **Decline of ports (as gleaned from literature)**

In the beginning of the 19th century, siltation and sandbar formation at the mouth of the river Budhabalanga

obstructed the entrance of the river and blocked the Balasore port<sup>7</sup>; the construction of the coastal canal in 1885 further facilitated the silting of the river Budhabalanga. During low tide, the water depth at the sandbar was more than 2 m at high tide. Hence, sea going ships could not move into the river. A storm wave devastated the Balasore port on 22 September 1885. The Pipli port lost its importance because of sandbar formation and accumulation of silt at the mouth of the river Suvarnarekha<sup>8</sup>. Further, Hamilton mentions that floods in the river Suvarnarekha washed away the remnants of the Pipli port. By the end of the 19th century, the Pipli port became unprofitable for the British and they did not develop the port<sup>3</sup>.

The storm of 22 September 1885 also ravaged the Chandbali port. The Dhamra port declined because of the formation of a sandbar across the mouth of the river<sup>9</sup>. The silting up of the river mouth prevented ships entering into the Churamani port and slowly the port declined. The Laichanpur port was deserted owing to the non-availability of government aid for maintenance and development. Attempts were made to improve the condition by removing the silt from the port, but it was unsuccessful because the deposit of silt was an uninterrupted process. The severe cyclone of 22 September 1885 destroyed the major part of False Point port. After that, it gradually declined because the sea became shallower near the coast and posed problems for the free movement of vessels.

In addition to the above natural processes, manmade factors were greatly responsible for the decline of these ports. During the Mughal regime, the ports of Orissa lost their importance because maritime trade was gradually transferred to Bengal, and the Europeans established their trade centres in different parts of Bengal. This indicates the withdrawal of royal patronage from trade and commerce. The shifting of headquarters from Balasore to Hugli also affected the commercial transactions at Orissa. Subsequently, the Hugli port came into prominence. The transfer of juridical power from Orissa to Bengal also led to a delay in decision-making on any policy matters pertaining to Orissa. The Mughal officers in Orissa demanded customs and transit duties from the Europeans for their transactions. Trade privileges such as *farmans*, *parwans* and *dastaks* were granted by emperors, princes and provincial officers. The frequent demand of bribes by the Mughal officers and the harassment of mariners and traders by the provincial officers adversely affected the maritime trade. The demand of bribes became so harsh during the reign of Rashid Khan that Thomas Bowery has evidenced him as a 'ravenous wolf'<sup>5</sup>. The frequent change of governors in Orissa became a common feature and this hindered the smooth operation of trade. In the 18th century, the British established their monopoly on trade and eliminated both Indian and other European merchants from the markets of Orissa<sup>10</sup>.

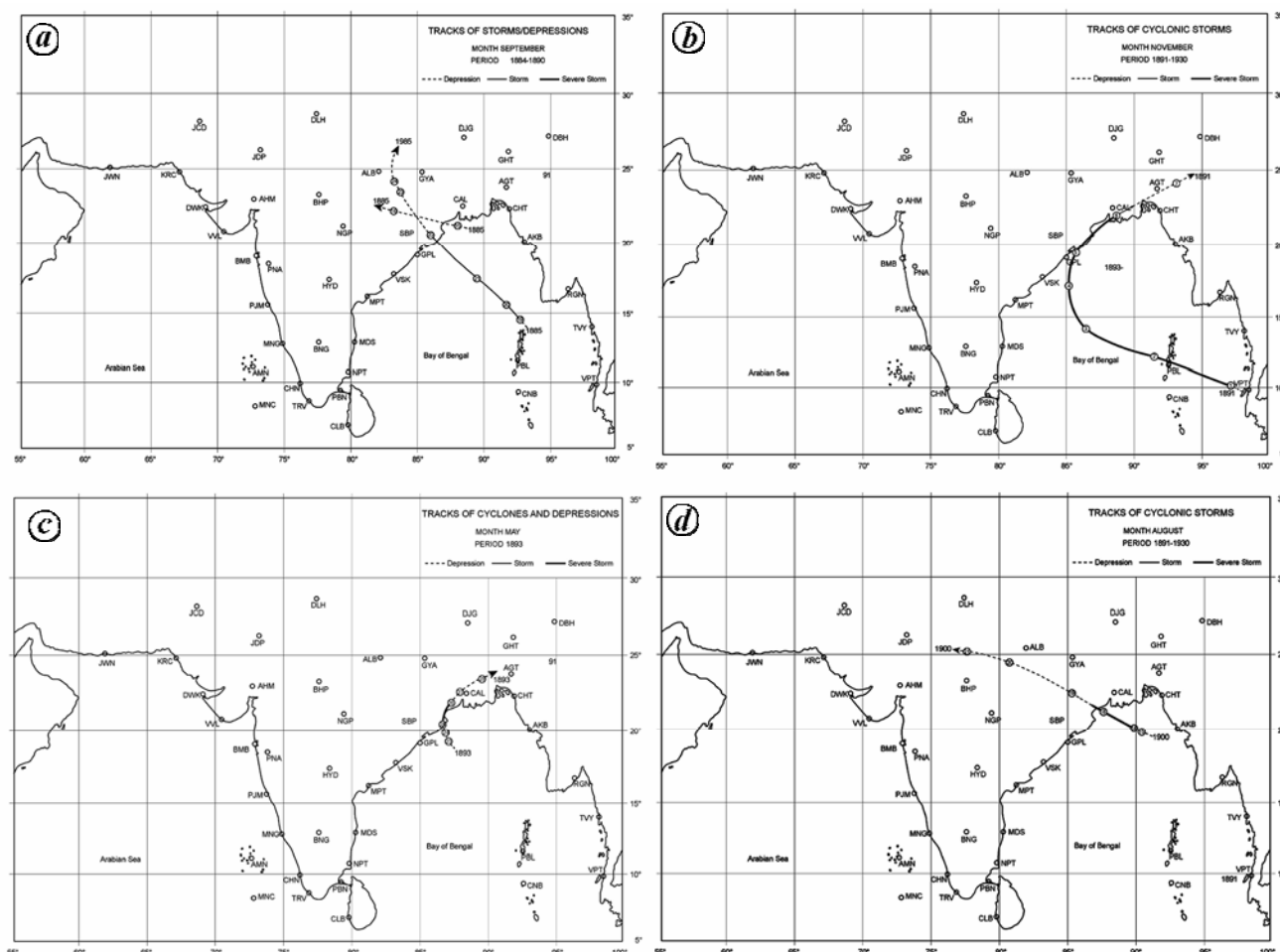


Figure 2a-d. Tracks of storms and depressions along the Orissa coast in the Bay of Bengal (Source: ref. 12).

### Role of cyclones in the decline of ports

The Orissa coast experienced cyclones and storm surges very frequently. In simple terms, a storm surge is the rise of water in the open ocean, which is generated by the low pressure of a cyclone. When surges propagate to shallow coastal regions, they amplify together with the action of winds and shallow water effects, and often become very destructive at the coast. The majority of these devastating cyclones occurred between October and December during the post-monsoon season, and some also took place during the southwest monsoon season between June and September. Their impact along the coast is severe, not only due to the strong winds of the cyclones, but also because of the storm surges they generate. When these surges arrive at the coast, they amplify in some cases and cause tremendous destruction and heavy loss of lives and properties in both the coastal and hinterland regions and also damage coastal structures and port installations.

Taking into account the records (1804–1999) of the British East India Company and India Meteorological Department (IMD), a database on cyclones and their

impacts along the Orissa coast was prepared<sup>11</sup>. Since the establishment of IMD in 1875, data on cyclones and storm tracks in Orissa between 1877 and 2000 is available, and the same has been used in the present study. Table 1 shows the cyclones that occurred along the Orissa coast between 1823 and 1900 and the intense damage caused by them. Some of the cyclone tracks that crossed the Orissa coast are shown in Figure 2. One severe cyclonic storm was developed in the northwest region of Port Blair in September 1885 whereas the other depression was built up off the Orissa coast in the same month. The depression developed into a storm at latitude ~14°N and longitude ~93°E over the Bay of Bengal. The storm travelled nearly 1000 km from its origin and destroyed both life and property along the Orissa coast. The depression further moved far inside the coastal region and weakened around 24 September (Figure 2a)<sup>12</sup>. During November 1891, a storm formed in the eastern Bay of Bengal, crossed the northern Orissa coast on 5 November, took a turn, then moved towards the sea and later crossed the West Bengal coast. Many ships were destroyed and both men and animals died in the storm (Figure 2b). On

**Table 1.** Cyclones that occurred along the Orissa coast between 1832 and 1900 and their impacts (Source: India Meteorological Department)

Period of cyclone	Affected area and surge information	Damage and loss of life
May 1823	Unbelievably violent winds and rain in Balasore, with terrible storm surge and inundation up to 10 km inland area	Several ships and villages disappeared
October 1831	Cyclone affected Balasore. 2–5 m surge and extensive inundation	Loss of 22,000 humans and 83,566 cattle
October 1832	Balasore area affected. Storm was more violent than 1823 and 1831. The surge was destructive	
May 1833	Second recorded cyclone in northern Bay of Bengal in May; first one in 1823. Balasore district was affected	
April–May 1840	Balasore, Cuttack and Puri districts were affected; cyclone crossed south of Puri	Most severe damage in Puri district
October 1848	Balasore, Cuttack and Puri districts were affected	Crops were destroyed in cyclone. A part of the tower of Konark temple was blown off
April 1850	Worst cyclone since 1832. False Point to Midnapore	Great damage by surge at the mouth of Subarnarekha river
October 1851	Severe cyclone in Balasore and Cuttack districts. Surges in Cuttack and Puri districts. High floods in river Mahanadi	Five ships driven to shore; six ran into Baitarani river. Crops damaged
July 1872	Cyclone affected 10 miles north and south of Balasore	A large number of animals and people were killed
October 1874	Southern part of Balasore district. Surge at Chandbali	Several ships destroyed, including human lives and animals
September 1885	Wind speed at False Point region was 243 kph, cyclone speed was 21 kph and this cyclone is still referred as ‘Sunia Batasa’. 7 m surge at False Point	Heavy loss of life and property; more than 5000 people died
May 1887	False Point to Sagar Island. Major surges at False Point	Several ships capsized; 776 people drowned
November 1891	Between Puri and False Point. Worst affected 50 miles inland area	Quite a few ships, sloops and large steamers either destroyed or damaged. 548 people and 3592 animals died
May 1893	One of the most severe cyclones in the Bay of Bengal in 25 years	Excessive rain in Balasore, Cuttack, Keonjhar and Puri districts. 5000 houses and river embankments destroyed
September 1895	False Point	More than 5000 deaths of humans

25 May 1893, another depression developed over the Bay of Bengal and moved towards Balasore and the West Bengal coast. While passing the Orissa coast, the depression took the form of a severe cyclonic storm with wind speed of 48–63 knots, and both life and properties were lost (Figure 2 c). On 18 August 1900, a severe storm crossed the northern coast of Orissa and played havoc there (Figure 2 d).

Murty *et al.*<sup>13</sup> have described the major storm surge events that occurred in the Bay of Bengal and the models used to stimulate the storm surges. Unnikrishnan *et al.*<sup>14</sup> have analysed the hourly tide gauge data for a period of 15 years and estimated 100-year return level of extreme sea level events at Paradip as 4.87 m. Dube *et al.*<sup>15</sup> have also used numerical model simulations and showed that the maximum values of simulated surges along the north-

ern coast of Orissa between Puri and Balasore vary from 5.0–8.0 m, with the maximum values found south of Balasore.

### Past cyclones and storm surges

The past recorded evidences indicate that the Orissa coast has been hit by many tropical cyclones. The cyclones that affected the Orissa coast between 1877 and 1987 show irregular tracks and they occurred between the mouth of the Dhamra and Paradip. Between 1891 and 1970, there were 1036 depressions in the Bay of Bengal and among them, 360 intensified into storms<sup>16,17</sup>. The cyclones in 1823 brought storm surges 5 miles inland and carried away even large ships as well as animals and men. The

5 m high storm surge of 1831 submerged the whole of the Balasore coast in which 26,000 people died. A similar destructive cyclone occurred in 1832 (ref. 18). The cyclone of 1855 had a 6 m tidal surge. The cyclones of 1831, 1885 and possibly the one in 1895 could have been super cyclones. Historical records<sup>19</sup> further state that between 1823 and 1893, about 16 cyclones occurred causing profound loss to the Orissa coast. These devastating cyclones not only brought human suffering but also ruined the economy of Orissa. The disastrous tropical storm which occurred in 1885 at False Point was associated with the highest storm surge of 7–8 m (ref. 20). Such storm surges might have also affected the nearby ports and the hinterland. The cyclones in Orissa between 1804 and 1999 and their details, areas affected, surge information, loss of life and property and damage caused have been discussed<sup>11,21</sup>. The British East India Company records give details about the cyclones of Orissa for the period from 1804 to 1875 (ref. 22).

Cyclones are accompanied by severe floods. The floods caused by cyclonic storms in the Bay of Bengal are associated with storm surges. The last hundred years' record shows that the Mahanadi, Brahmani and Baitarani river deltas had as many as 99 floods among them, 30 were high floods, 41 and 28 were medium and low floods respectively. Some of these floods are associated with heavy rains during the monsoon period and also caused by storm surges. These floods brought extensive damage and great suffering in the districts of Balasore, Cuttack and the adjoining regions<sup>19</sup>. Further, Orissa suffered greatly from the devastating floods which occurred between 1868 and 1896. Under such circumstances, the destruction of port installations was inevitable.

## Discussion

The archival and historical documents and writings of contemporary scholars provide information on maritime trade, import and export of cargo and the role of both natural and manmade factors in the rise and decline of the ports of northern Orissa. George Minchin, the master attendant of Puri, reported about the unsuitability of the ports of Orissa because the deposition of silt at the mouth of the river Budhabalanga caused difficulties in navigation and the movement of big vessels in the harbour; no steps were taken to protect the Balasore port<sup>23</sup>. The Orissa coast also witnessed the formation of sandbars at the estuaries of many rivers. Siltation and formation of sandbars were caused by the transport of sediments from upstream when the river discharge rates were high. For instance, Balasore, Pipli and Churamani have experienced the formation of sandbars and siltation, which are continuous processes and seasonal phenomena along the rivers.

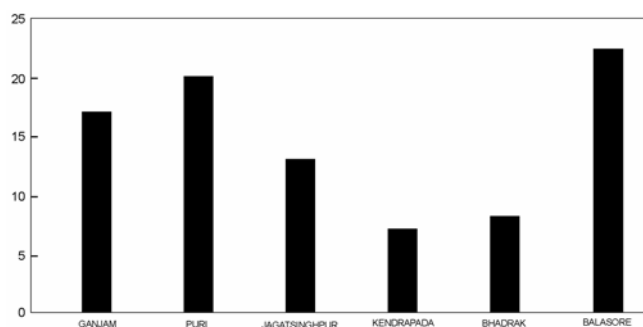
Scholars have attributed the decline of ports due to the formation of sandbars, but under such circumstances, it

would not have been possible to set up another port in the close vicinity after the decline of a port. The frequent cyclones and floods of high intensity might have washed out the sandbars and silt along the river mouths. Consequently, those might have formed again and accumulated. There is an instance of one of the merchants of Balasore attempting to improve the Churamani port by removing the silt, but the port again fell into disuse after sometime because of siltation<sup>18</sup>; then, it was only suitable for the movement of small vessels in the narrow channels. In the case of sedimentation, a study shows that the direction of longshore sediment transport in northern Orissa is towards the northeast from February to November and southwest in December and January<sup>24</sup>. The volume of transport per month is large during the southwest monsoon. Month-wise distribution of sediment shows that the transport is high in August and low in January. The direction of annual net sediment transport is towards northeast. This shows that longshore sediment transport is a continuous process and the deposited silt and sediment was carried away during the longshore sediment transport. The amount of silt brought by the Budhabalanga, Suvarnarekha, Brahmani, Baitarani, Gammai and Kamsabamsa may be of limited quantity because these are not major rivers like the Mahanadi, Godavari and Ganges. Thus sandbars, siltation and sedimentation were probably not the prime factors for the decline of these ports. It is more likely that cyclones followed by storm surges, which occur frequently along the Orissa coast, played a significant role in the deterioration of the ports of Orissa. For instance, among other factors Balasore, Chandbali and False Point ports were highly affected by the devastating cyclones between 1823 and 1895, which struck several times and caused severe loss of life and property. Literary information on cyclones and their occurrence in the Orissa coast is very limited. After a cyclone, ports decline affecting the economy, trade and commerce of the region. The rise and fall of a port is a continuous process that is related to both manmade and natural factors. Unless it was essential to shift the port or a suitable site is found, the same port continued even after the cyclone, siltation and sedimentation.

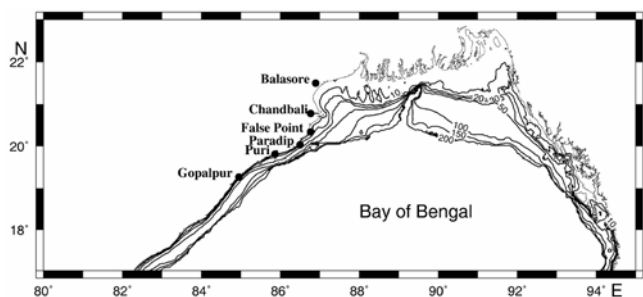
Sikka<sup>25</sup> made a reviewed various studies on cyclones in the north Indian Ocean. He discussed the improvements in the observational methods and numerical modelling approaches in predicting cyclones in the north Indian Ocean. Piddington<sup>26,27</sup> and Eliot<sup>28</sup> have documented the meteorological events of the 19th century in the Bay of Bengal. It is observed that cyclones occurred all along the coastal districts of Orissa, but the maximum number of cyclones struck the Balasore district followed by Puri<sup>21</sup> (Figure 3). However, the occurrence of higher number of cyclones in a region is not the only cause for the formation of large surges causing destruction. Even the bathymetry of the region and orientation of the coastline play a crucial role. The bathymetric chart of Balasore

coast (Figure 4) shows that the continental shelf is relatively wide. Hence, high amplification of surges takes place during the cyclones causing large destruction in this region<sup>29</sup>. Even the numerical modelling studies of Dube *et al.*<sup>15</sup> indicate that very high surges are possible along the Orissa coast, between the north of Paradip and Balasore coast.

Unnikrishnan *et al.*<sup>30</sup> have estimated the present day sea level rise along the Indian coast by analysing the past tide gauge data, and have found trends of about 1.3 mm/year on an average. The current sea level rise is caused by global warming happening since the industrial revolution, which is less likely to have impacts on the decline of ports in the 19th century. The Orissa coast is characterized by relatively large tidal ranges which increase northward. For example, the mean spring tidal ranges are 1.87 and 2.06 m in Paradip and Chandbali whereas in Short Island and Sagar the tidal ranges are 2.76 and 4.30 m respectively, which are higher than those at Paradip and Chandbali<sup>31</sup> (Table 2). Large tidal



**Figure 3.** Frequency of cyclones, district wise, along the coast of Orissa (after ref. 21).



**Figure 4.** Bathymetric contours along the Orissa coast. The data used is the modified ETOPO5 dataset (after ref. 29).

**Table 2.** Tidal ranges at selected ports along the Orissa and West Bengal coast (Source: ref. 31)

Station	Mean low water springs (m)	Mean high water springs (m)
Paradip	0.71	2.58
Chandbali	0.78	2.84
Short Island	0.58	3.34
Sagar	0.92	5.22

ranges combined with high surges during cyclones cause tremendous destruction at the coast.

## Conclusion

Numerous cyclones and floods have affected the Orissa coast compared to other states of India. As stated earlier, scholars have assumed that the formation of sandbars and siltation were responsible for the decline of ports. However, in the present study, analysis of past data on cyclones shows that the large number of cyclones could have caused their decline and destruction. This could be another important causative factor for the dwindling of maritime activities in Orissa. Various manmade factors also adversely affected and hindered the smooth operation of maritime trade.

Cyclones and storms have occurred regularly since time immemorial. Ancient ports and port structures might have been destroyed by cyclones, but no documents are available prior to the 19th century. Records show that the entire eastern coast of India has been experiencing cyclones of varying intensity on a regular basis. The storm surges might have had a great impact on the port structures which could not withstand their force. It appears that the role of sea level rise is minimal in comparison with cyclones. Cyclones and storm surges are the main factors in the decline of ports, particularly along the northern Orissa coast where large and frequent surges occur due to bathymetric features and orientation of the coastline; contemporary writers have not recorded them in their writings.

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