

“Climate Change and Its Behavioral Effects on the Wave Patterns within Indian Coastal Areas”-A Perspective

Prof.S.M.Gawande¹, Mr. Sartaj Ahmad Malik², Mr. Vipul Neeraj Khosla³, Mr. Prodinso Pul⁴,

¹Prof. S.M. Gawande, affiliated to Head of Department of civil Engineering, Anantrao Pawar College of Engineering & Research, Pune (411009), India

Mr. Sartaj Ahmad Malik², Mr. Vipul Neeraj Khosla³, Mr. Prodinso Pul⁴

UG Students, Department of Civil Engineering,
Anantrao Pawar College of Engineering & Research,
Pune (411009), India

ABSTRACT- Climate change in coastal areas is often referred to rise in sea level. This increase of sea level is due to the global warming, as the glaciers are melting because of increase in temperature. This increase of sea level is resulting in increase in wave heights and tidal ranges which is a serious threat to the coastal structures and people living near the coastal areas. India has highly productive coastline of around 7516.6 km long. According to census 2011, nearly about 48% people are living in coastal areas. However, due to increase in sea level there is threat to the human life and coastal structures and also the occurrence of disasters in coastal areas has increased.

Keywords: climate change, disasters, global warming, glaciers

I. Introduction

The coastline is the triple interface of air, land and sea. The land water interface along the coastline is always in a dynamic condition and nature works towards maintaining equilibrium condition. The energies of tides, waves, winds and currents are always active in the coastal zone. Dissipation of energy is often provided by beaches, mud flats, marshes, mangroves, etc. the coastal processes are the mechanisms that operate along a coastline bringing about various combinations of erosion and deposition.

The length of the Indian coastline is approximately 7516.6 km which consists of 9 states and 4 union territories including Andaman and Nicobar, Lakshadweep, Pondicherry and Diu and Daman. The coastline of India extends from Gujrat in the west coast to the West Bengal in the east coast consisting of Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh and Orissa from west to east.

The changes in the wave patterns occur due to the change in sea level. The rising sea level is threat to almost 48% of population which lives near the coastal areas. This sea level rise also affects the life of fishermen economically. The rise in sea level is also a threat to the stability of the coastal structures.

Hence, it is very important to keep a track of global warming as the global warming is resulting in decreasing the density of the ozone layer which is resulting in increase of penetration of U.V. rays. This penetration of U.V. rays increases the temperature on the surface of earth which results in melting of glaciers and increase in the sea water level.^[10]

II. Objectives

The main objective of this paper is to study about the causes of the sea level rise. This paper also elaborates about the causes of climate change in coastal areas. This climate change leads to the changes in the wave patterns which is a severe threat to the coastal structures and people living near these areas. The objective of this paper is also to study about the coastal processes which occur due to the climatic changes near the Indian coastline.

III. Climate Change

The change in the statistical distribution of weather patterns when the change for a long period of time (i.e. decades to millions of years) is known as climatic change. The main causes of climatic changes in the coastal areas can be variations in solar radiations, volcanic eruptions, melting of glaciers and plate tectonics. Human activities can also be identified as significant causes of recent climate changes, often referred to as global warming. Scientists actively work to understand past and future climate by using observations and theoretical models. A climate record extending deep into the Earth's past has been assembled, and continues to built up, based on geological evidence from the past sea level records.

Within scientific journals, global warming refers to surface temperature increase while climatic change includes global warming and everything else that increasing greenhouse gas levels affect.^[8]

IV. Causes of climate change

The energy received by earth from the sun and the rate at which it is lost to space determines the equilibrium temperature and climate of Earth. The energy then gets distributed with the help of winds, ocean currents, and other mechanisms around the globe which further affect the climate of different regions.

The factors that shape the climate are called “forcing mechanisms”. The forcing mechanism includes the processes such as variations in solar radiation, variations in the Earth’s orbit, atmosphere and oceans and changes in the concentration of green house gases. Some parts of the climate system, such as oceans respond to climate change slowly while others respond quickly.

This climate changes occurs slowly but are very harmful to the life on earth. These effects are mostly due to the increasing pollution and depletion of the ozone layer. The climate changes referring to coastal processes also include the pollution done by the ships and cargo. This pollution includes oil spillage, dumping of garbage or plastics in the ocean or rivers. This causes of pollution in the coastal parts should be triggered properly and should be worked out efficiently.

V. Behaviour of climate change

The main aspect of climate change occurs due to the increase in Sea Level Rise. This sea level rise increases by the global warming which causes the Glaciers to melt and the water from the melted glacier thus mixes with the sea water and increases the level of sea.

When the Sea Level Rises the coastal area starts to get submerged constantly beneath the water level thus affecting the lives of the people living near the coast. This increase in the sea level causes increase in the height of the waves and tides. This increase in waves and tides affects the coastline and also the stability inside the

Many natural phenomenon’s such as waves, tides, cyclones, etc affects the coastline. This phenomenon affects the coastline such as costing lives and coastal structures. The waves and tides affect the coastline in the form of erosion and sediment disposal.

Waves occurs due to the interfacial shear between the wind and water surface which gives rise to waves in the sea whereas tides in the sea occurs by the gravitational pull of Earth, Moon and Sun. Tsunami occurs when there is an earthquake beneath the sea bed. These natural activities in the water bodies is the cause of climatic change of the water bodies which further affects the lives of people, marine structure and also causes erosion.

The waves and tides with their continuous crest and trough behaviour erode the coastal structure which causes silting

offshore. This siltation further causes chocking up of the navigation channels of the ports. This siltation also sometimes creates natural beaches on the coastline.

VI. Sea level change

Global sea level change for much of the last century has generally been estimated using tide gauge measurements collated over long periods of time to give a long-term average. More recently, altimeter measurements in combination with accurately determined satellite orbits have provided an improved measurement of global sea level change. To measure sea levels prior to instrumental measurements, scientists have dated coral reefs that grow near the surface of the ocean, coastal sediments, marine terraces, voids in lime stones, and near shore archaeological remains. The predominant dating methods used are uranium series and radiocarbon, with cosmogenic radio nuclides being sometimes used to date terraces that have experienced relative sea level fall. In the early Pliocene, global temperatures were 1–2°C warmer than the present temperature, yet sea level was 15–25 meters higher than today.^[7]

VII. Coastal area of India

The nearly 7500 km long coastline of India is remarkably varied and dynamic and displays diverse rock-based, sediment-based and coral-based coastland landforms. Coastal processes along the Indian coasts are controlled largely by monsoons. The Arabian Sea coast differs from the Bay of Bengal coast in several respects. The east coast is wider, with several large deltas, large lagoons, one of the world’s largest mangrove wetland (Sunderbans) and long stretches of sandy beaches backed by dunes or ridges. In comparison, the west coast is more indented with rocky headlands, intervening sandy bays and multiple estuaries. Cliffs and associated features are relatively more common. A large saline marshland and lagoon-barrier complexes (kayals) are some of the noteworthy features along the west coast.

The varied tectonic history, underlying lithology, monsoon climate, sea level fluctuations in the Quaternary and modern littoral processes have created a great variety of the coastal landforms along the ~7500 km long coastline of the Indian Peninsula. The coastline displays diverse rock-based (headlands, sea cliffs and shore platforms), sediment-based (beaches, dunes, sand bars, spits, tidal flats) and coral-based (reefs and atolls) landforms, which vary significantly in their spatial scale and form.^[9]

VIII. Coastal processes

Modern coastal processes along the Indian coasts are controlled largely by three meteorological seasons - fair weather (February to May), southwest monsoon (SWM, June to September) and northeast monsoon (NEM, October to

January). Among the processes that shape the Indian coasts, affect the dynamics in the near-shore region and contribute substantially to alter the coastal environment; the monsoonal rainfall, winds, waves, tides, currents, and extreme events. Sediment input and sub-surface sedimentary structures also play a role in molding the coastal tracts.

The east coast experiences a subtropical monsoonal climate with an annual rainfall of 1600–1800 mm and severe cyclonic storms. The SWM splits into two branches, the Bay of Bengal branch and the Arabian Sea branch. The Bay branch moves northwards in early June, while the Arabian Sea branch remains active all along the west coast as the moisture laden winds hit the Western Ghat Escarpment. The NEM, on the other hand, largely affects the east coast and is characterized by a high pressure over the landmass and a persistent north easterly wind.

While the west coast is visited by SWM alone, the east coast is drenched both by SWM and NEM.

Apart from the monsoons, the Indian coasts are constantly impacted by cyclones and storm surges. When such surges occur during the spring tide they cause devastation on low-lying coastlines and river mouths. The west coast experiences comparatively homogenous wave regime throughout the year (except during SWM), and the current pattern is usually influenced by the shifting of the Inter-Tropical Convergence Zone (ITCZ). Compared to this, east coast has a varying climatic regime. Every year, low-pressure systems form in the Bay of Bengal during October-January and move towards the land to strike the coast. The occurrence of cyclones in northern Bay of Bengal has increased by ~26% during the last 120 years.^[1, 6]

IX. Conclusion

From this paper we conclude that climatic change in reference to sea level rise (SLR) is a very disastrous phenomenon for the coastal processes, wave patterns and coastal structures. This climatic change is due to increase in global warming around the globe. With this we conclude that humans should take into consideration that the global warming is very dangerous so it is the duty of every human being to take care of the environment by not polluting the environment and should try to make use of natural resources very wisely without wasting them, otherwise the consequences will be disastrous.

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