

SEA LEVEL RISE ANALYSIS BETWEEN MANDAPAM TO MANAMELKUDI REGION, TAMIL NADU

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Abstract: Shorelines are dynamic environmental process that changes the shape of the coast day by day. Coastal erosion is one of the major issues in world coastline. Its impact has adverse effects on the livelihood of coastal community. The area under study lies adjacent to Palk Bay and is a shadow zone. An attempt is made to understand the geomorphic evolution of the area, examine the changes that occur to the shoreline for the past 20 years and analyse the impact of rise in sea level in the study area. The SRTM(Shuttle Radar Topographic Mission) data is used to calculate the impact of rising sea level. The analysis map was drawn for 2m, 5m, 8m and 12m sea level rise, showing various areas submerging in the sea using ENVI 4.7 and Arc GIS software.

Keywords: Arc GIS, ENVI4.7, Sea level rise, SRTM data.

I. INTRODUCTION

Predictions of sea-level rise due to global climate change, and in particular by global warming, are at the forefront regarding the controversy of the climate change discourse. The world contains a defined amount of water. This volume of water cannot be increased or diminished, either by environmental or anthropogenic influences. Because water is found at any moment in all its different states - vapour, liquid, solid forms – a large proportion of the earth's surface is covered with ice. Not only is water in its solid state found on the surface of the ocean, but it can also be in this state on land surfaces. In the East, the coastal plains stretch from Tamil Nadu to West Bengal. Being coastal regions, they usually remain humid. These plains are divided into six areas namely, Coromandel Coast, Kanyakumari Coast, Krishna-Godavari deltas, Mahanadi delta and south of Andhra Pradesh plain. It has been mooted that, due to anthropogenic activities and mainly via industrialization, deforestation and agricultural activities, the earth's greenhouse effect is being accentuated.

While sea-level rise will only directly impact the coastal zone, such changes raise significant concern due to the high concentration of natural and socio-economic values located there. The coastal zone is a major focus of human habitation and economic activity, as well as being important ecologically (Holligan and deBoois, 1993; Turner et al., 1996; Sachs et al., 2001).

The local change in sea level at any coastal location depends on the sum of global, regional and local factors and is termed relative sea-level change (Nicholls and Leatherman, 1996; Nicholls, 2002a). Therefore, global-mean sea-level rise does not translate into a uniform rise in sea level around the world.

Taking the greenhouse gas emission scenarios from the Special Report on Emission Scenarios (SRES) (Nakicenovic et al., 2000), it is estimated that the global rise in sea level from 1990 to 2100 would be between 9 and 88 cm, with a mid-estimate of 48 cm (Church et al., 2001). This is a slightly lower estimate than the second IPCC assessment (Warrick et al., 1996), but the large range of uncertainty for future global-mean rise remains.

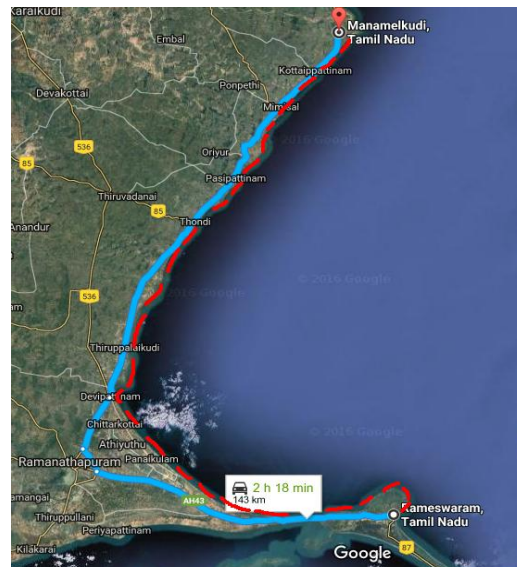
Many other aspects of climate change will also have coastal implications that will interact with sea-level rise, although the details will vary from place-to-place (Nicholls, 2002a). A major concern is changes in the frequency, magnitude and location of the tracks of tropical and extra-tropical storms (e.g., Knutson et al., 1998; Warrick et al., 2000), and this issue often excites more attention than sea-level rise (e.g., Henderson-Sellers et al., 1998).

The coastal system is best defined in terms of interacting natural and socio-economic systems. Both systems may be characterized by their exposure, sensitivity and adaptive capacity to change, both from sea-level rise and related climate change, and this may be modified by other non-climate stresses. Collectively, sensitivity and adaptive capacity, combined with exposure, determine each system's vulnerability to sea-level rise and other changes.

This effect is most extreme for coastal areas as the commitment to sea-level rise may commit coastal inhabitants to adapt to sea-level rise for hundreds if not thousands of years into the future (Watson et al., 2001).

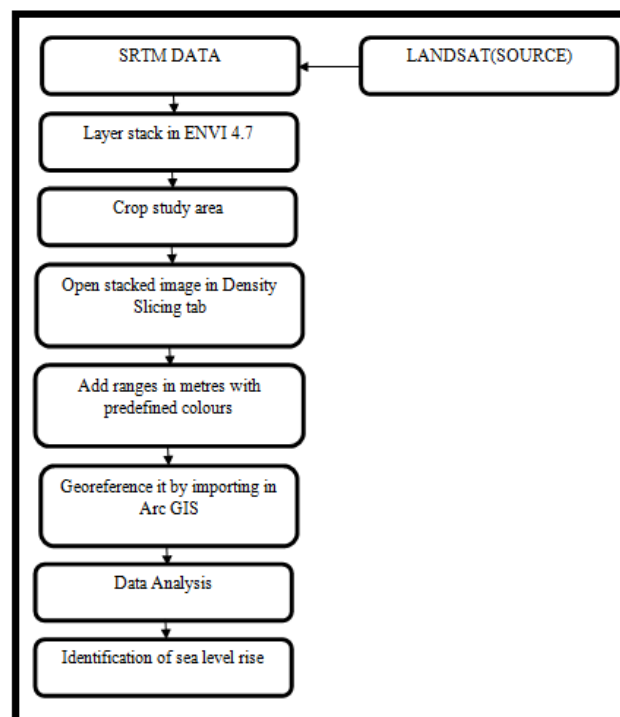
II. STUDY AREA

The coastline does not have dense forests and the soil is marshy. Coconut and palms stand tall alongside the coastline. The economy of this region largely depends upon Agriculture. Crops like sugarcane, legumes, rice, groundnuts and cotton are grown here which serve as major source of income for farmers. A coastal zone of 146km length from Mandapam (latitude: 9.2770, longitude: 79.1252) to Manamelkudi (latitude: 10.0359, longitude: 79.2317) was selected. The path and row of our study area is 142-53 and 142-54. The coast is oriented in NE-SW direction from Devipattinam to Manamelkudi and NW-SE direction from Mandapam to Devipattinam.



III. MATERIALS AND METHODOLOGY

The SRTM data is downloaded from Landsat.org. The file is processed in ENVI 4.7 using layer stacking method. The red band, green band and blue bands are clubbed into a single file in grey scale. After cropping the study area the file is opened in Density Slices and sliced them with respect to required rise in sea level. The file is then exported to Arc GIS and georeferenced it



A. EFFECT OF SEA LEVEL RISE ON ENVIRONMENT AND HUMAN BEINGS

The assessment of the impact of sea-level rise on ecosystems and human settlements can only go so far as to say that in the event of sea-level rise, a number of socio-economic, political and environmental implications will be felt across the entire globe, especially along the coastline of the various continents. When sea levels rise rapidly, as they have been doing, even a small increase can have devastating effects on coastal habitats. As seawater reaches farther inland, it can cause destructive erosion, wetland flooding, aquifer and agricultural soil contamination, and lost habitat for fish, birds, and plants. When large storms hit land, higher sea levels mean bigger, more powerful storm surges that can strip away everything in their path. In addition, hundreds of millions of people live in areas that will become increasingly vulnerable to flooding. Higher sea levels would force them to abandon their homes and relocate. Low-lying islands could be submerged completely.

Rising sea level is a threat to people who live near the ocean. Some low-lying areas will have more frequent flooding, and very low-lying land could be submerged completely. Rising sea level can also harm important coastal ecosystems like mangrove forests and coral reefs.

The IPCC TAR WGII report notes that current and future climate change would be expected to have a number of impacts, particularly on coastal systems. Such impacts may include increased coastal erosion, higher storm-surge flooding, inhibition of primary production processes, more extensive coastal inundation, changes in surface water quality and groundwater characteristics, increased loss of property and coastal habitats, increased flood risk and potential loss of life, loss of non-monetary cultural resources and values, impacts on agriculture and aquaculture through decline in soil and water quality, loss of tourism, recreation, and transportation functions

IV. RESULTS AND DISCUSSION

The sea level when rises from MSL(mean sea level) assumed as zero to 2m in height(denoted in red colour) will cause damages to only a few areas like Mandapam, Ariyaman, near Attrankarai. It also has a thin strip of 2m height from Attrankarai to the north of Thiruppalaikudi which may be around 43km long. It also extends from Thondi to Muthukuda, from Thiruvadanai to Kodiakarai with a very narrow coast land. Sea level rise till 5m (denoted in green colour) will affect Mandapam to Ariyaman, Devipattinam to the north of Thirupalaikudi just below Nambuthalai. Again from Muthukuda to Mimisal, then extends from Thiruvadanai and continues to the north. Again the same elevation exists in the inner part of land denoting an elevated sand ridge along the coast. Sea level rise till 8m (denoted in yellow colour) is located near the sea in Devipattinam, Nambuthalai, Thondi and Mimisal extending till Kodaikarai and it also exists after 5m height from Siththarkottai to Kodaikarai. The sea level rise till 12m (denoted in purple colour) from South of Mandapam to North of Devipattinam along the coast, Nambuthalai, Thondi, Mimisal and Thiruvadanai and it also extends from Siththarkottai to Kodaikarai.



V. CONCLUSION

The effects are going to be disastrous and it is a fact. Each of us is hence left with a choice to make: a choice that will impact not only us, but also our future generations. It is no doubt a big challenge but certainly not impossible. We know that our planet's future depends on the global commitment in this regard. We need to work towards this initiative. Over the past century, the burning of fossil fuels and other human and natural activities has released enormous amounts of heat-trapping gases into the atmosphere. These emissions have caused the Earth's surface temperature to rise, and the oceans absorb about 80 percent of this additional heat. The study highlights that by reducing emissions of four specific pollutants—methane, tropospheric ozone, hydro fluorocarbons and carbon—we could possibly prevent the rate of sea level rise by approximately 25 to 50 percent. **Afforestation** is the conclusion for all the problems related to air, water and land.

The sea level rise can be monitored and CRZ (Coastal Regulation Zone) can be updated and human settlement can be alarmed regarding any future sea level rise. Using Remote Sensing the coastal zones can be continuously monitored and evolution of coastal organisms can be predicted for ecological and business purposes.

Remedial Measures:

It has become important through the facts that we need to take important immediate measures to tackle this phenomenon and reduce the carbon emission. The suggested remedial measures are:

- Electricity should be produced by using new techniques and technology as the current method of thermal power plants is one of the major reasons of Global warming.
- Farmers should practice what is called Green Farming.
- To fix the issue of transportation in an eco-friendly way, we need to use alternate energy sources like solar, wind etc.
- Use fuel cells for electricity to be produced. In these cells no greenhouse gas are emitted. Only water is the result which can be reused for energy generation.
- Carpooling, using energy efficient sources of light, etc., will all help in this endeavor against Global warming.

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