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Introducing Tsunami, Affected Area, Impacts and Prevention on Vigorous Tsunami in Coastal Areas of India

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Abstract

Tsunami is a Japanese word. Tsunamis are among the most terrifying natural hazards known to man and have been responsible for tremendous loss of life and property throughout history. Because of their destructiveness, tsunamis have notable impact on the human, social and economic sectors of our societies. The main propose of this study is observing the tsunami affected area, impact and prevention on vigorous tsunami in India. About 50% population is living in coastal areas at near ocean. India's coastline more affected with natural disaster like tsunami and cyclones a big loss of human life and their properties every year. In 2004 Indian Ocean tsunami was among the deadliest natural disasters in human history with over 230,000 people killed in 14 countries bordering the Indian Ocean.

Keyword:

Introduction

India is a country in South Asia. It is the seventh-largest country by area, the second-most populous country with over 1.2 billion people, and the most populous democracy in the world. With 1,210,193,422 residents reported in the 2011 provisional census, India is the world's second-most populous country. Its population grew at 1.76% per annum during 2001–2011, down from 2.13% per annum in the previous decade (1991–2001).The human sex ratio, according to the 2011 census, is 940 females per 1,000 males. The Indian climate is strongly influenced by the Himalayas and the Thar Desert, both of which drive the economically and culturally pivotal summer and winter monsoons. The Himalayas prevent cold Central Asian katabatic winds from blowing in, keeping the bulk of the Indian subcontinent warmer than most locations at similar latitudes. The Thar Desert plays a crucial role in attracting the moisture-laden south-west summer monsoon winds that, between June and October, provide the majority of India's rainfall. Four major climatic groupings predominate in India: tropical wet, tropical dry, subtropical humid, and mountain.

History of Tsunami

Tsunamis are generated by geophysical phenomena such as earthquakes, volcanoes, submarine landslides, and meteorite impacts. Historically, worldwide tsunami events (from 1790 to 1990) were mostly generated by earthquakes (90.3 percent), volcanoes (6.4 percent) and landslides (3.3 percent).

According to the Integrated Tsunami Data Base, at least 1 963 tsunamis have been noted from 1628 to 2005 (ITDB/WRL, 2005). In the Indian Ocean region, including the eastern part of Indonesia, the Philippines, and Taiwan Province of China, there were at least 282 tsunami events from 1600 to 2005. Only one event occurred in the Arabian Sea in November 1945 (earthquake magnitude 8.3 and Tsunamiintensity of 3.0). Several events have been also reported in the Bay of Bengal, as well as the Andaman and Nicobar Islands.

Study Area

Study area is the India's coastline and measures 7,517 kilometres (4,700 mi) in length; of this distance, 5,423 kilometers (3,400 mi) belong to peninsular India and 2,094 kilometers (1,300 mi) to the Andaman, Nicobar, and Lakshadweep island chains. India lies to the north of the equator between 6° 44' and 35° 30' north latitude and 68° 7' and 97° 25' east longitude. Bounded by the Indian Ocean on the south, the Arabian Sea on the south-west, and the Bay of Bengal on the south-east, it shares land borders with Pakistan to the west; China, Nepal, and Bhutan to the north-east; and Burma and Bangladesh to the east. In the Indian Ocean, India is in the vicinity of Sri Lanka and the Maldives; in addition,

India's Andaman and Nicobar Islands share a maritime border with Thailand and Indonesia.

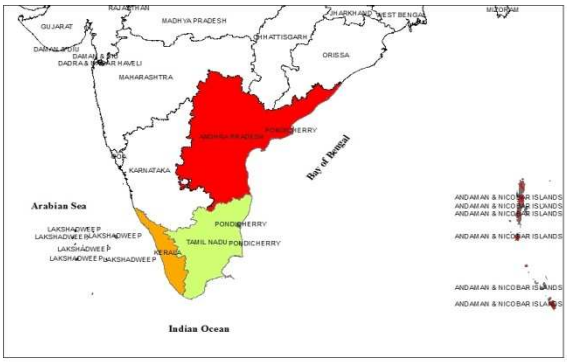


Figure 1: Showing the Study area in Coastal India

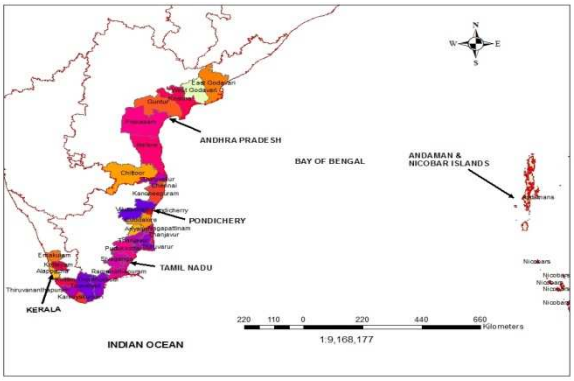
Table 1: Recent tsunamis in the Indian Ocean

Year	Locality	Country
1992	Flores, Nusa Tenggara Timur	Indonesia
1994	Banyuwangi, East Java	Indonesia
1994	Mindoro	Philippines
1996	Toli-Toli, Central Sulawesi	Indonesia
1996	Biak, Irian Jaya	Indonesia
1998	Taliabu, Maluku	Indonesia
1998	Aitape, PNG	Papua New Guinea
2000	Banggai, Central Sulawesi	Indonesia
2004	Indian Ocean Tsunami	Indian Ocean countries
2005	Nias, North Sumatra	Indonesia
2006	Pangandaran, West Java	Indonesia

Results and Discussion

The Indian Ocean Tsunami of 26thDecember 2004 is one of the most destructive Tsunamis known to have hit

India and 13 other countries in the Indian Ocean region. With a combined toll of 238,000 casualties (including51,500 people missing), and roughly more than1.5 million people displaced in fourteen countries, this tsunami resulted in damage and destruction of property, assets and infrastructure in the coastal areas. In India10, 749 people lost their lives due to the tsunami and 5,640 people were missing in the Tsunami-affected areas. Out of the 7516 km long coastline of India, more than 4500 km stretch was badly affected by the 9.0 magnitude earthquake-triggered tsunami, resulting in the total destruction of living environment along the coast. The worst affected areas along the Indian coast were in Tamil Nadu, Kerala, and Andhra Pradesh states. Tamil Nadu state suffered maximum loss with the damage concentrated in 4 districts. (National Disaster Management Guidelines: Management of Tsunamis, August, 2010)



Map 1: Showing the Affected Coastal Area of India in Dec., 2004

Tsunami Affected areas

The tsunami caused extensive damage in Southern regions of India and Andaman & Nicobar Islands affecting a total of 2,260 km of coastline. The waves were reported to be as high as 3-10 meters in southern India and penetrated from 300 m to 3 km inland. The worst-affected regions were the State of Tamil Nadu and the Andaman and Nicobar archipelago. The States of Pondicherry, Andhra Pradesh and Kerala were affected to a lesser extent. Tsunami affected more than one-fourth of the total coastal line of the country. According to this estimate the total populations are affected about 3415000 peoples in India in 2004. In Tamil Nadu is affected about 691000 peoples on 2487 hectors area. Kerala is affected with 2470000 peoples and Andhra Pradesh & Pondicherry are combined damaged with 211000, 43000 peoples on the land of 790, 790 hectors. Economic losses have been estimated at around Rs. 113,533 million which amounts to 0.45% of Gross Domestic Product of the country at current prices in 2003-04. Over 2 million were directly or indirectly affected. Among these, large numbers of people had to be moved to the safer place. It has been estimated that about 0.57 million people were evacuated
from the tsunami affected areas to safety. (Source: UNDMT Situation Report 18 January 2005)

Table 2: Tsunami Damage in India (2004)

Factor	Andra Pradesh	Kerala	Tamil Nadu	Pondicherry	Total
Population affected	211000	2470000	691000	43000	3415000
Area affected (Hac.)	790	Unknown	2487	790	4067
Length of coast affected (K.M.)	985	250	1000	25	2260
Village affected	301	187	362	26	876

Source: DiMaRF, India, 2005

Observation During Tsunami

Mitigation of natural disasters can be successful only when detailed knowledge is obtained about the expected frequency, character, and magnitude of hazardous events in an area.

- The maximum damage had occurred in low-lying areas near the coast.
- High casualties were found in thickly populated areas.
- Mangroves, forests, sand dunes and coastal cliffs provided the best natural barriers to reduce the impact of the tsunami.
- Heavy damage was reported in areas where sand dunes were heavily mined (e.g., Nagapattinam and Kolachal) and where coastal vegetation was less.
- Mangrove wetlands should be regenerated.
- Coral reefs, grass beds, and coastal forests should be preserved and conserved for both short-term and long-term ecological and livelihood benefits.
- Raising coastal plantations like casuarinas, saliconia, palm, bamboo, etc. will act as an effective bio-shield and provide protection to the coastal communities.
- Geomorphologic features like sand dunes, beaches, coastal cliffs should be protected.
- Impact of natural hazards in the coastal and marine areas should be taken into account while formulating coastal area management schemes.

Use of Remote Sensing Technique

Many types of information that are needed in natural disaster management have an important spatial component. Spatial data are data with a geographic component, such as maps, aerial photography, satellite imagery, GPS data etc. remote sensing and geographic information systems (GIS), which have proven their usefulness in disaster management.

Remote sensing and GIS provides a data base from which the evidence left behind by disasters that have occurred before can be interpreted, and combined with other information to arrive at hazard maps, indicating which areas are potentially dangerous. Secondly, many types of disasters, such as floods, drought, cyclones, volcanic eruptions, etc. will have certain precursors. The satellites can detect the early stages of these events as anomalies in a time series. Images are available at regular short time intervals, and can be used for the prediction of both rapid and slow disasters.

In the disaster relief phase, GIS is e extremely useful in combination with Global Positioning Systems (GPS) in search and rescue operations in areas

Remote sensing can assist in damage assessment and aftermath monitoring, providing a quantitative base for relief operations.

In the disaster rehabilitation phase GIS is used to organize the damage information and the post - disaster census information, and in the evaluation of sites for reconstruction.

Remote sensing is used to map the new situation and update the databases used for the reconstruction of an area, and can help to prevent that such a disaster occurs again.

When a disaster occurs, the speed of information collection from air and space borne platforms and the possibility of information dissemination with a matching swiftness make it possible to monitor the occurrence of the disaster. Many disasters may affect large areas and no other tool than remote sensing would provide a matching spatial coverage.

Remote sensing also allows monitoring the event during the time of occurrence while the forces are in full swing.

GIS is used as a tool for the planning of evacuation routes, for the design of centers for emergency operations, and for integration of satellite data with

other relevant data in the design of disaster warning systems.

Tsunami Warning and Mitigation Plan

In order to achieve the first goal, it is necessary to prevent, prepare for, mitigate and minimize effects of a natural disaster. Therefore, before a natural disaster, the phases of Prevention, Mitigation, and Preparedness are essential.

- Before a disaster (pre-disaster). Pre-disaster activities those which are taken to reduce human and property losses caused by a potential hazard. For example, carrying out awareness campaigns, strengthening the existing weak structures, preparation of the disaster management plans at household and community level, etc. Such risk reduction measures taken under this stage are termed as mitigation and preparedness activities.
- During a disaster (disaster occurrence). These include initiatives taken to ensure that the needs and provisions of victims are met and suffering is minimized. Activities taken under this stage are called emergency response activities.
- After a disaster (post-disaster). There are initiatives taken in response to a disaster with a purpose to achieve early recovery and rehabilitation of affected communities, immediately after a disaster strikes. These are called as response and recovery activities.

All these disaster management phases are inter-linked and are cyclic – i.e., one phase cannot be effective in isolation of the others. In other words, the phases before an event – prevention, preparedness and mitigation – are as important as response, recovery and rebuilding.

Conclusion

The present study successfully shows that affected area of India and their management to escape the natural disaster like tsunami, cyclone etc. and shows the better use of remote sensing in their fields.

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