RESEARCH PAPER | Engineering | Volume - 5 | Issue - 1 | Jan Special Issue - 2015 | ISSN - 2249-555X

Tsunami Risk in India

KEYWORDS

Patel A.B.
Asst. Prof., Gandhinagar Govt. Engineering College, Gandhinagar

Patel D.P.
Assot. Prof. Saffrony Institute of Technology, Mehsana

Patel U.R.
Asst. Prof., CED, L.D.R.P, Gandhinagar

ABSTRACT The Indian coastal belt has not recorded many Tsunamis in the past. Waves accompanying earthquake activity have been reported over the North Bay of Bengal. During an earthquake in 1881 which had its epicenter near the centre of the Bay of Bengal, Tsunamis were reported. The earthquake of 1941 in Bay of Bengal caused some damage in Andaman region. This was unusual because most Tsunamis are generated by shocks which occur at or near the flanks of continental slopes. During the earthquakes of 1819 and 1845 near the Rann of Kutch, there were rapid movements of water into the sea. There is no mention of waves resulting from these earthquakes along the coast adjacent to the Arabian Sea, and it is unlikely that Tsunamis were generated. Further west, in the Persian Gulf, the 1945 Mekran earthquake (magnitude 8.1) generated Tsunami of 12 to 15 metres height. This caused a huge damage, with considerable loss of life and property at Ormara and Pasi. The estimated height of Tsunami at Gulf of Combay was 15m but no report of damage is available. The estimated height of waves was about 2 metres at Mumbai, where boats were taken away from their moorings and casualties occurred. A list showing the Tsunami that affected Indian coast in the past is given in Table-2.1. The information given in the Table is sketchy and authenticity cannot be confirmed except the Tsunami of 26th December 2004

I. INTRODUCTION

Tsunami is a very broad area for research, so the literatures available in this field are categorized in various stages. So, for the study of Tsunami is vary important in country like India which have very large costal area.

II. EARTHQUAKE EFFECT

The Indian coastal belt has not recorded many Tsunamis in the past. Waves accompanying earthquake activity have been reported over the North Bay of Bengal. During an earthquake in 1881 which had its epicenter near the centre of the Bay of Bengal, Tsunamis were reported. The earthquake of 1941 in Bay of Bengal caused some damage in Andaman region. This was unusual because most Tsunamis are generated by shocks which occur at or near the flanks of continental slopes. During the earthquakes of 1819 and 1845 near the Rann of Kutch, there were rapid movements of water into the sea. There is no mention of waves resulting from these earthquakes along the coast adjacent to the Arabian Sea, and it is unlikely that Tsunamis were generated. Further west, in the Persian Gulf, the 1945 Mekran earthquake (magnitude 8.1) generated Tsunami of 12 to 15 metres height. This caused a huge damage, with considerable loss of life and property at Ormara and Pasi. The estimated height of Tsunami at Gulf of Combay was 15m but no report of damage is available. The estimated height of waves was about 2 metres at Mumbai, where boats were taken away from their moorings and casualties occurred. A list showing the Tsunami that affected Indian coast in the past is given in Table-1. The information given in the Table is sketchy and authenticity cannot be confirmed except the Tsunami of 26th December 2004.

Above facts indicate the coastal region of Gujarat is vulnerable to Tsunamis from great earthquakes in Mekran coast. Earthquake of magnitude 7 or more may be dangerous. It may be noted that all earthquake do not generate Tsunami. Research is still being undertaken in this field. For the Indian region, two potential sources have been identified, namely Mekran coast and Andaman to Sumatra region.

III. HISTORY OF TSUNAMIS AFFECTING INDIAN OCEAN

Although not as frequent as in the Pacific Ocean, tsunamis generated in the Indian Ocean pose a great threat to all the countries of the region. The most vulnerable are: Indonesia, Thailand, India, Sri Lanka, Pakistan, Iran, Malaysia, Myanmar, Maldives, Somalia, Bangladesh, Kenya, Madagascar, Mauritius, Oman, Reunion Island (France), Seychelles, South Africa and Australia.

TABLE I
LIST OF TSUNAMI THAT AFFECTED INDIA IN PAST

Date	Remarks
326 B.C.	Alexander the Great
Between 1st April & 9th May 1008	Tsunami on the Iranian coast from a local earthquake
27th Aug1883	Karatoa 1.5 m Tsunami at Madras, 06 am at Nagapattainam, 0.2 m at Arden
1884	Earthquake in the western part of the Bay of Bengal Tsnamis at Port Blair,Doublet (mouth of Hoogly River)
26th June 1941	M 8.1 quake in the Andaman Sea Tsunamis on the east coast of India with amplitudes from 75 to 1.25 m. Some damage from East Coast was reported.
1945	Mekran Earthquake (M 8.1) 12 to 15 M wave height in Ormara in Pasi (Mekran coast) Considerable damage in Mekran coast. In Gulf of Cambay of Gujarat wave heights of 15 meter was estimated. Damage report from Gujarat coast was not available. The estimated height of waves at Mumbai was about 2 meters.

Volume - 5 | Issue - 1 | Jan Special Issue - 2015 | ISSN - 2249-555X

27th November 1945	M8.25 quake 70 km south of Karachi at 24.5 N, 63.0 E Tsunami amplitude at Kutch was 11.0 to 11.5m
26th December 2004	Earthquake of magnitude 9.1 off north Sumatra coast generated devastated Tsunami waves affecting several countries in South East Asia. In India Andaman & Nicobar Island, Tamil Nadu, Pondichery, Andhra Pradesh, Kerala and Lakshdweep have been affected about 9700 people lose their lives and about 6000 more reported missing. (Till end January 2005.)

TABLE II
RUN-UP LEVEL FOR TSUNAMI OCCURRED BETWEEN 1700 AND 2004 IN INDIAN OCEAN

Sr. No	Name of Affected Location	Run up heights (m)	Year / Date	Earthquake Magnitude at source	Source Location
1	Tributaries of the Ganges river (Bangladesh)	1.83	12-04-1972	NA	Bay of Bengal
2	------	---	1847	---	Great Nicobar Island
3	Port Blair, Andaman Islands	4.0	19-08-1868	MW 7.5	Bay of Bengal
4	Car Nicobar Island, Nicobar Islands	0.76			
5	Dublat, India	0.30			
6	Nagapattinam, India	1.22			
7	Port Blair, Andaman Islands	1.22			
8	Chennai	1.5	26-08-1883	---	Island of Java and Sumatra
9	Andaman & Nicobar Islands	NA	26-06-1941	MW 7.7	Andaman Sea
10	Mumbai, India	1.98			
11	Karachi, Pakistan	1.37			
12	Ormara, Pakistan	13.0			
13	Pasni, Pakistan	13.0			
14	Victoria, Mahe Island, Seychelles	0.30	27-11-1945	MS 8..3	Arabian Sea
15	Not felt in India	---	19-08-1977	MS 8.1	West of Sumatra Island
16	Cocos Islands, Australia	0.30	18-06-2000	MS 7.8	Arabian Sea
17	Sumatra (Indonesia)	3.5	26-12-2004	MW 9.1	West of Sumatra Island

The states which are facing Indian Ocean (Arabian Sea and Bay of Bengal) also come under a high risk of earthquake prone zones. These states mostly comes in a zone of III and IV as per IS 1893-2000 (Indian Standard Code of Provisions). These states are Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamilnadu, Dadra Nagar Haveli and Daman etc. From past histories, of tsunami events in India we predicted that, Gujarat State is under high risk of tsunami in future. Maximum wave height observed in Kutchch region was 5-6 m, but an earthquake of M 8 or more than M8 in Arabia Sea will cause waves of 15-20 m in Gujarat state. Table 2.3 gives the earthquake zone and maximum tsunami height observed in each state.

TABLE III
EARTHQUAKE ZONES AND TSUNAMI REGIONS (DR.SISIRA KODAGODA 2005)

Name of coastal State	EQ zone	Astronomical High Tide (m)	Flood Proneness	Tsunami Proneness (m)
Gujarat	III, IV and V	1.1 – 5.3	In 5 coastal districts	10 - 12
Dadra & Nagar Haveli	III	1.1 – 5.3	-	+
Daman & Diu	III	1.1 – 5.3	-	+
Maharashtra	III and IV	-	-	1.5 - 2
Goa	II and III	-	-	+
Karnataka	II and III	-	-	+
Kerala	III	-	In 9 coast districts	3 - 5
Tamilnadu	III	-	-	7 - 10

IV. CONCLUSIONS

1. The Tsunami Risk after 26th Dec 2014 is much higher so the data will helpful to make modelling.
2. The Tsunami produced due to earthquake in the beneath of the Sea so the reference documents will helpful to save the lifes and the economy lost of the country.
3. The Tsunami is not very much affect India in past years compare the countries of the world but now a day's earthquake are frequent ion Earth and in the sea areas so the study is necessary to help out for future rescue work.

REFERENCE

[1] Anandan. C and Sasidhar. P (2008), "Assessment of the impact of the tsunami of december 26, 2004 on the Near-shore bathymetry of the kalpakkam coast, east coast of India", Science of Tsunami Hazards, Vol. 27, No. 4, pages 26-35. | [2] Annunziato A. and Best C. (2005), "The tsunami event analyses and models", Work for institute for the Protection and security of the Citizen, Joint Research Centre, European Commission. | [3] Apotsos A., Jaffe B. and Gelfenbaum G. (2011), "Wave characteristic and morphologic effects on the onshore hydrodynamic response of tsunamis", Coastal Engineering, Vol.58 pages 1034–1048. | [4] Arnason. H, Petroff. C and Yeh. H (2009), "Tsunami Bore Impingement onto a Vertical Column", Journal of Disaster ResearchVol.4 No.6. | [5] Arya. A. S and Agarwal. A (2006), "Protection and Mitigation from risk of tsunami", National Disaster Management Division Ministry of Home Affairs Government of India.