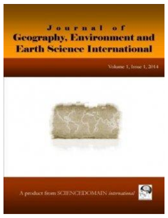

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A Historical and Geographical Analysis of Earthquake and Associated Tsunami Events on Bangladesh Coast

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

Bangladesh is vulnerable to a variety of natural hazards including frequent tropical cyclones and, less commonly, earthquakes and tsunamis. The 2004 Indian Ocean Tsunami (2004 IOT) challenged assumptions about the level of regional hazard. Remarkably, little historical data are available to help contribute to earthquake and tsunami risk reduction in Bangladesh. This research addresses this gap by documenting and analysing selected histories and geographies of earthquakes and associated tsunami events (i.e. 28 January 1679, 2 April 1762, 19 August 1868, 31 December 1881, 5 May 1930, 26 June 1941, 26 December 2004 and 11 August 2009) those originated in the northern Bay of Bengal and adjacent region. Findings indicate that only one definite tsunami, occurring in 1762, was generated in the northern Bay of Bengal. Analysis of earthquakes generated in the northern Bay of Bengal indicates that the 1762, 1881 and 1930

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earthquakes caused widespread damage. A repeat of similar earthquakes from any of the active seismic sources could cause damage to major population centres in Bangladesh. However, these major earthquakes including 1679 event originating from the Bay of Bengal and adjacent regions did not generate large tsunamis in the northern Bay of Bengal.

Keywords: Tsunamis; earthquakes; hazards; damage; Bay of Bengal; Bangladesh.

1. INTRODUCTION

The Bay of Bengal and adjacent Bangladesh coasts are at risk from multiple natural hazard events, including earthquakes, tropical cyclones, storm surges, river floods and tsunamis [1-5]. While earthquakes in the northern Bay of Bengal region are relatively frequent, large tsunamis appear to be moderately rare – having recurrence intervals of a few hundred years [4,6, 7,8,9]. Before the occurrence of the 2004 Indian Ocean tsunami, this region was not recognised as having a particularly high tsunami hazard compared to other regions of the world such as the Pacific Ocean [6,10,11]. This view changed abruptly when a submarine earthquake (M_w 9.1) off NW Sumatra triggered the most catastrophic tsunami the modern world has known on the 26 December 2004 [4,12]. The 2004 mega thrust earthquake originating near the northwest coast of Sumatra, ruptured 1300 km of the Sumatra Subduction Zone (SSZ) (Fig. 1). The number of deaths in India and Myanmar were 16,269 and 61 respectively [13]. It was not the first event of this magnitude, nor will it be the last [14,15].

The northern part of the Bay of Bengal, particularly the Andaman region (7^o-22^o N and 88^o-100^o E), experienced 348 earthquakes between 1900 and 1980 [16]. The Sunda Subduction Zone (SSZ), an elongated zone from Java to the Myanmar coast, is capable of triggering large tsunamigenic earthquakes [17]. The region has experienced several large historic earthquakes including the 2nd June 1762 [18], the 31 December 1881 [19 and 20] and the 26 June 1941 events in Andaman Trench (Fig. 1). Thus, it is a region where large earthquakes can occur, but there is a fragmented historical record. However, in order to quantify the hazard, it is necessary to have fundamental data about earthquakes and tsunamis. This research seeks to fill in the gaps by analysing past records of earthquakes and associated tsunami events.

This research begins by introducing the Bay of Bengal and its active seismic sources and providing a review of previously published catalogues and records of tsunamis in the Bay of Bengal and adjoining regions. This is followed by a description of how the research was conducted and a presentation of the results. Finally, it provides a discussion and conclusions of this paper.

2. THE BAY OF BENGAL AND ACTIVE SEISMIC SOURCES

Three subduction zones including the Sunda Subduction Zone (SSZ), the Andaman Trench (AT) and the Arakan Subduction Zone (ASZ) are located within and adjacent to the Bay of Bengal (Fig. 1). The locations of the epicentres of earthquakes that occurred in 1762, 1881, 1941 and 2004 are located within and adjacent to these zones (Fig. 1). The Sunda Subduction Zone (SSZ) has a long history of earthquake events that have affected the whole Indian Ocean, including the Bay of Bengal [19]. Like other similar zones, the SSZ is capable of triggering large tsunamigenic earthquakes [17]. The 26 December 2004 M_w 9.1 earthquake ruptured 1,300 km of crust in the SSZ and triggered a disastrous tsunami in the Indian Ocean [13]. This was the most fatal and damaging tsunami event in recent history, with a maximum wave height of 50.90 m in Sumatra. It caused the death of approximately 297,248 people in 16 countries [13]. The 2004 IOT challenged assumptions about the level of regional risk, particularly in the northern Bay of Bengal.

The Andaman Trench is located between the ASZ and SSZ and separates the Indian and Sunda Plates [20]. The Andaman-Nicobar Islands are located along this trench. The greater Andaman regions are already known for their seismic activity and volcanic eruptions. However, this region has fewer records of tsunamis in comparison to the occurrence of earthquakes [16]. Earthquakes that occurred in 1847, 1881, and 1941 and originated in this trench are known to have generated tsunamis in the Bay of Bengal [2]. North of the Andaman Trench is the Arakan Subduction Zone (ASZ) (Fig. 1). At least one earthquake that of 1762 originated in the ASZ [4].

Since then, a seismic gap has developed from the ASZ to the Andaman Trench, where a large earthquake may occur that may generate tsunamis which would severely affect the coast of Myanmar, Bangladesh and SE India [21].

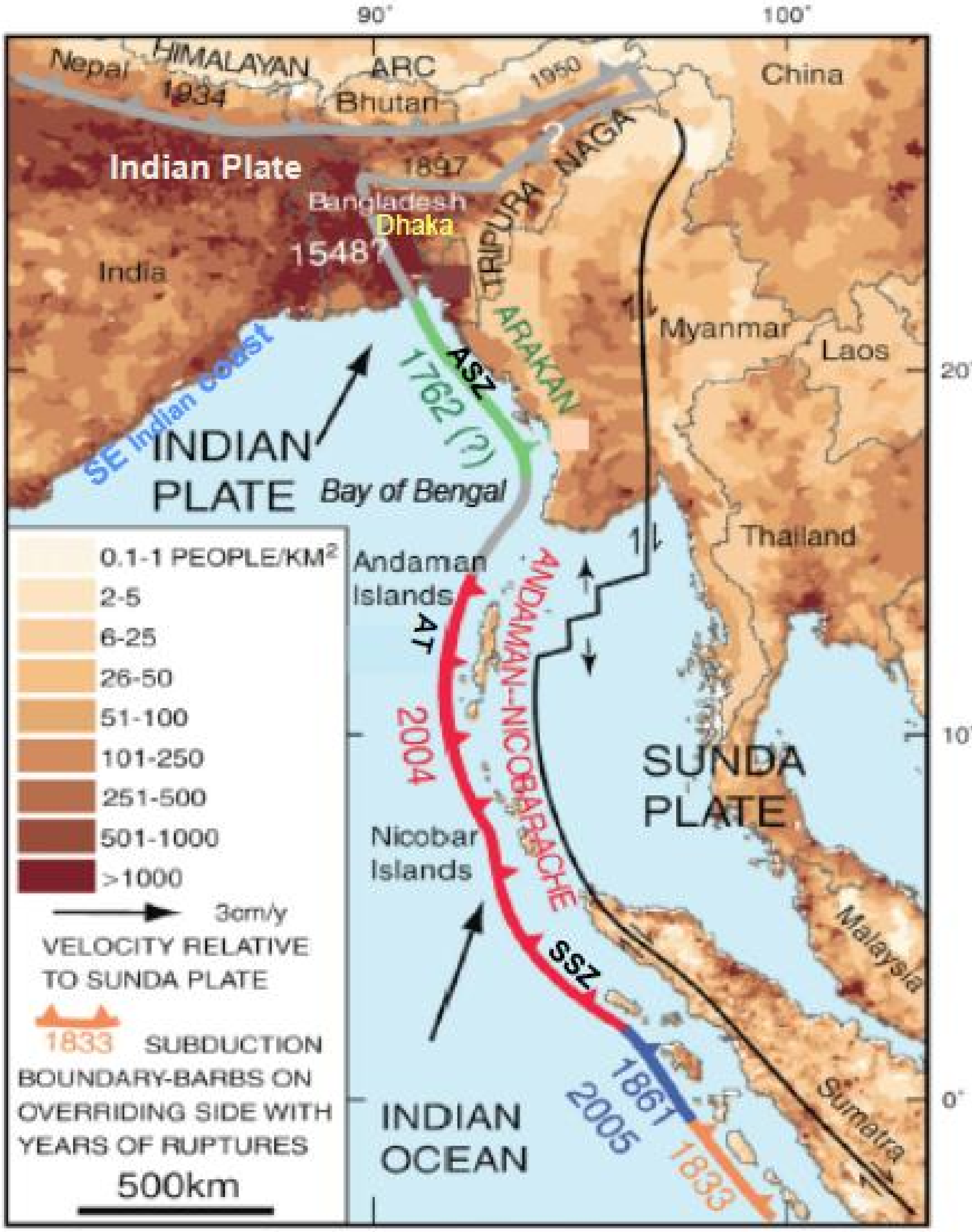

Fig. 1. The India, Burma, Sunda plate boundaries and the rupture areas of the earthquakes occurring in 1548, 1762, 1833, 1861, 2004 and 2005 superimposed on a population map. The 2004 giant earthquake ruptured a length of 1300 km along the SSZ and generated the megatsunami IOT 2004. The 1762 earthquake ruptured the Arakan to Bangladesh coast [5]

3. PREVIOUS TSUNAMI CATALOGUES AND STUDIES IN THE INDIAN OCEAN AND BAY OF BENGAL REGION

Regional tsunami catalogues have been produced for many areas of the world (e.g., Europe [22]; the Caribbean [23]; Australia [24]; New Zealand [25]; the Indian Ocean [10] and the South China Sea [26]. For the Indian Ocean, Alam et al. [2] subdivided tsunami catalogues into two groups: those published *before* and those published after the 2004 IOT [2]. Most of those published before the 2004 IOT were based on archival records and focused primarily on earthquakes but made reference to coincidental ‘tsunamis’, ‘sea waves’, ‘seismic sea waves’ and ‘tidal surges’ occurring in association with an earthquake. Those published after the 2004 IOT have attempted to be more comprehensive and explored geological evidence of tsunami events [2]. Table 1 represents a reported catalogue of tsunami events in the Bay of Bengal.

4. METHODS AND APPROACHES

This research was conducted by reviewing secondary data sources. In order to analysing history and geography of tsunami occurrence, this research reviews tsunami catalogue, online global tsunami databases (e.g., the National Geophysical Data Center (NGDC) and Novosibirsk Tsunami Laboratory (NTL)), published tsunami records, journal articles in the peer reviewed literature, books, newspaper reports, and historical archives from the India Records Office of the British Library and Royal Society in London.

To better understand selected case history events (i.e., 28 January 1679, 2 April 1762, 19 August 1868, 31 December 1881 earthquake, 5 May 1930, 26 June 1941, 26 December 2004 and 11 August 2009 earthquakes), a thorough search for historical documents was conducted in local libraries and government authorities in Bangladesh between January 2016 and August 2015. The search for historical documents eventually extended to India and Myanmar and the British Library. Bangladeshi and regional Indian sources were consulted in order to document local histories and records of natural hazards in the area and examine the impacts of the earthquake along the SE Bangladesh coast.

To maximize authenticity, credibility, representativeness, and quality of the secondary data of earthquake and tsunami events, different strategies are used in this research. For example, for each individual earthquake and tsunami event, this research has attempted to search for multiple sources and have cross-referenced different source documents. None of the sources were considered on face value [27]. In order to verify the descriptions given in historical documents, this research undertook content analysis and the results were checked against the context of descriptions, effects of events and locations of occurrence where available. This was necessary because the sources we used were not originally generated for the purpose of geographic analysis [28].

5. RESULTS: CASE HISTORY ANALYSIS OF SOME SELECTED EVENTS AFFECTING THE NORTHERN BAY OF BENGAL AND BANGLADESH COAST

A total of 22 tsunamis are reported from the sources that were examined. Poisson probability calculations were conducted on the region’s tsunami database to estimate the occurrence of tsunamis in the future. The results of probability analysis indicate that the Bangladesh and Myanmar coasts have lower risk with a probability of 0.99% per year and 63% per century. In the following sections, case history analysis of 28 January 1679, 2 April 1762, 19 August 1868, 31 December 1881, 5 May 1930, 26 June 1941, 26 December 2004 and 11 August 2009 earthquakes and associated tsunami events (if any) are provided (Fig. 2).

5.1 28 January 1679

Earthquake event on 28 January 1679 with Ms 7.5 magnitude was felt severely from the east coast of India to Myanmar coast [29]. This earthquake also struck the Bay of Bengal tremendously. Malick et al. [30] analysed sediments in the south Andaman for the pre IOT tsunamis. Findings of ^{14}C dating suggests 1 m subsidence dated ~1670, which might have been caused by the 1679 earthquake [30]. Consistent with this, geological investigations did not provide evidence of significant tsunami deposits by the earthquake [31].

5.2 1762 Earthquake in the Northern Bay of Bengal

The great earthquake potentiality and its tsunamigenic nature and flooding history in the northern Bay of Bengal have two propositions; the potential significant tsunamigenic earthquakes [4] and no possibility of tsunamigenic earthquakes [7,9,32]. The northern Bay of Bengal is generally considered a non-favourable condition to generate tsunamigenic earthquake [32]. Gupta and Gahalaut [7] and Khan [32] showed that the northern Bay of Bengal is completely non-seismogenic to generate large tsunamigenic earthquake analysing geodynamic status, seismo-tectonic environment and geophysical signatures. The oblique motion of the plates along the SSZ makes the unfavourable condition for the generation of large tsunamigenic earthquakes in the northern Bay of Bengal.

Cummins [4] suggests that the 2nd April 1762 along the Arakan Coast, generated a megatsunami and flooded the northern Bay of Bengal particularly Bangladesh coast. Cummins [4] provided a geophysical analysis of the tectonic environment of the northern Bay of Bengal suggesting it has a favourable environment to produce great tsunamigenic earthquake similar to the other subduction zones. Cummins [4] referred to the 1762 earthquake which generated a tsunami and flooded the northern Bay of Bengal region. Alam et al. [2] confirmed that the 1762 Arakan Subduction Zone (ASZ) earthquake, further north than the epicentre of the 2004 IOT, also generated a tsunami. By reviewing descriptions of documents at the time of 1762 and ground-truthing those evidences in Chittagong coast, Alam and Dominey-Howes [18] suggest that the 1762 actually generated several local tsunamis in SE Bangladesh. Over 500 people were drowned by tsunami and land subsidence and submergence occurred during the earthquake. Furthermore, the 1762 earthquake caused significant damage to built-environment and properties in Chittagong (Fig. 3).

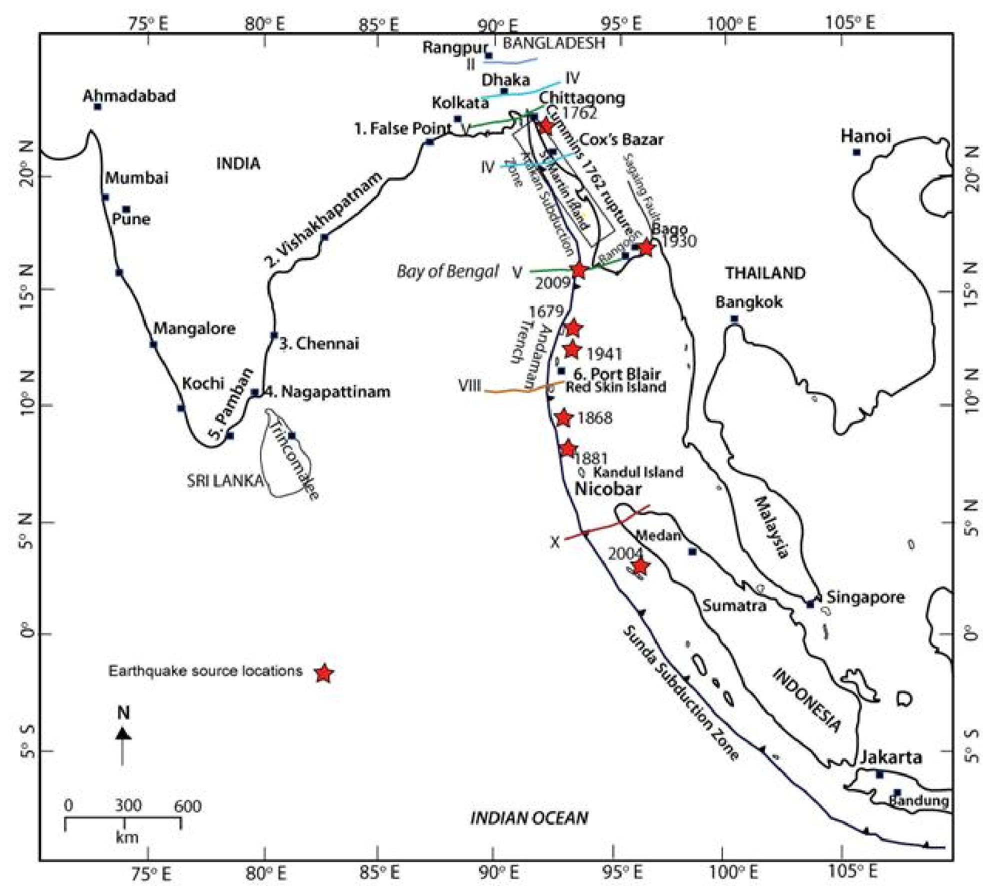

Fig. 2. The locations of epicentres of major earthquakes in the Bay of [2]. Isoseismal lines of the effects of the 2004 IOT from southern Sumatra to Bangladesh coast [33-35]. Arabic numbers 1-6 shows the tides gauges that were in operation at the time of the 1881 earthquake

Table 1. A catalogue of earthquakes and associated tsunamis between 50BC and 2010 for the Bay of Bengal

Event no	Date of event	Source region		Cause Code	Tsunami affected area		Magnitude of earthquake	Max water height (m) or Max run-up height (m)	Num of Run-up	Deaths/ injuries	Key comments
		Name of location	Latitude / longitude		Country	Locations affected					
1	50BC - AD100	*	*	1	India	Kapaadarapuram	*	*	*	*	The ferocious sea has engulfed the river
2	AD9 - AD11	*	*	1	India	Kaveripattinam	*	*	*	*	A sea flood that crippled the historic port at Kaveripattinam
3	AD500	Krakatoa	- 6.07 / 105.27	4	India	Tamilnadu	*	*	*	*	The ancient town Kaveripattinam was washed away and the time of event matches with the Krakatau explosion
4	AD900	Sunda-Andaman Arc	10.46 / 79.54	2	India	Nagapattinum and Tamilnadu	*	*	*	Hundred s	Waves washed away the monastery and several temples
5	4 Aug AD1714	Ava (Innwa)	19.24 / 94.33	2	Myanmar	Ava (Innwa)	*	*	*	*	Pagodas, etc fell. The water from the river rushed into the city
6	AD1750	Myanmar Coast	18.5 / 93.4	2	Myanmar	Cheduba Island	*	*	*	*	Several small non-damaging waves
7	2 Apr AD1762	Northern Bay of Bengal	22 / 92	2	India, Bangladesh Myanmar	Kolkata Chittagong Cheduba	M_w 8.8	1.83	1	200	At Dhaka hundreds of large country boats were driven ashore, or lost, and great numbers of lives lost in them.
8	11 Nov AD1842	Earthquake in northern of the Bay of Bengal	21 / 89	2	India Bangladesh Myanmar	Kolkata Dhaka Cheduba Island	Ms 6.0	*	3	*	Tsunami wave at the various tributaries of the Ganges River, Dhaka, Calcutta and Cheduba Island
9	31 Oct AD1847	Little Nicobar Island	7.33 / 93.66	2	India	Kondul Island	M_w 7.5-7.9	*	1	*	The small island of Kondul was inundated
10	19 Aug AD1868	Earthquake in Andaman Islands	11.67 / 92.73	1	India	Port Blair	*	4	1	*	Tsunami at Port Blair
11	31 Dec AD1881	Centre of the Bay of Bengal	8.5 / 92.4	2	Indian Sri Lanka	Car Nicobar Island, Chennai Visakhapatnam Trincomalee	M_w 7.9	1.22	11	*	Tsunami wave from Sri Lanka to Ganges Delta in Bengal
12	27 Aug AD 1883	Krakatoa explosion	-6.10 /105.42	-	Australia Indonesia Sri Lanka, India	Cocos Island Java Mumbai Trincomalee	*	35	83	36, 000	Krakatau eruption generated waves with local heights up to 100 feet
13	June AD1897	*	*	2	India	Kolkata and Assam	*	*	*	*	A great tidal wave swept up the Brahmapootra River over 250 miles from sea
14	5 May	Myanmar Coast	17.3 / 96.5	2	Myanmar	Pegu	Ms 7.2	*	1	550	The ancient seaport of Pegu was almost

Event no	Date of event	Source region		Cause Code	Tsunami affected area		Magnitude of earthquake	Max water height (m) or Max run-up height (m)	Num of Run-up	Deaths/ injuries	Key comments
		Name of location	Latitude / longitude		Country	Locations affected					
	AD1930										entirely destroyed
15	31 May AD1935	Andaman-Nicobar Islands	16 / 91	2	India	*	M_w 7.5	*	*	30, 000	-
16	26 Jun AD1941	Andaman Sea	12.5 / 92.5	2	India	Andaman sea and E. Coast of India	M_w 7.7	*	2	5000	-
17	28 Nov AD1945	Makran Coast	24.12 / 62.36	2	India	Bombay	6.65	*		*	Bombay experienced a wave height 6.5 feet on 8.15 am.
18	17 May AD1955	Little Nicobar Island	6.5 / 94	2	India	Little Nicobar Island	Ms 7.3	*	*	*	-
19	26 Dec AD2004	NW Sumatra	3.29 / 95.98	2	Indonesia, India and other 14 countries	Sumatra and other	M_w 9	50.9	997	227898	-
20	24 Jul AD2005	Nicobar Islands	7.9 / 92.1	2	India	Nicobar Islands	M_w 7.2	*	*	*	-
21	10 Aug AD2009	Andaman Island	14.09 / 92.88	2	Thailand	Off the Phuket	M_w 7.5	0.01	*	*	-
22	12 Jun AD2010	Little Nicobar Island		2	Sri Lanka	Kutch	M_w 7.5	0.03	1	*	-

Note: Asterisk (*) indicates no information available, Cause code 1 = unknown, 2 = earthquake, 3 = earthquake and landslide, 4 = volcano, 5 = meteorological (Sournce: Alam et al (2012)
7.74/ 91.93

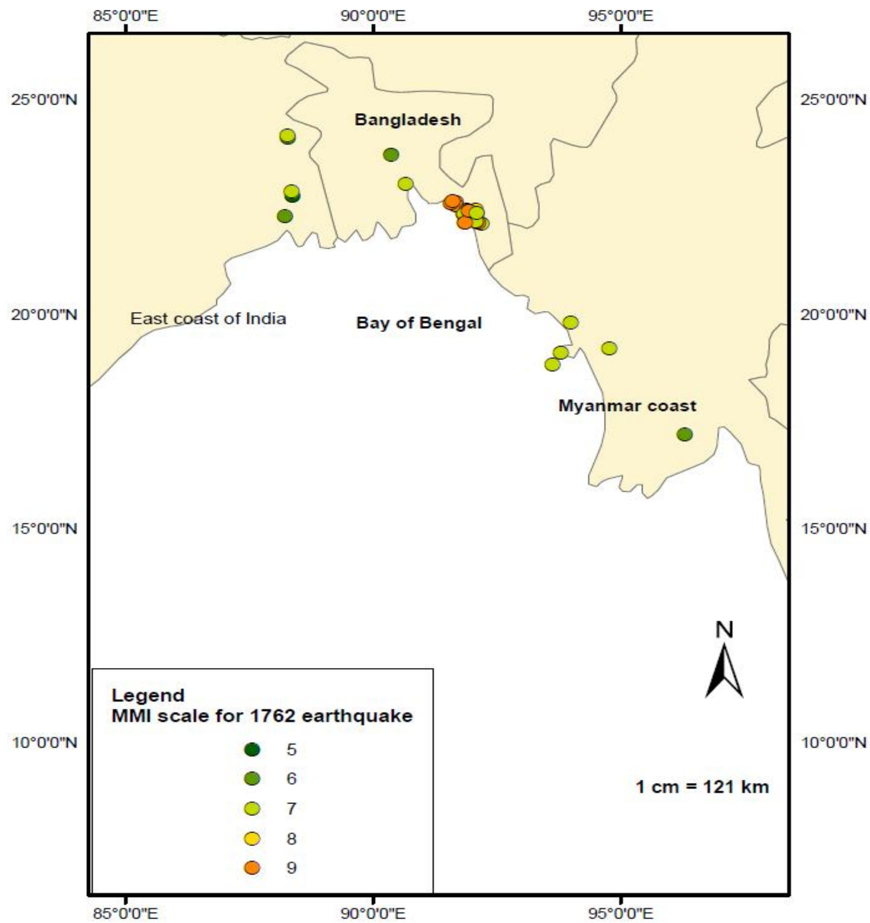

Fig. 3. Locations of the effects of the April 1762 earthquake by Modified Mercali Intensity (MMI) in Myanmar, Bangladesh and east coast of India

5.3 19 August 1868

The 19 August 1868 earthquake that originated in Andaman Islands generated a tsunami. Magnitude data are not available for this earthquake. It was a definite tsunami with a run-up height 4 m and caused extensive damage in Port Blair. By reviewing data sources [10,24] about this tsunami, no damage reports are available for the Bangladesh coast and adjacent region. The 19 August 1868 earthquake and associated tsunami probably did not affect the Bangladesh and adjacent coasts.

5.4 31 December 1881 Earthquake

The 31 December AD1881 (M_w 7.9) earthquake originated beneath the deep ocean in Andaman Sea and generated a tsunami with a maximum wave height of 0.8 m was recorded by eight tide gauges surrounding the Bay of Bengal [20]. The earthquake felt in the coast of the Bengal and mud volcanoes erupted in the Ramri Island. Wave form and amplitude modeling analysis of the tsunami showed that it was triggered by a Mw = 7.8 ± 0.1 rapture on the India/Andaman plate boundary that causes 10-60 cm of uplifting at the Car Nicobar Island. The earthquake generated two rupture segments constituting the southern one 150 km long and the northern part 40 km long. Tsunami flooded from the northern Ceylon along the east shore of the Bay through Ganges delta and further to Andaman and Nicobar Islands to south of Sumatra. However, there was no tsunami reported to the Myanmar coast (former Burma) [36]. GPS convergence rates and inferred plate closure vectors indicate that the recurrence interval for 1881-type earthquake is calculated to be 114-200 years [20].

5.5 05 May 1930 Myanmar Earthquake

The 5 May 1930 earthquake occurring on the Saigaing Fault Zone in Myanmar caused many deaths in Bago (former Pegu), the most important sea port by then British Government and a local level tsunami followed the quake. The earthquake damaged the oldest city of Rangoon. The ships anchored in the Bago port were lifted approximately 1.06 m by a tsunami. The rise of water was considered caused by a local tsunami. No tsunami was reported in Bangladesh and tide gauge stations in the east coast of India had not report any rise of water during the earthquake in Bago. No loss of lives was reported by tsunami. However, liquefaction induced surface cracking and landslides in the young sediment along the banks of rivers were widespread in the deltaic areas of Myanmar [37]. The effects of this earthquake were mostly resulted in ground shaking. The maximum intensity, IX, on MMI was recorded for an area of 630.50 sq. km of the deltaic plain south of Bago. Crackings in ground and liquefaction were extensive in the unconsolidated delta land by the earthquake [37]. Additionally, in several places, portion of riverbanks cracked and sunk into the rivers. An uplift of 23 cm was occurred along the Tawa lock of the Pegu- Sittang canal and adjoining country [38]. The earliest scientific report for this earthquake, Brown [38] estimated approximately 600 deaths, but the New York Times (1930) reported 5000 to 7000 deaths in Myanmar. This means that media report tends to exaggerate death data.

5.6 26 June 1941 Earthquake

The 26 June 1941 earthquake generated a tsunami that killed over 5000 people in east coast of India [39]. No report of deaths and damage are available for the Bangladesh coast. Indian media mistakenly attributed to the deaths and damage occurred by this tsunami to a storm surge. However, Indian meteorological department did not record any tropical cyclonic depression and associated storm surges in the Bay of Bengal.

5.7 Indian Ocean Tsunami (IOT) 2004 in Bangladesh Coast

Following the IOT 2004, the risk of tsunami in the northern Bay of Bengal has raised a great concern to some local and international scientists and policy planners. The IOT 2004 very moderately affected the Bangladesh coast with a decreasing rate of tsunami height from south to north at 2.30 and 1.30 m respectively. The country is lies approximately 1900 km northeastward from the epicentre and 1100 km away from the northern end of the earthquake rupture. The energy of tsunami waves propagated faster to the perpendicular to the fault direction (i.e east-west). The Bangladesh coast is located vertical to the fault line at the northern end of the Bay of Bengal was affected very moderately. However, Sri Lanka approximately a distance of 1200 km locating perpendicular to the rupture area has experienced extensive property damage and over 30, 190 human casualties. Kamal and Khan (2005) applied digital elevation model (DEM) for the Bay of Bengal region to measure the velocity of IOT 2004 waves. They suggest that tsunami waves off the 17 km continental slope of Bangladesh, lower end of the sub marine delta margin and upper end of the sub marine delta margin, were reduced to 160 km/h to 100 km/h to 50 km/h respectively. The velocity was down to 25 km/h along the northern part of continental shelf off the 50 km away from the west-east directed Satkhira to Sitakund. The same amount of wave velocity was measured 5 km away from Chittagong to Technaf coast. This amount of tsunami velocity is not enough to produce any significant devastation in Bangladesh coast. During the 2004 Indian Ocean tsunami (IOT), the sea water rose about 7-8 feet above high tide level at Akilpoor, Sitakunda coast.

The IOT 2004 reached at the St Martin Island, the southern Island of Bangladesh within 2.2 hours with a maximum runup height 31 cm. The simulation of over 8 M_w earthquakes from the ASZ showed that local tsunami could inundate Bangladesh coast. The effect of the earthquake in Bangladesh coast was estimated from 3-7 at Mercali scale (Fig. 4). Dhaka city, being 2200 km off the epicentre, has faced impact at Mercali intensity 5. Bangladeshi newspapers reported the effects of the 2004 earthquake in different districts of Bangladesh. The Daily Star, a leading English newspaper from Dhaka, quoted a police constable, Md. Hafizur Rahman, who was placed near the Dhanmondi Lake “All of a sudden I saw that there were big waves in the lake moving from one bank to another. I realised that it must be an earthquake. It lasted for two hours” [34]. Another from Uttara, informed that “I woke up by the shaking of the quake and I thought I were sick or something. It took me a while to realise that my whole room was shaking” [34]. Some part of Al-Beruni student accommodation building at the Jahangirnagar University was jolted by the quake, causing panic among resident students. The building was quite old and oscillated heavily during the quake. The residential students who were sleeping during the quake came running out of their dormitories. The building developed some new crackings [34]. The Daily Newspapers from Chittagong reported that some old buildings including the Public Library of the City got some crackings by the earthquake. People from these old buildings were suddenly became panic and come out at street. Local meteorological office confirmed that sea became very rough which caused fear of tidal waves. The pond water swelled by 4 to 5 feet [34].

5.8 11 August 2009 the Bay of Bengal Earthquake

On 11 August 2009 an earthquake with Mw 7.5 and focal depth 4 km was originated from a 300 km long seismic gap of active subduction zone of Indian and Burmese plates between the locations of the 2004 Sumatra and 1762 Chittagong earthquakes. The epicenter was located in Bay of Bengal between north Andaman Island and Myanmar coast, 1100 km south southeast of Dhaka. Panic was created among the residents of the upper floor in Dhaka and Chittagong. A tsunami warning was issued for Bangladesh but later withdrawn within few hours.

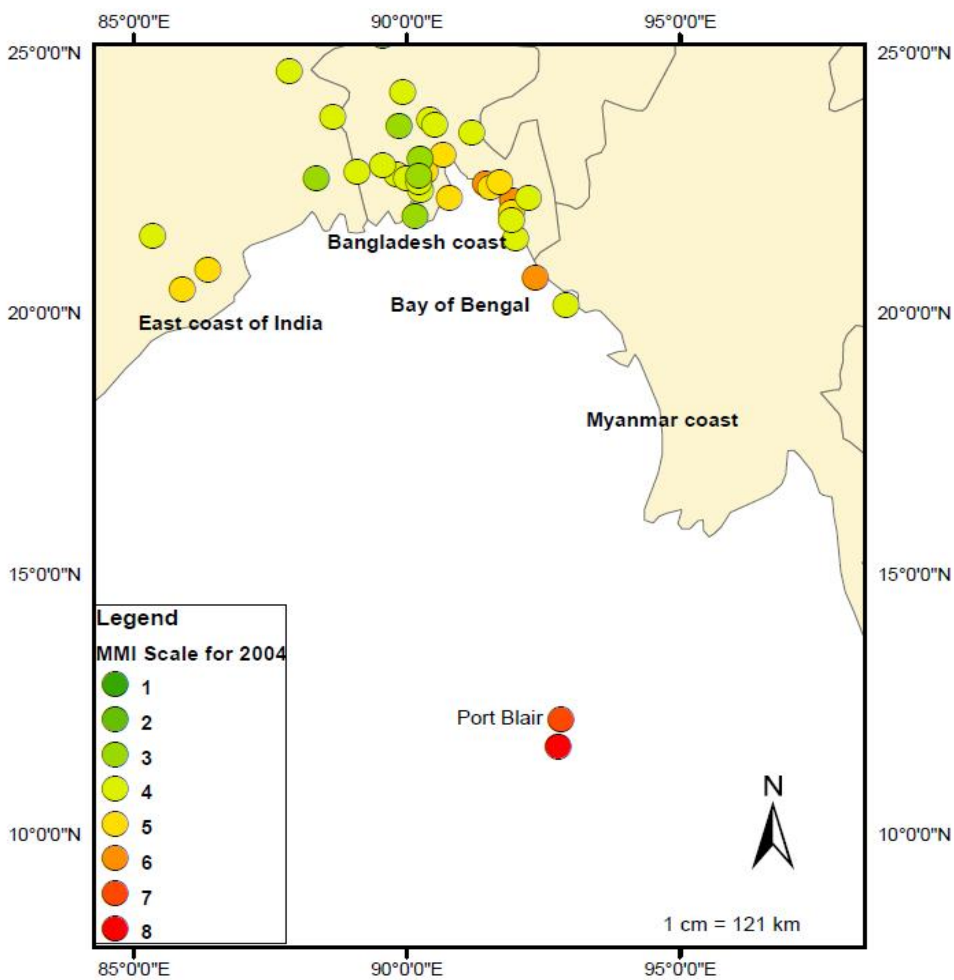

Fig. 4. Locations of the effects of the IOT 2004 by MMI in Myanmar, Bangladesh and east coast of India

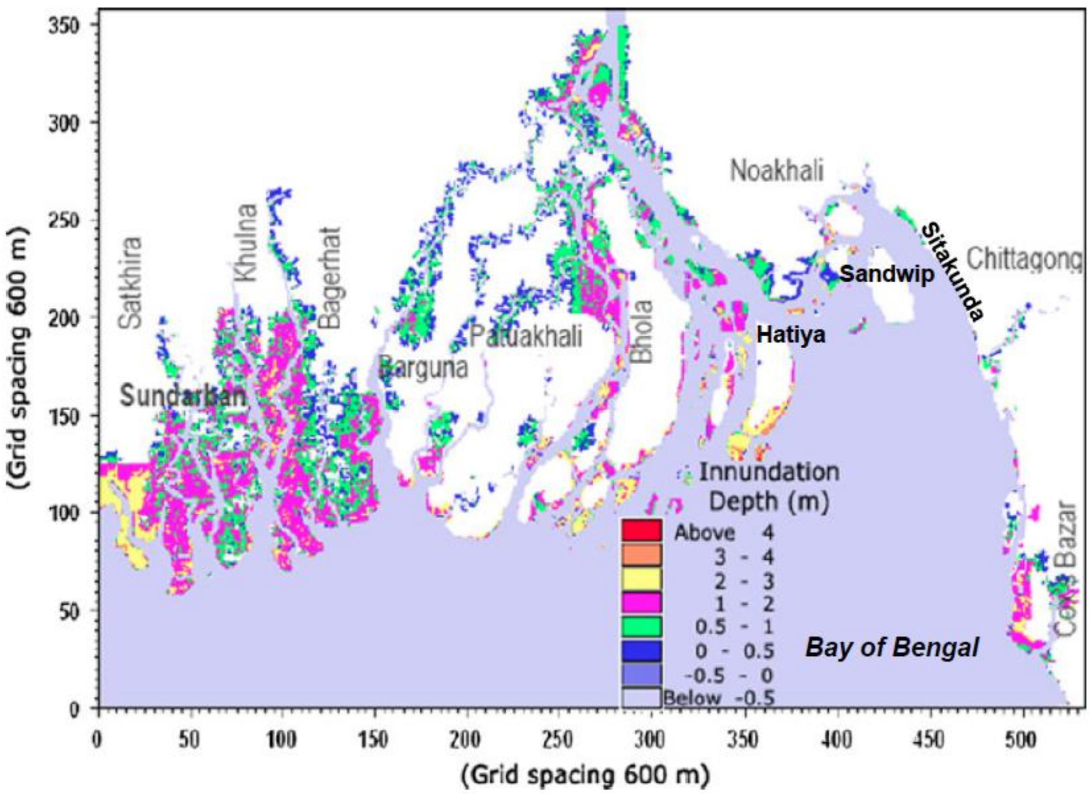

Fig. 5. Worst case scenario of tsunami inundation during Mean High Water Spring (MHWS) tide in the north Bay of Bengal due to fault source located in the Andaman Subduction Zone [32]

6. DISCUSSION AND CONCLUSIONS

The 1762 and 2004 tsunami events prompted efforts to better understand tsunami hazard and risk in the northern Bay of Bengal, Bangladesh coast and beyond. An understanding of the tsunamigenic nature of the Bay of Bengal begins with recording tsunami events from the broader source areas for that region. At least six major earthquakes (i.e., 2 April 1762, 19 August 1868, 31 December 1881 earthquake, 5 May 1930, 26 June 1941, and 11 August 2009 earthquakes) were reported with tsunamis from the Andaman to ASZ. The earliest earthquake is dated to 1762, which had caused widespread liquefaction, subsidence and compaction in the northern Bay of Bengal. Another submarine earthquake in the morning of the December 1881 beneath the Andaman Islands generated a tsunami with crest height of 0.8m that was recorded by eight tide gauges surrounding the Bay of Bengal. By waveform and amplitude modelling of the tsunami, Ortiz and Bilham [20] suggested it was a generated by moment magnitude Mw = 7.9 ± 0.1 rupture on the India/Andaman plate boundary resulting in 10–60 cm of uplift of the island of Car Nicobar.

The strike-slip component of focal mechanism solutions and oblique subduction of the Indian Plate along the Andaman trench reduce the possibilities of thrust faulting [40,41]. Khan [32] modelled worst case scenario of an earthquake (i.e. the fault length 350 km, fault slip 5 m, fault-plane dip 50, fault-slip angle 45, fault strike angle 30, focal depth 10 km, and moment magnitude Mw 8) from the only tsunamigenic earthquake location, the Andaman Arc to estimate tsunami run-up height in Bangladesh coast. The maximum inundation at Mean High Water Spring (MHWS) tide condition is 4m (Fig. 5). Kuddus [42] estimated tsunami height at 4.8 m for worst case scenario of tsunamigenic earthquake source from Bangladesh coast.

The increased number of earthquakes after 1800 in Bangladesh and adjacent regions is likely indicative of increase in neotectonics activity [43]. The apparent increase of earthquakes may also be attributed to improvements in instrumental recording. In Bangladesh, evidence of earthquakes and corresponding damage reports has become available after the 1762 earthquake in Chittagong. However, records are only available for greater magnitude (6 and above) earthquakes of 1762, 1881, and 1930. No detailed records are available for lesser magnitude earthquakes. Analysis of earthquakes generated in the northern Bay of Bengal indicates that the 1762, 1881 and 1930 earthquakes caused widespread damage. A repeat of similar earthquakes from any of the active seismic sources could cause damage to major population centres in Bangladesh. However, these major earthquakes including 1679 event originating from the Bay of Bengal and adjacent region did not generate large tsunamis in the northern Bay of Bengal.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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