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ORIGINAL PAPER

Seismogenic sources in the Bay of Bengal vis-à-vis potential for tsunami generation and its impact in the northern Bay of Bengal coast

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Abstract Geodynamic status, seismo-tectonic environment, and geophysical signatures of the Bay of Bengal do not support the occurrence of seismogenic tsunami. Since thrust fault and its intensity and magnitude of rupture are the key tectonic elements of tsunamigenic seismic sources, the study reveals that such characteristics of fault-rupture and seismic sources do not occur in most of the Bay of Bengal except a small segment in the Andaman–Nicobar subduction zone. The inferred segment of the Andaman–Nicobar subduction zone is considered for generating a model of the deformation field arising from fluid-driven source. The model suggests local tsunami with insignificant inundation potential along the coast of northern Bay of Bengal. The bathymetric profile and the sea floor configuration of the northern Bay of Bengal play an important role in flattening the waveform through defocusing process. The direction of motion of the Indian plate makes an angle of about 30° with the direction of the opening of Andaman Sea. The opening of Andaman Sea and the direction of plate motion of the Indian plate results in the formation of Andaman trench where the subducting plate dives more obliquely than that in the Sunda trench in the south. The oblique subduction reduces significantly the possibilities of dominant thrust faulting in the Andaman subduction zone. Further, north of Andaman subduction in the Bengal–Arakan coast, there is no active subduction. On the otherhand, much greater volume of sediments (in excess of 20 km) in the Bengal–Arakan segment reduces the possibilities of mega rupture of the ocean floor. The water depth ($\approx$1,000 m) along most of the northern Bay of Bengal plate margin is not optimum for any significant tsunami generation. Hence, very weak possibility of any significant tsunami is suggested that based on the interpretation of geodynamic status, seismo-tectonic environment, and geophysical signatures of the Andaman subduction zone and the Bengal–Arakan coast.

Keywords Geodynamics · Seismo-tectonics · Seismicity · Tsunamigenesis · Bay of Bengal

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1 Introduction

Bangladesh coast occupies a substantial portion of the northern Bay of Bengal. Chittagong a major port city, Cox's Bazar Sea Beach one of the longest sea beaches and the UN heritage site Sundarban Mangrove Forest are situated along the coast. Indian Ocean tsunami of December 2004 has created a major concern among the scientists, policy makers, and other stakeholders in view of the possibilities of the occurrence of tsunami and its adverse effects in this region. Since the genesis of tsunami is directly related to the occurrence of major earthquake (magnitude between 7 and 8) in the ocean bed, it is customary to see the distribution and pattern of earthquakes in the Bay of Bengal. Figure 1 exhibits the location of epicenters and the distribution of earthquakes from various focal depths point of view. Earthquake distribution in the Andaman–Sumatra segment follow a definite trend of the Benioff zone and Andaman spreading exhibiting more active crust. While in the Bengal–Arakan segment, earthquake distribution does not follow any definite trend signifying much less crustal activities.

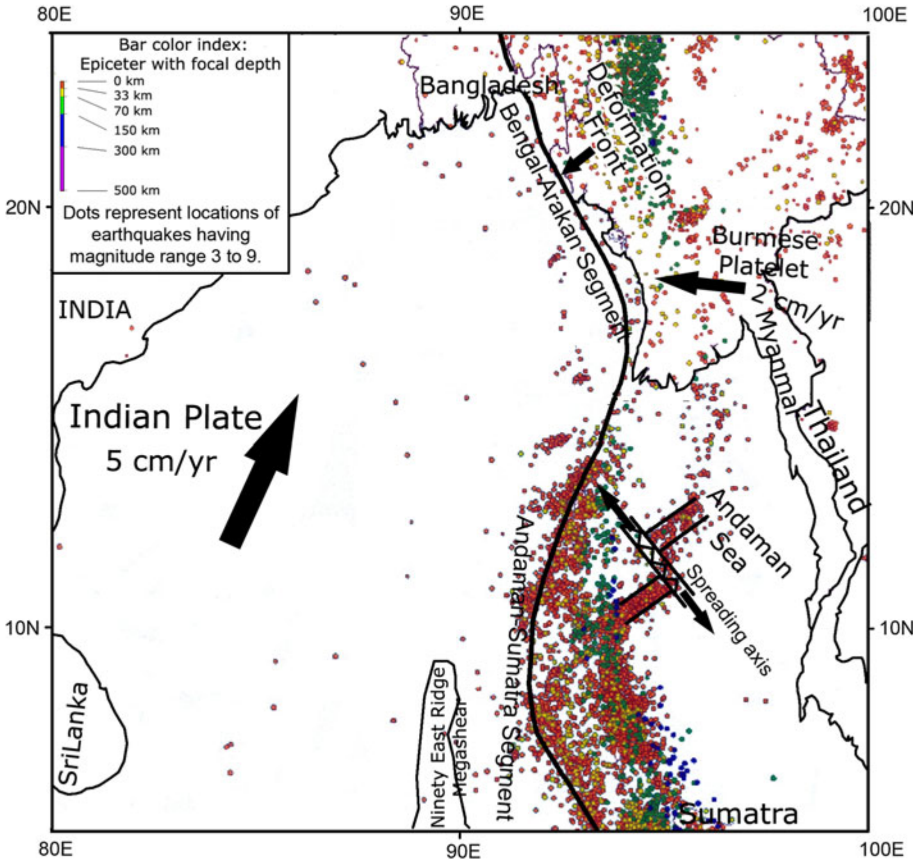

Fig. 1 Map showing all the earthquakes occurred between 1973 and 2010 of all magnitude range and focal depths in the Bay of Bengal. An arcuate shape Benioff zone geometry in the Andaman–Sumatra segment suggests an ongoing subduction while the absence of any definite Benioff zone geometry in the Bengal–Arakan segment negate subduction (earthquake data source USGS)

Two scientific publications by Cummins (2007) and Ioualalen et al. (2007), respectively, have opined two different views. Cummins (2007) predicts a giant tsunami in the northern Bay of Bengal, while Ioualalen et al. (2007) demonstrated the reasons for the weak impact of the 26 December Indian Ocean tsunami on the Bangladesh coast. Hence, the status of tsunami formation and its adverse effect in the northern Bay of Bengal coast remains a matter of controversy. The controversy has raised a serious question about the massive investment plans for protecting the coast from any possible tsunami.

According to Cummins (2007), giant tsunamigenic earthquakes could occur in the northern Bay of Bengal along the coast of Myanmar owing to the assumption of similar tectonic environment as of Sunda subduction zone, the region of devastating tsunami of December 26, 2004. However, attributing to similar tectonic environment is a matter of conjecture. Tectonic environment and geodynamic activities pertaining to the mega-thrusting, stress–strain character, and locking of seismogenic zone in the Bengal–Arakan subduction zone as suggested by Cummins (2007) are not same as Sunda subduction zone (Khan et al. 2002). The opinion expressed by Cummins (2007) are constrained from placing: (1) a deformation front well offshore of the Bengal–Arakan coast, (2) active subduction in the Bengal–Arakan subduction zone beneath the Bengal Fan, and (3) locking of seismogenic subduction zone for generating megathrust and giant tsunamigenic earthquakes (Fig. 2).

According to Genrich et al. (2000), the plate convergence along the Sunda trench is nearly orthogonal and it is rotated 30°–40° anticlockwise to take up by right-lateral shear within the overridding plate of the Sunda subduction zone. He also found the fault-rupture pattern is dominantly thrust with minor strike-slip motion. While, the plate convergence in the Andaman and Bengal–Arakan is oblique and the fault-rupture patterns is dominantly strike-slip with minor thrust component. GPS-derived slip rate is 23 ± 3 mm/year in the Sumatran Fault System (SFS) of Sunda trench region, while it is ≈ 50 mm/year in the Bengal–Arakan segment. The basal decollement (a detachment plane between sediments and the rigid crust) occurs at around 8 km depth in the Sunda segment, while the same occurs at around 20 km depth in the Bengal–Arakan segment. The majority of the slip vector is accomodated in the Sumatran Fault System (SFS), the neighboring and parallel tectonic element with the Sunda subduction zone. On the otherhand, the majority of the slip vector of the Indian plate is accomodated in the Frontal Himalayan Fault System and Dauki Fault System of Himalayan orogen (Fig. 3).

According to Ioualalen et al. (2007), the extended shallow bathymetric profile of the continental shelf of northern Bay of Bengal have played a key role in flattening the waveform of the tsunami of December 26, 2004 through a defocusing process rather than to dynamical processes like non-linearity, dispersion, or bottom friction. A typical wave length of a tsunami is 100–300 km with amplitude of 0.5–1 m in deep water. When the wave approaches shallow water, the speed reduces and the wave height increases due to shoaling. The wave grows even larger when it enters a bay due to funneling effect. However, the shoaling and funneling in case of northern Bay of Bengal would occur at the continental shelf break located 200 km away from the coast. The tsunami height in such case will merge with the normal tide height at about 43 km away from Bangladesh coast (Khan 2005; Maksud Kamal and Khan 2005).

The pertinent questions are to what extent Bay of Bengal and its bed rupture character is potential for tsunami generation, and how much vulnerable are the coasts of Bay of Bengal to any trans-oceanic tsunami like the one December 26, 2004. The study aims to assess the occurrence of seismogenic fault sources and its potentials for tsunami generation, and its

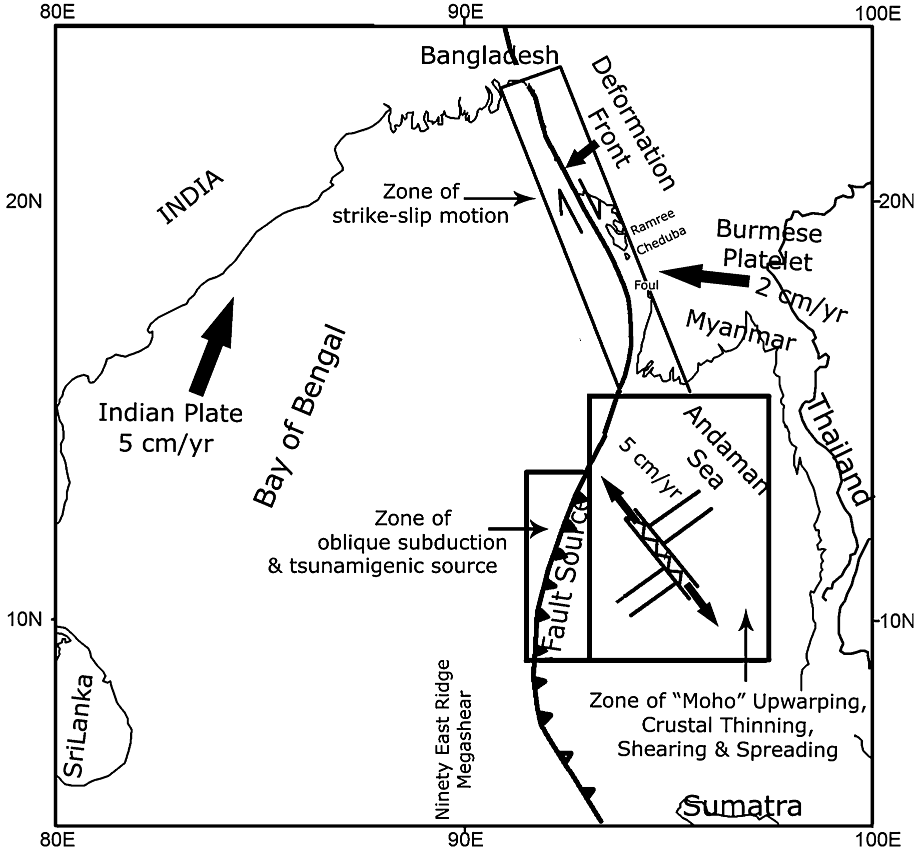

Fig. 2 Map showing various tectonic elements viz., plate motion, deformation front, subduction, strike-slip motion, Moho-upwarping, crustal thinning, shearing and spreading of the converging plate margin in the Bay of Bengal

impact in the northern Bay of Bengal coast constraints from geodynamic, tectonic, geophysical characters.

2 Methodology

Active subduction-related geotectonic sources with ocean-bed rupture due to thrust faulting are the essential requirements for generating any potential tsunami. Another important element of tsunami generation is the submarine landslide. However, the characterization of landslide induced tsunami is beyond the scope of the present study. Interpretation of available data pertaining to geodynamic status, seismo-tectonic environment, and geophysical signatures of the Bay of Bengal has been performed in order to characterize the geotectonic sources. Quantitative parameters like magnitude, centroid depth, fault strike angle, fault rake angle, fault-dip angle, fault slip, fault length and width and shear modulus have been determined for required input in modeling tsunami generation and propagation (Okada 1985). In this study, the first step is to prepare seismogenic fault source map of the entire Bay of

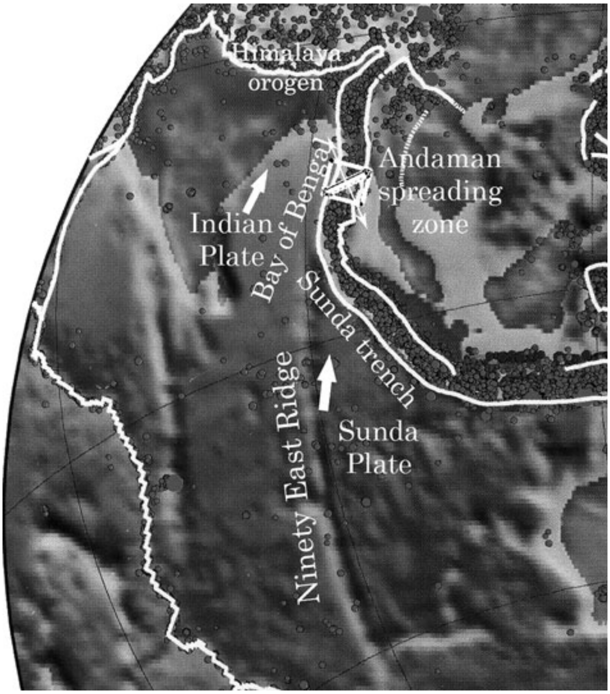

Fig. 3 Bird's eye view of Bay of Bengal and its surroundings with major tectonic elements. *White lines* are the major plate boundaries

Bengal. In doing so, geophysical data were collected from scores of literature survey (Anonymous 1975; Chandra 1975; Curray and Moore 1971; Khan and Chouhan 1996; Khan 1991; Kumar 1981; Le Pichon et al. 1968; Paul and Lian 1975, and Schlich 1975). The geophysical data coupled with seismicity data were used for fault source mapping.

The fault sources have been modeled based on the theory proposed by Mansinha and Smylie (1971) and Okada (1985) for the modeling of deformation fields arising from fluid-driven crack sources. In order to determine the values of all the quantitative parameters of the tsunamigenic sources for modeling, the following steps are taken.

(a) assigning fault-rupture length, fault offset, and magnitude pertaining to December 26, 2004 Sumatra earthquake,
(b) determining possible rupture length of the fault sources,
(c) assigning fault offsets of reported paleo-earthquakes from the field observations,
(d) determining maximum probable magnitudes based on mathematical relation proposed by King and Knopoff (1968).
(e) fault-dip angle is assumed in reference to the subduction angle, while the fault-slip angle is determined from the focal mechanism solutions.

3 Geodynamic status

Bengal basin has evolved largely over a remnant-ocean basin and rifted peri-cratonic margin of Indian plate (Graham et al. 1975; Khan 1991). It occurs mostly along the eastern collision margin of the Indian plate. The collision margin is characterized by doubly convex arc of about 2,400 km long known as “Burmese–Java Arc”. Presently, the Indian plate is moving NNE at a rate of about 5 cm/year. The Burmese platelet is rotating clockwise and is moving westward at about 2 cm/year. Andaman Sea is opening up NNW direction at about 5 cm/year. The opening of Andaman Sea in the north–south direction is envisaged from magnetic anomaly map of the Indian Ocean (Fig. 4).

The trend of the prominent shift in the spreading axis of the Andaman Sea (Fig. 2) also matches well with the north–south direction of the magnetic anomaly shift (Fig. 4). The magnetic numbers of the Indian ocean and the plate motion along Ninetyeast Ridge Megashear show longitudinal slip of the ocean floor substantiating the northeastward motion of the Indian plate. Further, the opening and spreading results from “Moho” (Mohorovicic discontinuity between crust and upper mantle) upwarping, crustal thinning due to mantle plume and shearing. This mechanism has been attributed for Andaman Sea opening. The E–W seismic profile across Andaman Sea basin exhibits some prominent normal faults on either sides of the acoustic basement indicating extension and opening of the crustal segment (Fig. 5).

The back-arc region of the Andaman–Nicobar arc is the Andaman Sea which is opening almost in the direction N30°W–S30°E. On the otherhand, Indian plate is moving in the direction N30°E. The direction of movement of these two tectonic elements makes an acute angle of about 60° resulting in oblique subduction of the Indian plate along the Andaman trench. All the above geodynamic elements result in forming an active trench and oblique subduction along Andaman collision margin. On the otherhand, the absence of

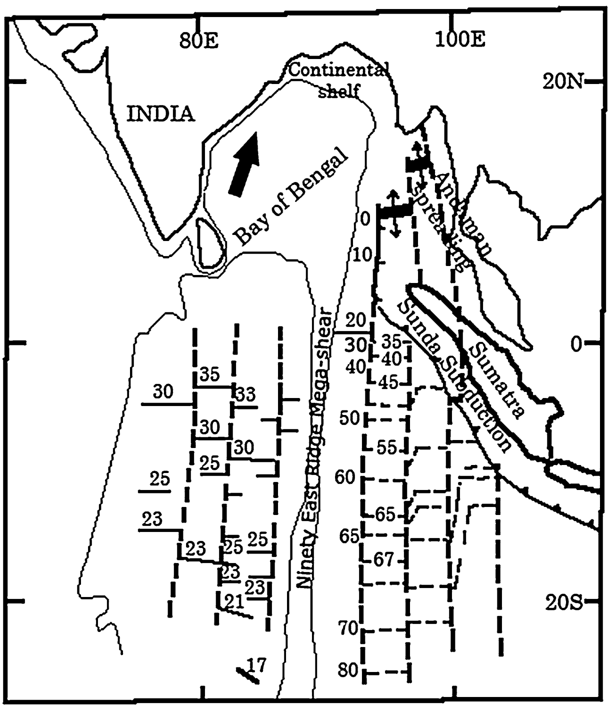

Fig. 4 Magnetic anomaly number map of the Indian Ocean (Schlich 1975)

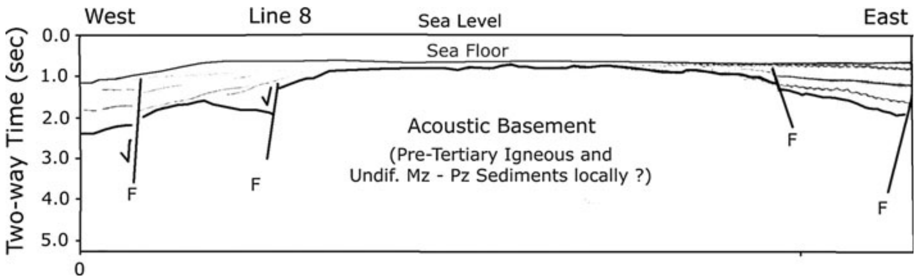

Fig. 5 East–west seismic line No. 8 across Andaman Sea exhibiting extensional stress regime for upwarping, thinning and spreading (Paul and Lian 1975)

these geodynamic elements results in ceasing subduction and transforming to dominant strike-slip displacement along the Bengal–Arakan segment (Fig. 2).

Geodynamics plays an important role in shaping a basin. The basin configuration of the Bay of Bengal has been clearly demonstrated by the pattern and trend of the thickness-contour lines (Fig. 6). It is elongated longitudinally. Tectonically, Bay of Bengal is characterized by a basin and ridge in the western part, while it is characterized by a relatively large basin and the Ninetyeast ridge megashear in the eastern part. The maximum thickness of sediments in excess of 21 km occurs in the Bengal–Arakan segment.

The conceptual model along 20°N latitude (AB profile direction in Fig. 6) between Indian pericraton in the west and Shan plateau in the east demonstrate an existing geodynamic status of the Bengal–Arakan coast (Fig. 7). The model is developed based on the data derived from sediments thickness map (Curray 1994); East–West 100 km long seismic line along 21°N latitude (Paul and Lian 1975) and geological field data.

The most important tectonic element shown in the model is the basal decollement (a detachment plane between sediments and the rigid crust). Interface thrust, which is no more a subduction plane, terminates along 92°E longitude coinciding with the Eastern Thrust (Khan 1991) and the deformation front (Fig. 2). The zone above the basal decollement between "Eastern Thrust" and "Ophiolite belt" has suffered two thrust movements one along "Eastern Boundary Thrust" and the other along "Eastern Thrust" due to major east–west compression of the mountain building process (Fig. 7). Since the present movement of the crust along the "interface thrust" is dominantly horizontal northward, any major "thrust jump" toward deeper basin zone in the west along "basal decollement" is unlikely. Similarly, mega rupture along decollement plane occurring at around 20 km depth is also very much unlikely. Further, any thrust movement along "interface thrust" would require a seismic force to rupture about 20 km thick sediments in front. Such seismic force is unlikely to occur in the existing tectonic environment of the region. The tectonic environment of Sunda trench (region of 2004 Indian Ocean tsunami) and Japan trench (region of 2011 Honsu tsunami) are markedly different than that of the tectonic environment prevailing in Andaman and Bengal–Arakan region. Further, maximum sediment thickness is 6 km (Curray 1994) in the Sunda trench region.

4 Seismo-tectonic status

Major earthquakes ($M \geq 7$) those occurred in the Arakan–Andaman–Sumatra region between 1903 and 1957 are shown in the Fig. 8 (Nuannin 2006). The only reported major

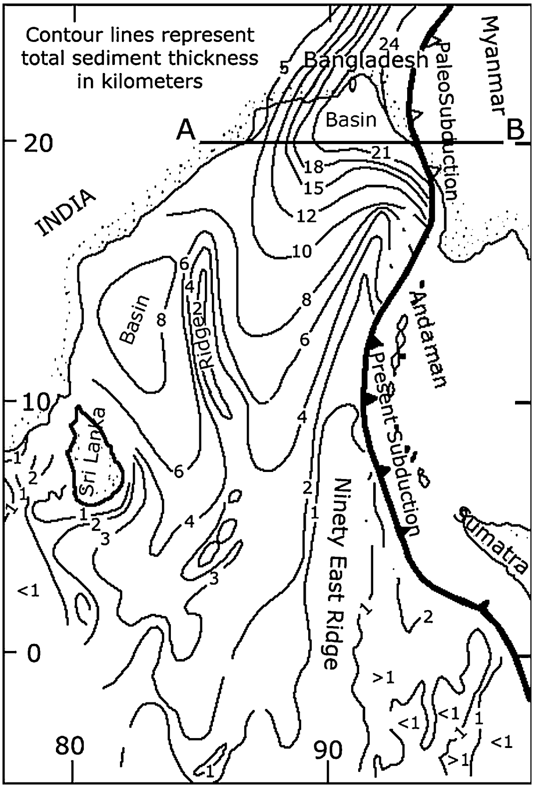

Fig. 6 Map showing sediments thickness in the Bay of Bengal. *Thick black line* marks the plate margin of paleosubduction in the Bengal–Arakan segment and the present subduction in the Andaman–Sumatra segment (modified from Curray 1994)

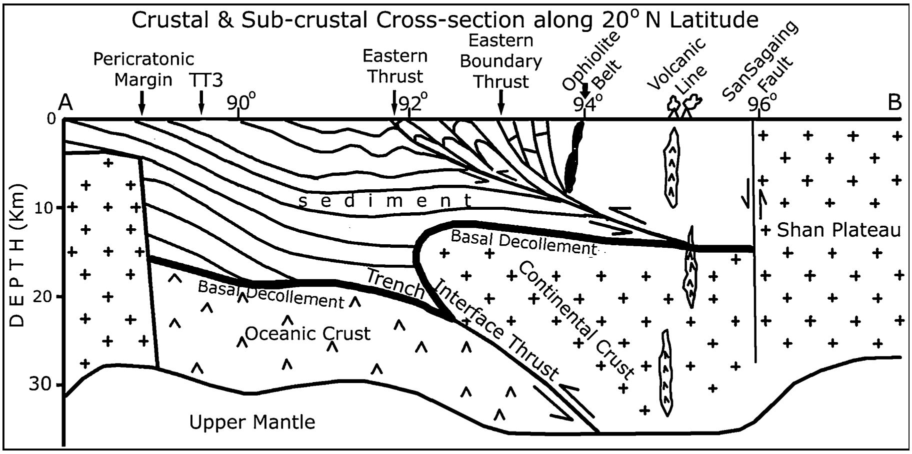

Fig. 7 Crustal and Sub-crustal cross-section along 20°N latitude showing important tectonic features

earthquake in the Bengal–Arakan region dates back to 1762 and is referred to Oldham (1883), Halsted (1843) and Hirst (1763). Although the exact location of 1762 earthquake is not known, the occurrence of two mud volcanoes at Sitakund Hills (Bangladesh) and the ground subsidence and ground uplift in several places along Bengal–Arakan coast strongly suggest that the rupture plane of 1762 earthquake is located much landward from the coast. According to Oritz and Bilham (2003), a submarine earthquake occurred on the morning of December 31, 1881 beneath the Andaman Islands generated a tsunami with a maximum crest height of 0.8 m that was recorded by eight tide gauges surrounding the Bay of Bengal. Since the earthquake occurred 8 years before the construction of the world's first teleseismic recording seismometer, little has been known about its rupture parameters or location. However, waveform and amplitude modeling of the tsunami indicate that it was generated by moment magnitude $M_w = 7.9 \pm 0.1$ rupture on the India/Andaman plate boundary resulting in 10–60 cm of uplift of the island of Car Nicobar (Oritz and Bilham 2003). On the otherhand, 1941 earthquake of 8.1 magnitude occurred in Andaman did not generate any tsunami.

Oblique subduction that reduces the possibilities of thrust faulting of the Indian plate along the Andaman trench is further substantiated by the focal mechanism solutions that show dominant strike-slip component (Khan and Chouhan 1996; Mukhopadhyay and Dasgupta 1988; Chandra 1975) with pressure axis (P-axis) plunge toward north-northeast and Wadati–Benioff zone (WBZ) dips 30° NNE (Ni et al. 1989) in the north–south trending subduction zone. The nature of fault rupture is more strike-slip type in the western Bay of Bengal (Fig. 9). The focal mechanism solution of four earthquake events clearly exhibits distinct strike-slip in nature (Table 1).

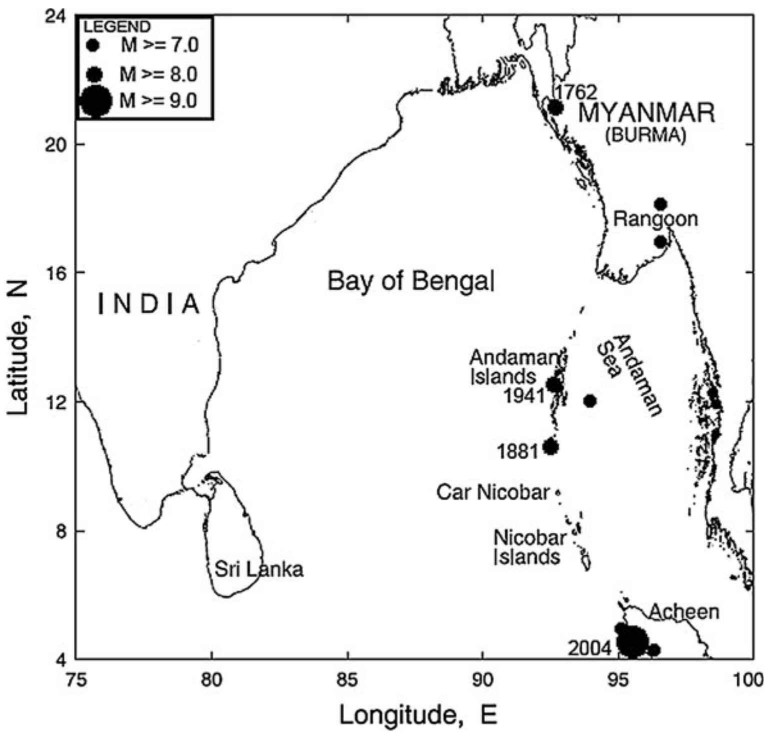

Fig. 8 Historical major earthquakes with dates occurred in Arakan–Andaman–Sumatra region. 2004 earthquake generated most devastating tsunami in the history. The 1881 earthquake generated a tsunami with a maximum crest height of 0.8 m only (modified after Nuannin 2006)

5 Tsunamigenic-source modeling

Geodynamic and seismo-tectonic status of the Bay of Bengal suggest that the potential tsunamigenic fault sources do not occur in the Bay of Bengal except in the zone of oblique subduction of the Andaman segment (Fig. 2). In the Fig. 2, a fault source located in the zone of oblique subduction is considered as potential tsunamigenic source. This inferred tsunamigenic source has further been considered to be the worst case scenario for tsunami modeling because of the possible occurrence of an earthquake event with magnitude, focal depth, fault rupture and offset, and fault length. The characterization of this fault source provides with 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 M_w 8.

The numerical modeling of the tsunami waves from the source to the coastal inland can be considered in three stages:

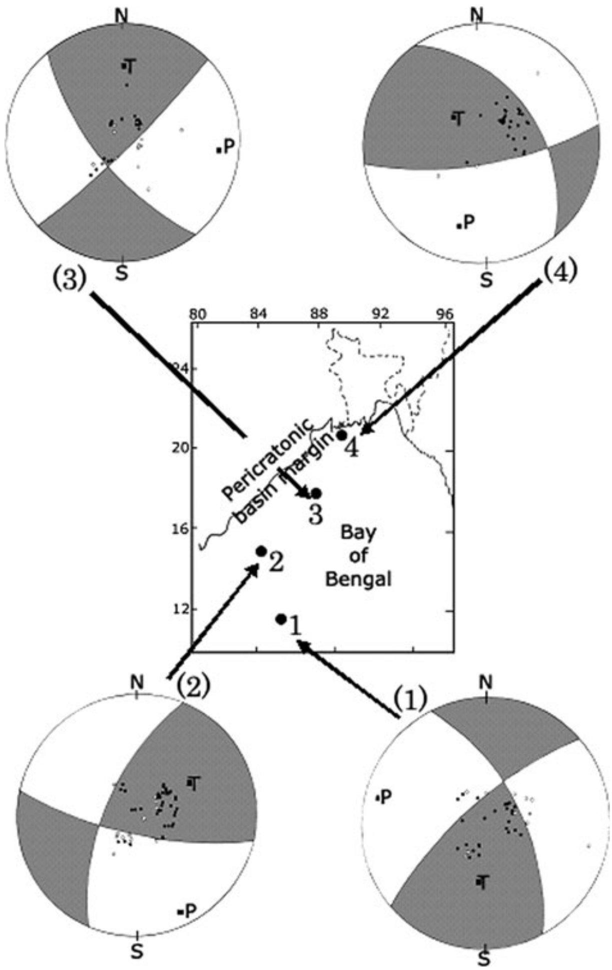

Fig. 9 Focal mechanism solutions of earthquake events showing prominent strike-slip fault motion in the western part of the Bay of Bengal (modified from Khan and Chouhan 1996)

Table 1 Four earthquakes located in the western region of the Bay of Bengal along the Eastern Ghats mobile belt (magnitudes are not known)

Event no.	Date	Location	Focal depth	Nature of faulting
1	Nov. 24, 1972	11.7 N 85.4 E	50	Strike-slip
2	August 30, 1973	15 N 84.3 E	43	Strike-slip
3	July 1, 1985	18.4 N 87.2 E	10	Strike-slip
4	June 23, 1976	21.5 N 88.7 E	50	Strike-slip

1. source modeling: simulation of initiation of tsunami generated by sea floor displacement,
2. tsunami wave propagation modeling: simulation of tsunami wave propagation from the source to the coast, and
3. tsunami inundation modeling: simulation of tsunami waves propagation from the coast to the inland over dry land.

The most important part of tsunami modeling is to create initial water level displacement due to the impact of the sea-bed's vertical rupture. Geological model known as QuakeGen model has been used to derive initial sea bottom and water displacement. The QuakeGen model is based on the theory of Mansinha and Smylie (1971). The QuakeGen tool for "geological modeling" developed by Leschka et al. (2008), was applied to derive the initial sea bottom and water displacement, which in turn is used as starting conditions for the hydrodynamic models, either directly as a time varying bathymetry or as an initial water level displacement. The initial sea water elevation is assumed to be equal to the coseismic vertical displacement of the sea bottom, that is computed by means of the analytical Mansinha–Smylie's model (1971), based on the classic theory of dislocations, which is valid for inclined constant-slip plane faults. It calculates a displacement of the seabed that results from seismogenic fault movements assuming that the crust consists of an elastic body and fault shape is rectangular. The initial field velocity is considered to be null. Implemented in QuakeGen is Okada's (1985) double-couple method. The method describes the deformation of the bed level due to a double-couple model developed by Okada (1985) (Fig. 10). The model assumes elastic medium in Cartesian coordinate system that occupies the region of $Z \leq 0$ and X axis is taken to be parallel to the strike direction of the fault. Elementary dislocations U_1, U_2, and U_3 correspond to strike-slip, dip-slip, and tensile components of arbitrary dislocation, respectively. Each vector represents the movement of hanging-wall block relative to foot-wall block.

The expressions derived for the model represent powerful tools not only for the analysis of the static field changes associated with earthquake occurrence but also for the modeling of deformation fields arising from fluid-driven crack sources. The model uses the following fault parameters viz., dip (δ), slip (λ), and strike (ϕ) angles, focal depth of the earthquake, and the length, width, and height of the slip vector. Strike is the azimuth of the fault plane (fault strike line) measured from north, and dip is the azimuth of the fault plane measured from the horizontal plane. Slip is the angle of the fault-slip direction measured from the horizontal plane (Fig. 11).

A hydrodynamic nested grid modeling complex using MIKE 21 (DHI 2009) was established to model the tsunami wave from the source to the near-shore area. Initial surface level has been generated using hydrodynamic module of MIKE 21 modeling system (DHI 2009) based on the output from a geological model known as QuakeGen

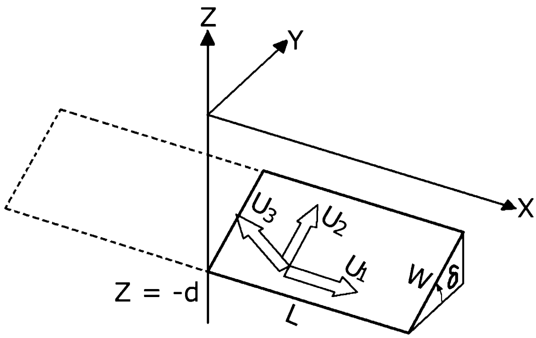

Fig. 10 Geometry of the source model (Okada 1985)

model. "Fault Source" located in the zone of oblique subduction (Fig. 1) is considered for numerical modeling. Tsunami wave propagation and inundation modeling from this fault source to the coast have been carried out using hydrodynamic module or flow module of MIKE21 modeling system by the Institute of Water Modeling (IWM 2009). The flow model is two-dimensional hydrodynamic simulation program which calculates non-steady flow resulting from tidal and meteorological forcing both on rectilinear grid and flexible mesh. The model solves the non-linear shallow water equations on a dynamically coupled system of nested grid using finite difference numerical scheme. It simulates unsteady two-dimensional flows taking into account density variations, bathymetry and external forcing such as meteorology, tidal elevations, currents and other hydrographical conditions. The basic partial differential equations are the depth integrated continuity and momentum equations (shallow water equations) have been adopted to develop simulation program.

The initial surface level is calculated with a hydraulic model that can take into account the displacement of the bed level. The correct propagation of tsunami waves depends primarily on the initial conditions of the wave and secondly on the bathymetry of the area. After the calculation of water surface deformation from source model, the tsunami propagation model is initialized with the deformed sea surface, after which it simulates the spreading and propagation of the wave in different directions and finally produces inundation at the land area. A worst case scenario is developed for the "Fault Source" assigning 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 M_w 8. These quantitative parameters

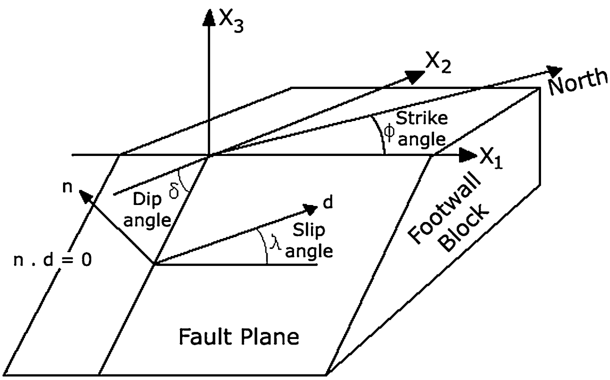

Fig. 11 Descriptions of fault parameters used in the Okada (1985) model

are derived based on the most likely tsunamigenic fault source located in the "zone of oblique subduction & tsunamigenic source" of Fig. 2. This tsunamigenic source is considered to be the worst one because of fault offset 5 m, focal depth 10 km and the moment magnitude 8 based on the 1762, 1881, and 1941 earthquakes (Fig. 8). Model of the worst case scenario of the tsunamigenic source, the maximum inundation shows insignificant influence in the region of Bengal–Arakan coast under Mean Sea Level (MSL 3.46 m) condition. However, it shows some influence under Mean High Water Spring (MHWS) tide condition 4 m (Fig. 12).

6 Discussions and conclusion

Oblique subduction trending NNE of the Indian plate occurs in the Andaman subduction zone, while it is dominantly vertical in the Sunda trench. This results in dominant thrust fault rupture in the Sunda trench and dominant strike-slip rupture along Andaman tectogen. The focal mechanism solutions along the volcanic arc also support more of a strike-slip with normal component faulting. Further, north of Andaman in the Bengal–Arakan segment, the nature of faulting is also dominantly strike-slip. The focal mechanism solutions of the earthquake events in the western region of the Bay of Bengal also suggest strike-slip motion.

Since there is no active subduction in the Bengal–Arakan tectogen, the majority of the plate motion is consumed by strike-slip displacement. The majority of slip vector of the Sunda plate is accommodated in the Sunda Subduction zone, while the majority of the slip vector of the Indian plate is accommodated in the Himalayan orogen. Similarly, the slip

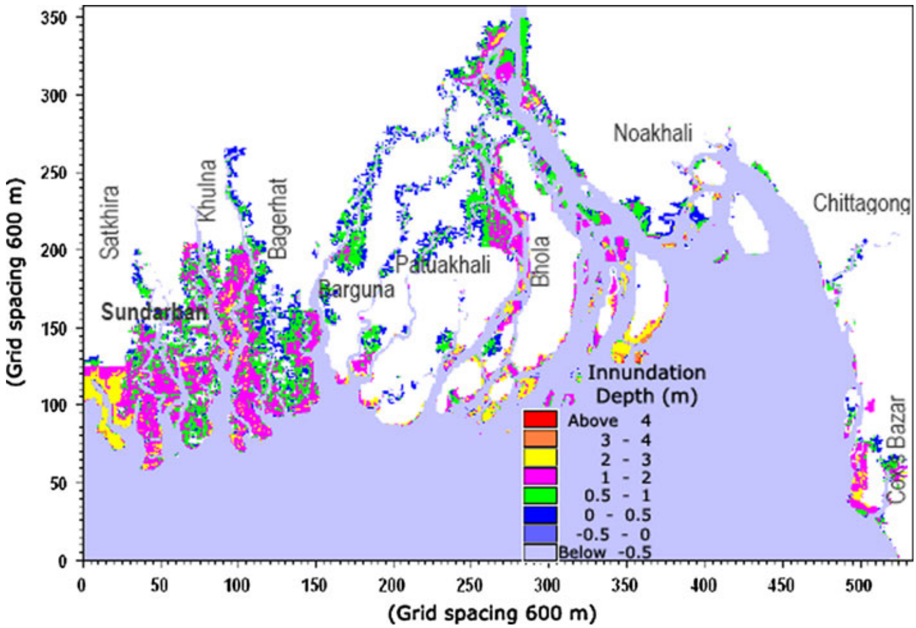

Fig. 12 Worst case scenario of tsunami inundation during Mean High Water Spring (*MHWS*) tide in north Bay of Bengal coast due to fault source located in the Andaman subduction zone

rate (23 ± 3 mm/year) of Sunda plate is less than half in comparison to the slip rate (≈50 mm/year) of the Indian plate. Since the strain accumulation and fault rupture are linearly related to the slip rate, it implies that the probability of mega rupture in the Bengal–Andaman segment is less than fifty percent to that of the probability of mega rupture in the Sunda subduction zone or the strain accumulation time required for mega rupture in the Bengal–Arakan segment is double the strain accumulation time required for the mega rupture in the Sunda segment. Further, depth to the basal decollement plane (a detachment surface between sediments and the rigid crust) is around 21 km in the Bengal–Arakan region, while it is about 8 km in the Sunda subduction zone. Hence, any rupturing of the basal decollement occurring at around 21 km depth would require seismic force more than double the seismic force that ruptured the basal decollement occurring at about 8 km during 2004 seismogenic tsunami. The only record of a major earthquake in the Bengal–Arakan region dates back to 1762, while it dates back to 1881 and 1941 in the Andaman region. Further, rupturing of deformation front due to such major earthquakes would direct propagation of the water column to the southwest away from Bengal–Arakan coast with velocities 160 km/h for 200 m water column and 356 km/h for 1,000 m water column, respectively. The above analysis signifies that the Bengal–Arakan segment does not have the potential of mega rupture like in Sunda trench.

According to Hirst (1763), many islands near the coast of Chittagong have disappeared completely. According to Halsted (1843), the earthquake of 1762 raised the Coast of Foul Island 9 feet, and the northwest coast of Cheduba Island 22 feet above sea level is said to have caused a permanent submergence of 60 square miles near Chittagong, Bangladesh. However, there is no report of any tsunami. The disappearance of islands and the permanent submergence of 60 square miles are the evidence of seaward gravity sliding of land compensating the uplift of the coastal land. The massive submarine landslides might have generated local tsunami that is known from Halsted's interviews with the inhabitants of Cheduba quote, "the sea washed "to and fro" several times with great fury, and retired from the ground" unquote (Halsted 1843). However, the primary objective of this study is to deal with the earthquake sources for tsunami generation in the Bay of Bengal. Much detailed analysis is required to ascertain the validity of landslide induced tsunami. Sea-bed rupture by thrust faulting and the amount of vertical offsets are the essential elements for initial tsunami propagation generation at the source. The initial water height at the source generated by the fault-rupture offset is the basis for inundation modeling. The most likely tsunamigenic fault source has been identified only in the Andaman subduction zone. The fault source located in Andaman subduction zone has a potential for tsunami generation with very insignificant effect under Mean High Water Spring (MHWS) tide condition in the coasts of northern Bay of Bengal.

In conclusion, study reveals that Bay of Bengal does not have seismogenic fault sources having potential to generate major tsunami. It is further revealed that any trans-oceanic tsunami generated outside the bay would be flattened through defocusing process and would merge with the tidal height almost 43 km offshore thus creating very insignificant impact in the coastal belts of the northern Bay of Bengal.

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