

*Survey Report on the Tsunami of the Michoacan, Mexico
Earthquake of September 19, 1985*

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Abstract

The tsunami was caused by the Michoacan, Mexico earthquake (M_s 8.1) of September 19, 1985. According to the site survey, sea water ran up to an elevation of 2 meters or more above sea level in the coastal areas of Mexico from Petatlan to Playa Azul. The tsunami was as high as 4 meters at Barra del Potosi and Playa Linda, where minor tsunami damages occurred; some thatched huts on the beaches were destroyed and pieces of furniture were swept out to sea. The tsunami magnitude M_t is estimated to be 7.8 from the instrumental data recorded at Hilo.

The earthquake of September 19, 1985 in coastal Mexico was the most disastrous shock to date in that country. Epicentral parameters from U. S. Geological Survey in Denver, U. S. A. are 18.190°N , 102.533°W , origin time 13h 17m 47.35s U. T. (07h 17m in Mexico), depth 27.9 km, and M_s 8.1. The epicenter is located about 50 km west of Lazaro Cardenas. The earthquake caused locally large tsunami.

The tsunami propagated across the Pacific and was recorded at several tide stations. Table 1 shows the maximum wave heights (crest-to-trough heights) measured by tide gages (U. S. GEOLOGICAL SURVEY, 1986). The tsunami magnitude M_t , defined by ABE (1979), is estimated to be 7.8 from the amplitude recorded at Hilo. The maximum amplitude of tsunami on the Japanese coast is estimated to be only 5 cm or so from the tsunami magnitude. Actually, no tsunami was observed in Japan,

Table 1. Maximum wave heights measured by tide gages.

Station	Crest-to-trough heights (cm)
Acapulco, Mexico	140
La Libertad, Ecuador	60
Acajutra, El Salvador	58
Kahului, Hawaii	24
Pago Pago, American Samoa	24
Hilo, Hawaii	22
Baltra Island, Galapagos	21
Apia, Samoa	14
Rikitea, Gambier Islands	7
Papeete, Tahiti	5

Table 2. Local tsunami heights.

Place	Height (m)
Acapulco	1-1.5
Las Penitas	2.5
Barra del Potosi	4
Zihuatanejo	1.9, 2
Ixtapa	3.6, 3-4
Playa Linda	3-4
Lazaro Cardenas	4-5
Playa Azul	1.5-2
Tecuanillo	1.5
Manzanillo	1

though Japan Meteorological Agency issued the tsunami warning to the Pacific coast of Japan.

On the way to the reconnaissance for the earthquake disaster in Mexico, we tried to survey the tsunami heights and damages on the Pacific coast of Mexico. Brief interviews with local residents were conducted, and specific measurements were made at some places. The site survey was made during the period from October 16 to 20, 1985.

The result of our survey is summarized in Table 2 and Fig. 1. The height data represent the elevation above tide level at the time of observation and mostly refer to run-up elevation rather than to wave height. No tide-correction is made. The tsunami effects are summarized below.

The survey was made in the coastal area from Acapulco on the south

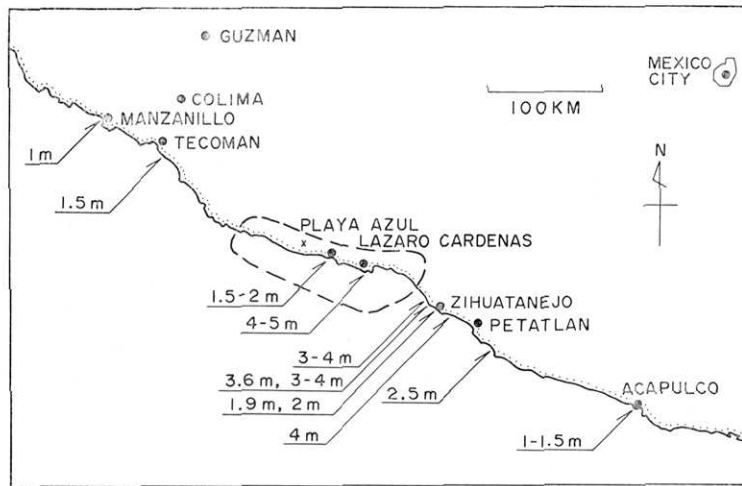


Fig. 1. Distribution of tsunami heights. The dashed region is the aftershock area of the 19 September earthquake, obtained by UNAM SEISMOLOGY GROUP (1985).

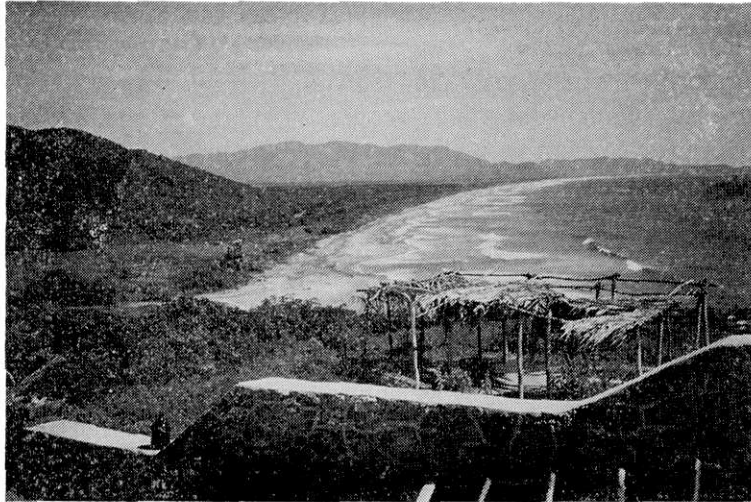


Fig. 2. Scenic view of sandy beach near Petatlan and Papanoa.

to Tecoman on the north. The highway between Acapulco and Playa Azul runs inland, generally along picturesque, unpopulated, sandy coasts with tropical trees. The typical view is shown in Fig. 2. The coastal area is studded with lagoons. Beaches can often be reached with access roads, about 5 km or so off the highway. In contrast the highway between Playa Azul and Tecoman passes through coastal hills with rugged cliffs. Generally, small villages are scattered beside the highway. Fishing



Fig. 3. Damage of thatched hut at Barra del Potosi. Pieces of furniture in the hut were washed away.

ports, breakwaters and other artificial structures are rarely seen between large cities.

According to witnesses, the tsunami of 1–1.5 m was observed at Acapulco. We happened to hear that the tsunami of about 3 meters had been observed at Vicente Guerrero, but could not confirm it.

At Las Penitas, about 25 km southeast of Petatlan, the first tsunami wave came about 15–20 min after the earthquake and water flooded the floor of a beachside restaurant; the inundation height was estimated at 2.5 m there.

The small village of Barra del Potosi, 14 km southeast of Zihuatanejo, suffered considerable damage. It is situated at the southeastern extremity of Bahia el Potosi bay, facing southwest. The area remained disturbed after the tsunami. Residents living near the sea first noticed unusual sea disturbance. They observed an initial withdrawal of sea and escaped to high ground or to a stone-masonry house for safety. There was no loss of life. One observer reported that water had reached to the top of a coconut tree on the beach, but the tree showed no evidence of the tsunami at the time of our investigation. Some huts of light construction on the beach were seriously damaged, many posts being uprooted or tilted (Fig. 3). They were of wood-skeleton structure with a thatched roof. Pieces of furniture in the huts were washed out to sea. The tsunami height was estimated at 4 meters. The move of the community to a safe place from the beach was under plan at the time of our survey.

At the town of Zihuatanejo, the coastal road was immersed with



Fig. 4. Damage of fences at Playa Linda.

water, but the floors of beachside houses were not; the inundation height was measured at 2 meters. In the small bay the wave crossed about 20 cm above a concrete jetty; the wave height of 1.9 m was measured by means of a hand-leveling apparatus.

In Ixtapa, a tsunami of 3–4 m was reported without details. At the western edge of Ixtapa, the water overflowed the man-made rock wall at the upland edge of the beach, leaving debris behind; the tsunami height of 3.6 m was measured there. No damage due to tsunami was observed. The lawn grass in the beach park partly remained dead. At Playa Linda near Ixtapa, where a camping site is situated on comparatively high ground beside the shore, there were minor damages due to tsunami. A camping car on the beach was swept inland, and wire-mesh fences around the residential area were demolished (Fig. 4). A thatched restaurant on the beach was partly destroyed, and dining tables and chairs were swept out to sea. Figure 5 shows that the tsunami went about 300 m up the small stream beside the residential area and overflowed its banks. The water flooded a part of the parking lot and houses, leaving dark traces on the boilers and walls. The traces were seen 0.4 m above the ground (Fig. 6). The lawn grass in the back yard mostly remained dead. The inundation height of tsunami in this area was measured at 3–4 m above sea level.

In the city of Lazaro Cardenas, the water reached the foundations of a tank in the fertilizer factory (FERTIMEX), 300–500 m away from the shoreline; the tsunami height of 4–5 m was inferred.



Fig. 5. Damage to the banks of the small stream at Playa Linda. The photo faces the sea.

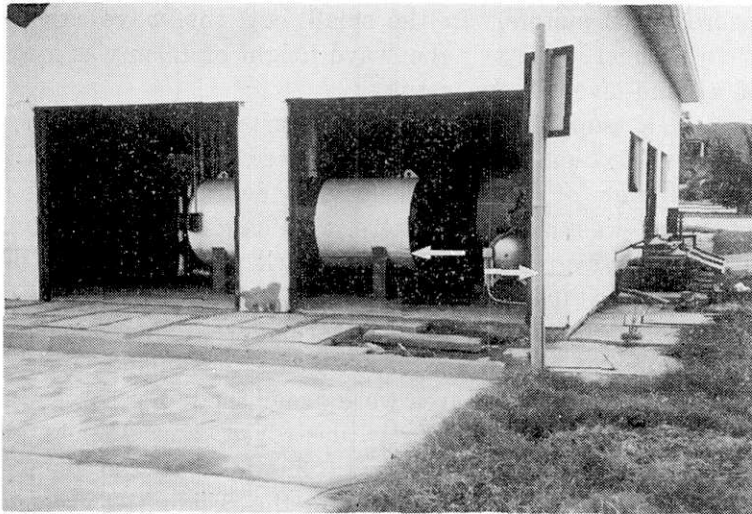


Fig. 6. Boilerhouse at Playa Linda. Note arrows where the tsunami left dark traces behind.

At Playa Azul, the tsunami of 1.5-2 m was witnessed, after the sea receded horizontally about 200 m. At Tecuanillo near Tecoman, the tsunami height of 1.5 m was measured. Tsunami of 1 meter was reportedly observed at Manzanillo. We were obliged to skip over the survey between Playa Azul and Tecoman for lack of time.

Acknowledgments

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1985年9月19日メキシコ地震津波の現地調査

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1985年9月19日にメキシコのミチョアカン州を震源とする大地震に伴ってメキシコの太平洋沿岸に津波が発生した。津波の波高や被害について現地調査を行った。ペタトランからプラヤアスルにかけては2m以上の津波があった。バラデルポトシやプラヤリンダでは4m前後の津波があり、住家の損壊や家具の流失などの比較的軽い被害があった。ハワイのヒロでの津波記録から、この地震の津波マグニチュード M_t は7.8と推定される。
