NATIONAL REPORT
Submitted by MEXICO

ICG/CARIBE-EWS Tsunami National Contact (TNC)

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BASIC INFORMATION

1. Tsunami Standard Operating Procedures for a Local Tsunami (when a local tsunami threat exists)

When the National Seismologic Service publishes the occurrence of a Local Seism Magnitude equal and/or greater than Magnitude 7.0, personnel on duty at CAT develops the following activities:

a. Receives the seismic information of the event, generated by the Servicio Sismologico Nacional (National Seismological Service), in the institutional geoportal called AION, which incorporates this information in its database to use it in the calculations of tsunami numerical modeling. Thus, an Alert Bulletin is automatically generated with the characteristics of the tsunami and the corresponding recommendations, the bulletin give information of the wave arrival time to the coast and the wave high for more than 100 localities in the Mexican Pacific coast.
b. Sents the Alert Bulletin generated by the AION to make it available in the official application (TSUNAMI MX) of the Tsunami Warning Center and its official website.
c. Distributes the Alert Bulletin to the Federal, State and Municipal Civil Protection Units, Port Captaincies, Administraciones del Sistema Portuario Nacional (National Port System Administrations), Naval Commands, as well as to strategic facilities and registered users, through mass mailing by email.
d. Distributes the Alert Bulletin to the Naval Commanders using the Integral System of Naval Operations (SIOPARM) which is installed in all the Command and Control Centers that operates 24 hours a day; this system emits a loud audible notification when receiving the alert bulletin.
e. Verifies that all of the intended recipients received the information sent through all the communication means used for such a purpose (Commercial telephone, Satelital telephone and Motorola Radio).
f. Analyzes the information provided by the National Tide Gauge Network, DART buoys, sea level observers, the historical seismic of the area, the sea level variations; and mantains a technical – scientific follow up of tsunami and seism world monitoring systems.
g. Does the observed sea level behavior demands for the bulletins to continue being issued?

    NO .- Issues a Cancelation Alert Bulletin (Connects to the previous activity)
    YES.- Issues a Follow Up Bulletin (Connects to the next activity)

h. Generates a Follow up Bulletin with updated information on sea level obtained from the Tidal Network of the National Tsunami Warning System in Mexico; updating recommendations if required. Same as sent by AION, mass mail and by SIOPARM.
i. Verifies that all of the intended recipients received the information sent through all the communication means used for such a purpose (Commercial telephone, Satelital telephone and Motorola Radio).
j. Does the comportment of the event demands for the continued issuance of Follow Up Bulletins?
   YES.- Issues a Follow Up Bulletin of the event (Connects to the previous activity).
   NO.- Issues a Cancelation Bulletin (Connects to the next activity).
k. Informs and seeks for the authorization from the Director at CAT on the fact that the event may have a Tsunami Warning Cancelation Bulletin.
l. Issues the Cancelation Bulletin and sends it to the Federal, State and Municipal Civil Protection Units, Port Captaincies, National Port System Administrations, Naval Commands, as well as to strategic facilities and registered users, through mass mailing by email.
m. Sents the Cancelation Bulletin generated by the AION to make it available in the official application of the Tsunami Warning Center and its official website.
n. Distributes the Cancelation Bulletin to the naval commanders by SIOPARM.
o. Verifies that all of the intended recipients received the information sent through all the communication means used for such a purpose (Commercial telephone, Satelital telephone and Motorola Radio).
p. Cronologically reports on the duty´s lodge the actions carried out.
q. When the local, regional or transoceanic tsunami significantly affects the national coasts, a technical report post event is prepared with information on the variations in sea level recorded by the tide gauge stations, as well as general information on the earthquake. The main actions carried out by the CAT´s on duty operators are also added.

2. Tsunami Standard Operating Procedures for a Distant Tsunami (when a distant tsunami threat exists)

When the PTWC, USGS and/or CISN publishes the occurrence of a regional Seism Magnitude greater than 7.0, personnel on duty at CAT develops the following activities:

a. Receives the first alert message from the PTWC about the earthquake by email from the CAT, likewise, observe the event and its characteristics in the CISN-display notification system (California Integrated Seismic Network).
b. Making use of the information about the earthquake, it executes the Tsunami Travel Time Program for the preparation of the Alert Bulletin.
c. Sents the Alert Bulletin generated by the AION to make it available in the official application of the Tsunami Warning Center and its official website.
d. Distributes the Alert Bulletin to the Federal, State and Municipal Civil Protection Units, Port Captaincies, National Port System Administrations, Naval Commands,

as well as to strategic facilities and registered users, through mass mailing by email.

e. Distributes the Alert Bulletin to the naval commanders by the Integral System of Naval Operations (SIOPARM) which is present in all the Command and Control Centers that operates 24 hours a day; same that emits an audible notification when receiving the alert bulletin.
f. Verifies that all of the intended recipients received the information sent through all the communication means used for such a purpose (Commercial telephone, Satelital telephone and Motorola Radio).
g. Analyzes the information provided by the DART buoys, the historical seismic behavior of the area, the variations in sea level and mantains a technical – scientific follow up of tsunami and seism world monitoring systems.
h. Does the observed behavior demands for the bulletins to continue being issued?
   NO .- Issues a Cancelation Alert Bulletin (Connects to the previous activity)
   YES.- Issues a Follow Up Bulletin (Connects to the next activity)
i. Generates a Follow up Bulletin with updated information on sea level obtained from the Tidal Network of the National Tsunami Warning System in Mexico; updating recommendations if required. Same as sent by AION, mass mail and by SIOPARM.
j. Verifies that all of the intended recipients received the information sent through all the communication means used for such a purpose (Commercial telephone, Satelital telephone and Motorola Radios).
k. Analyzes the information provided by the National Tide Gauging Network, DART buoys, sea level observers, the historical seismic behavior of the area, the variations in sea level and mantains a technical – scientific follow up of tsunami and seism world monitoring systems.
l. Does the behavior of the event demands for the continued issuance of Follow Up Bulletins?
   YES.- Issues a Follow Up Bulletin of the event (Connects to the previous activity)
   NO.- Issues a Cancelation Bulletin (Connects to the next activity)
m. Informs and seeks for the authorization from the Director at CAT on the fact that the event may have a Tsunami Warning Cancelation Bulletin.
n. Issues the Cancelation Bulletin and sends it both bulk and institutional mail to Federal, State and Municipal Civil Protection Dependencies, Harbour Master, Integrated Port Management, Naval Command and registered users.
o. Verifies that all of the intended recipients received the information sent through all the communication means used for such a purpose (Commercial telephone, Satelital telephone and Motorola Radio).
p. Cronologically reports on the duty´s lodge the actions carried out.
q. When the local, regional or transoceanic tsunami significantly affects the national coasts, a technical report is prepared with information on the variations in sea level recorded by the tide gauge stations, as well as general information on the earthquake. The main actions carried out by the CAT guard on duty are also added.

For each situation, please provide the following:

- *What organization identifies and characterizes tsunamigenic events?*

  Centro de Alerta de Tsunamis (CAT)
  Mexican Tsunami Warning Center

- *What is the threshold or criteria for declaring a potential tsunami emergency?*

TRANSOCEANIC SEISM						
Depth	**Lat. Long**	**Magnitude**	**Description**	**Affectation radio area**	**Estimated arrival time**	**Kind of bulletin**
< 100 km	In the sea or near the coast	≥ 8.5	Destructive	1000 km	9 - 10 hrs.	Alert/Warning
		7.4 a 8.4	Not destructive			Informative
> 100 km		≤ 7.3				None

- *What organization acts on the information provided by the agency responsible for characterizing the potential tsunami threat?*
  - Pacific Tsunami Warning Center;
  - U.S. Tsunami Warning System;
  - Hydrographic and Oceanographic Service from the Chilean Navy;
  - Centro de Asesoramiento para Tsunamis en Centroamérica (CATAC);
- *How is the tsunami information (warning, public safety action, etc.) disseminated within country? Who is it disseminated to?*
  - Both the electronic mail and the intranet system of the Mexican Navy. Redundant communication systems are available such as Matra and satellite network phone.
  - Bulletins issued by CAT are disseminated to all the civil and military authorities at municipal, state and federal levels that are in charge of civil protection and emergency management.

- *How is the emergency situation terminated?*
  - Once that the specialists at the Tsunami Warning Center have evaluated and determined that there is no threat for the national coasts or that the tsunami event represents no threat anymore; and counting on the authorization of the Director at CAT, an Alert Cancelation Bulletin is issued. However it is the National Center for the Prevention of Disasters the entity in charge of and responsible for determining and informing the population that they are permitted to go back to their houses.

- *For Distant Tsunami Procedures:*
  What actions were taken in response to warnings issued by PTWC and/or US NTWC, during the intersessional period?

On February 8, 2025, we attended a Tsunami alert for the Caribbean region issued by the PTWC, due to M 7.6 earthquake in the Cayman Trench, we issued three bulletins for this event. 1 alert, 1 monitoring and one cancellation.

3. National Sea Level Network

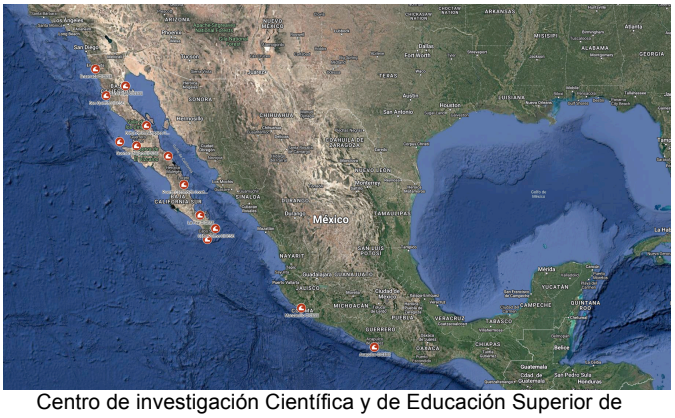
There are in Mexico four (4) Tide gauge networks managed by different institutions. CAT counts on access at real time to the data of almost 75% of the stations since not all of them count on systems for sending telemetric information. The tide gauge networks are the following:

a. Secretaría de Marina– SEMAR.
b. Universidad Nacional Autónoma de México– UNAM.
c. Centro de Investigación Científica y de Educación Superior de Ensenada, Baja California - CICESE.
d. Instituto Mexicano de Transporte– IMT.

Next charts shows the location of the 4 tide gauge networks in Mexico.

Mexican Navy tide gauge network

Universidad Nacional Autonoma de Mexico tide gauge network



Centro de investigación Científica y de Educación Superior de Ensenada Baja California tide gauge network

Instituto Mexicano del transporte de la Secretaría de infraestructura y comunicaciones y transportes tide gauge network

4. Information on Tsunami occurrences

Tsunami Ocurrence:

a. Historic information has registerd for the last 250 years, the arrival of 60 tsunamis to the West coast of Mexico. Distant tsunamis have reached in average, waves of 2.5 m height, while local tsunamis have reached waves of 5 m., height and exceptionally up to 10 m height provoking the loss of lives and property and the destruction of communities.
b. There are no records in recent history that the tsunamis ocurred in Mexico had been as destructive as those occurred in Chile between 1960 and 2010; Alaska in 1964; Sumatra in 2004 and Japan in 2011. However, the possibility or the likelihood for such an event to occur along the coast of the Mexican Pacific, must not be dismissed. In fact, there´s evidence that in 1787 a huge earthquake, Magnitude 8.4 took place in San Sixto, Oaxaca which lead to a heightly destructive local tsunami (Nuñez, Ortiz and Sánchez, 2008).
c. Recently, the earthquake that took place on September 19th., 1985, Magnitude 8.1 before the coasts of Lazaro Cardenas, Michoacán provoked up to 2.5 height waves and more than 500 meters of inland penetration.
d. The tsunami that took place in Manzanillo, Colima on October 9th., 1995, Magnitude 8.0 provoked 2.5 m height waves and moved 200 m inland.
e. A local tsunami was generated by a Mw 8.2 earthquake located on the coast of Pijijiapan, Chiapas (Isthmus of Tehuantepec) during September 07, 2017, recorded by several tidal gauges and offshore buoys, provoked up 1.5 maximum height wave.
f. An earthquake in June 23, 2020, M 7.4, Oaxaca, Mexico, provoqued a moderate tsunami off the coast of Oaxaca, recorded a maximum wave height of 1.4 m in La Crucecita, Oaxaca.
g. On March 4, 2021, an 8.1 magnitude earthquake occurred in the Kermadec-Tonga subduction zone in the southern region of the trench, which generated a tsunami that arrived in Mexico within a period of 11 and 13 hours after it occurred. the earthquake, registering sea elevations of less than 50 cm, but that caused important currents of approximately 2 to 3 knots at the entrance of the ports, however, there were no inundations along the Mexican coast.
h. On January 15, 2022, the Hunga Tonga-Hunga Ha´apai submarine volcano, located 30 km southeast of the island of Fonuafo‘ou, Tonga, had a violent eruption that caused the displacement of the water column located on it, which gave origin of a tsunami that affected the Pacific Ocean, specifically in Mexico, a maximum wave amplitude of 2.05 m was recorded at the Manzanillo station, Colima.
i. On September 19, 2022, an earthquake of magnitude 7.7 was recorded 63 km south of Coalcoman, Michoacán, which generated a tsunami that caused the rise in sea level with a maximum wave amplitude of 1.75 m in Manzanillo, Colima.

On CAT´s web page, a pdf file about the wide history of tsunamis in Mexico:
https://digaohm.semar.gob.mx/cat/centroAlertasTsunamis.html

5. Web sites (URLs) of national tsunami-related web sites

http://www.gob.mx/semar/acciones-y-programas/que-hacer-en-caso-de-tsunami
http://www.gobernacion.gob.mx/es_mx/SEGOB/Coordinacion_General_de_Proteccion_Civil
http://www.cenapred.unam.mx/es/
http://www.ssn.unam.mx/
https://twitter.com/SSNMexico
http://redmar.cicese.mx/
https://www.gob.mx/imt
https://chalchiuhtlicue.geofisica.unam.mx/

6. Summary plans of future tsunami warning and mitigation system improvements.

a. Improvement of communication systems.
b. Increase and upgrade the number of tide gauging stations.
c. Improvement of both communication and inter connection among seismic networks.
d. Promote the involvement of Mexican scientists on research projects for the creation of mathematical models focused on flooding provoked by tsunamis.
e. Continue to perform the yearly programs of exercises and drilling activities for tsunami alert, encouraging the participation of local authorities.
f. Improve and continue with lectures on training programs about tsunamis which are imparted at municipal and state civil protection delegations along the coastal zones.
g. To continue participating in national and international events related to the prevention, research and accuracy on the detection of tsunamis.

NATIONAL PROGRAMMES AND ACTIVITIES INFORMATION

7. EXECUTIVE SUMMARY

After thirteen years of Mexican Tsunami Warning Center has been created, we have a well prepared staff for monitoring and sending tsunami alerts, nowadays our capacity response is less than five (5) minutes after receiving the data provided by the National Seismologic Service, our bulletins are sent to more than 400 users along both Mexican littorals.

A permanent contact has been established with the main alert centers worldwide, as well as with the United Nations Educational, Scientific and Cultural Organization (UNESCO), which has certified more than 50% of CAT members to operate a Tsunami Warning Center.

The data provided below correspond to the period 2013-2025.

There have been issued 1124 tsunami bulletins of different types: informative, alert, follow up and cancelation ones, at local, regional or levels.

More than twenty-five technical reports have been issued about local, regional and distant tsunamis that were registered by tide gauging stations located along the national coast. The ones from: Japan 2011, Salomon Islands 2014, Petatlán 2014, Chile 2014 and Tonga (2022).

We have coordinated and participated in 20 national drillings; participated in 17 international drillings: Caribe Wave 2011, US Virgin Islands, Pacific Wave 2012 Nicaragua coasts; Caribe Wave Lantex 2013 in the North of Aruba, and Caribe Wave Lantex 2014 along the coasts of Mississippi, USA, PACIFIC WAVE 15 A Pacific-wide Tsunami Warning and Enhanced Products Exercise; and CARIBE WAVE and LANTEX 2015 Exercise in the Western Atlantic, Caribbean and Adjacent Regions on 25 March 2015; CARIBE WAVE 16 A Caribbean and Adjacent Regions on 17 March 2016; EXERCISE PACIFIC WAVE 2017 on 15-17 February 2017; CARIBE WAVE 17 A Caribbean and Adjacent Regions on 21 March 2017; CARIBE WAVE 18 A Caribbean and Adjacent Regions on 15 March 2018; EXERCISE PACIFIC WAVE 2018 on 30 November 2018; CARIBE WAVE 2019 A Caribbean and Adjacent Regions on 14 March 2019; CARIBE WAVE 21 on 21 March 2021; CARIBE WAVE 22 on 10 March 2022 and PACIFIC WAVE 22 on 13 October 2022. CARIBE WAVE 2023, on March 23rd. PACIFIC WAVE 23 on May 24th 2024. PACIFIC WAVE 24 on November 21st 2024.

CAT´s staff have participated in more than 100 events both national and international. These events include workshops, symposiums, congresses and courses about tsunami related topics such as: the creation of maps of tsunami sourced flooding; geographic information systems applied to maps of tsunami sourced flooding and the CAT operational system.

8. NARRATIVE

On February of 2017, published the Official Mexican Standard NOM-006-SEGOB-2015. Tsunamis.- Characteristics and specifications of prevention, warning and evacuation.

http://www.dof.gob.mx/nota_detalle.php?codigo=5472483&fecha=21/02/2017

In July 2020, the Mexican Navy developed the "TSUNAMI MX" application, capable of issuing timely and truthful information on the generation of tsunamis and alerting the population, as a mobile computing solution for smartphones, available free of charge.

https://digaohm.semar.gob.mx/cat/TsunamiMX.html

In relation to the UNESCO IOC Tsunami Ready Program, In August 2023, the national council of the Mexican Tsunami Ready Program was formed. There are 3 coastal cities that are interested in get the UNESCO Tsunami Ready Program certification.

https://digaohm.semar.gob.mx/cat/ProgramaTsunamiReadyMexico.html

Thirteen years after its creation, the Tsunami Warning Center has consolidated a monitoring and warning system, operated by trained staff to provide an effective and efficient response to a tsunami-generating event, always promoting a culture of self-protection.

With these actions, the Secretary of the Navy, through the Tsunami Warning Center, reiterates its commitment to Mexican society in prevention to avoid the loss of human life.

CONTRIBUTIONS TO THE UN OCEAN DECADE PROGRAM.

The Tsunami Warning Center (CAT) plays a crucial role in safeguarding lives and property on the Mexican coasts against the threat of tsunamis. Its contribution is manifested through a series of strategic actions and the generation of vital information products.

Firstly, the CAT carries out continuous monitoring of seismic activity with tsunamigenic potential, as well as anomalous variations in sea level through the expansion and modernization of the tide gauge stations of the Secretary of the Navy (SEMAR). This constant surveillance allows for the timely preparation and dissemination of bulletins (informative, alert, follow-up, and alert cancellation), ensuring that the population and authorities have the necessary information to make informed decisions.

A fundamental pillar of the CAT's contribution is the strengthening of its infrastructure, encompassing the Main CAT, the Alternate CAT, and the Mobile CAT. This modernization ensures the uninterrupted operation of the system, even in emergency situations, and optimizes the processing and dissemination capacity of critical information.

Preparedness for the tsunami threat is reinforced through the holding of national and international tsunami warning drills. These exercises allow for the evaluation of the effectiveness of response protocols, the identification of areas for improvement, and the raising of public awareness about the actions to be taken in the event of a real threat. The reports of these drills provide valuable feedback for refining procedures.

The implementation of the Tsunami Ready Program in Mexico represents a significant advance in building resilient coastal communities. The recognition of these communities, documented in the corresponding report, promotes the adoption of preparedness measures at the local level, strengthening the response capacity to a tsunamigenic event.

Finally, the coordination meetings of the members of the National Tsunami Warning System (SINAT) are essential for collaboration and information exchange among the various

institutions involved. The reports of these meetings demonstrate the joint commitment to continuously improve the warning system and tsunami risk management in Mexico.

In summary, the CAT's contribution to the National Tsunami Warning System is comprehensive and ranges from monitoring and early warning to infrastructure strengthening, public preparedness, and inter-institutional coordination. The products generated, such as bulletins and reports, are fundamental tools for decision-making and the construction of a safer Mexico in the face of the tsunami threat.

Date: April 2025.
Name: Captain Miguel Angel Reyes Martinez