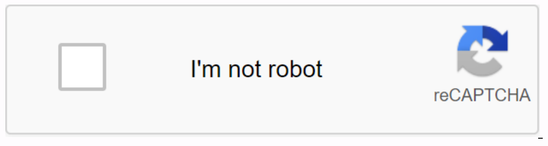

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Tsunami warning center noaa

Under the auspices of the United Nations, the Intergovernmental Oceanographic Commission (IOC) established the Intergovernmental Coordination Group for the Pacific Tsunami Warning System (ICG/PTWS) in 1968. The main activity is the Pacific basin teletsunamis and provides warnings for tsunamis. What is www.prh.noaa.gov/ptwc/ AttachmentSize PTWC.pdf57.86 KB 1.1 Tsunami? The tsunami is one of the most powerful and destructive natural forces. It is a series of extremely long waves (multiple waves between tens and hundreds of miles between hills) caused by the ocean's large and sudden displacement. Tsunamis spread outward from the starting point in all directions and can move across all ocean basins. When they reach the shore, they can cause dangerous coastal flooding and strong currents that can last several hours or days. 1.2 What is the origin of the word tsunami? The tsunami is coming from Japanese characters for port (tsu) and wave (name). 1.3 Is the tsunami the same as a seismic sea wave or tidal wave? Yes and no. A tsunami is a seismic sea wave created by an earthquake (which means related to a seismic earthquake), but tsunamis can also be created by non-seismic disorders. Thus, the tsunami has been internationally thought to mean that waves are caused by any large and sudden displaceation of the ocean. Tsunamis are not related to tides, which are the result of the attraction of shooting the Sun and moon in the Earth's oceans. Therefore, it is wrong to call a tidal wave from a tsunami. 1.4 Are tsunamis predictable? Like earthquakes that create most tsunamis, scientists can't predict when and where the next tsunami strikes. But, tsunami warning centers know which earthquakes are likely to create tsunamis and think a tsunami is possible can give tsunami messages. Once a tsunami is detected, warning centers use tsunami prediction models to estimate wave height and arrival times, the location and amount of flooding, and how long the tsunami will last. In some cases, when a tsunami source is close to a shore, there may not be time for warning centers to issue a detailed estimate for all at-risk coastal areas, so people should be prepared to recognize and respond to natural warnings. 1.5 How often do tsunamis occur? According to the Global Historical Tsunami Database, tsunamis that cause damage or death occur about twice a year close to their source. Tsunamis cause damage or deaths on remote shores (more than 1,000 kilometers, 620 miles, away) occur about twice a decade. 1.6 Where do tsunamis happen? Tsunamis can be created in all the world's oceans, in the in the inns and in any large body of water. They caused damage and deaths in coastal areas around the world. However, some areas are particularly prone to tsunamis due to their proximity to tsunami sources, the depth and shape of the ocean floor near the coast (bathymetry), and coastal height and characteristics Of the 754 incidents 754 754 edicts edict in the Global Historical Tsunami Database between 1900 and 2015, occurred in the Pacific Ocean (around the geologically active Ring of Fire), 8.6% in the Atlantic Ocean and Caribbean Sea, 5% in the Indian Ocean and 1% in other seas. Since 1900, the highest percentage of tsunamis was produced off Japan (21%), followed by Russia (8%), and Indonesia (8%). Most tsunamis are small and harmless or affect shores not only close to their source, but some tsunamis can cause damage and deaths on remote shores (more than 1,000 kilometers, 620 miles, away). The most significant remote tsunami since 1900 has emerged off the coasts ofAlaska, Chile, Japan, Indonesia, Pakistan and Russia. Visit the Natural Hazards Interactive Map to see where the tsunamis are and learn more about them. 1.7 Where could tsunamis be in the United States? An assessment of the danger of tsunamis in the United States shows that a tsunami could strike any U.S. coast, but the danger level varies. These danger levels are largely based on historical records (until 2014), geological evidence and tsunami sources, all of which provide clues as to what might happen in the future. Region Danger Level U.S. West Coast High Very High Alaska (South Coast) High Very High Alaska Arctic Coast (includes West Coast) Very Low Hawaii High Very High American Samoa High Guam and Northern Mariana Islands High Puerto Rico/U.S. Virgin Islands High U.S. Atlantic Coast Very Low U.S. Gulf Coast Very Low distant tsunamis pose a threat to the entire U.S. coast, while the danger is large earthquakes and related landslides around the Pacific and Caribbean, as well as near and far coasts can produce harmful waves that threaten subduction zones, close to the coasts. The U.S. East and Gulf Coast plunge zones are not close, and earthquakes are not as frequent in large or other regions. The most likely sources of tsunamis on these shores are underwater landslides and meteotsunamis. 1.7.1 What is the tsunami hazard level for anchorage and upper Cook Inlet in Alaska? The tsunami danger level for Anchorage and upper Cook Inlet is very low compared to alaska's South Coast. When tsunamis enter the Upper Cook Inlet in the Gulf of Alaska or lower Cook Inlet, they are no longer weakened by relatively shallow water in the upper Cook Inlet to a dangerous point. 1.8 What are some of the most damaging tsunamis affecting the United States? As of January 2018, 30 tsunamis that caused at least one death or $1 million ($2017) in damage affected U.S. states and regions, according to the Global Historical Tsunami Database. Region Local Tsunami* Remote Tsunami* U.S. West Coast 1820, 1878, 1894, 1930 1946, 1952, 1957, 1960, 1964, 1975, 2006, 2010, 2011 Alaska 1788, 1845, 1853, 1900, 1917, 1946, 1957, 1958, 1964, 1994 1960 Hawaii 1868, 1975 1868, 1877, 1923, 1946, 1952, 1957, 1960, 1964, 2011, 2012 American Samoa 2009 1946, 1960 Guam and the Northern Mariana Islands 1849 -- Puerto Rico/U.S. Virgin Islands 1867, 1918 -- * See the following question: What is the difference between a local and distant tsunami? For more information, see the Historic Tsunami Calendar. 1.9 When do tsunamis happen? There is no season for tsunamis. A tsunami can happen all the time, every season, and during every weather. 1.10 Where can I learn more about tsunamis? There are a number of online resources that can provide more information about tsunamis. Key sources include: COMET Program's Tsunami Remote Learning Course (six independent modules) National Weather Service JetStream Online Air School (tsunami module) National Weather Service Tsunami Safety website International Tsunami Information Center Global Historical Tsunami Database TsunamiZone 2.1 Tsunami Zone 2.1 Tsunami Cause Tsunami? The tsunami is caused by the large and sudden displacement of the ocean. While large earthquakes below or near the ocean floor are the most common causes, landslides, volcanic activity, certain types of weather conditions and near earth objects (e.g., asteroids, comets) can also cause tsunamis. Most of the tsunamis (88%) were created by the Global Historical Tsunami Database caused by earthquakes or landslides. 2.2 How earthquakes create tsunamis Earthquakes provide energy to create tsunamis through sudden movements into the water column. The main earthquake characteristics contributing to tsunami production are location, size and depth. Most tsunamis are caused by earthquakes occurring under or near the ocean with magnitudes above 7.0 (usually in subduction zones where ocean and continental plates collide) and more than 100 kilometers (62 miles) below the Earth's surface. Usually, an earthquake must exceed magnitude 8.0 to create a dangerous distant tsunami. An earthquake must be large enough and close enough to the ocean floor to cause vertical movement of the ocean floor, which usually sets a tsunami in motion. As the ocean floor rises or falls, so do the water on it. As the water moves up and down, seeking to regain balance, the tsunami spreads in all directions. The amount of movement of the ocean floor, the size of the area on which it occurred (reflective of how long the earthquake can last) and the depth of water at its source are all important factors in the magnitude of the resulting tsunami. Earthquakes can also cause landslides that create tsunamis. Examples of earthquake-instiased tsunamis: March 11, 2011 in Honshu Island, Japan (video)—A magnitude 9.1 earthquake produced a tsunami that caused local devastation and was observed all over the Pacific. The earthquake and tsunami that displaced more than 500,000 people in Japan caused nearly $236 billion ($2016) in damage and resulted in a nuclear accident. Most of the 18,457 were due to the tsunami. Along the coast of Japan, tsunamis reached 128 feet high and almost five miles in the interior. There have been few casualties due to warnings and evacuations outside Japan, but there have been more than $91 million in damage and one death in the United States. This is the most expensive natural disaster in history. December 26, 2004 in North Sumatra, Indonesia (animation)—A magnitude 9.1 earthquake produced the deadliest tsunami in history. The tsunami was responsible for the majority of the effects observed in Southeast and South Asia and 15 countries in East and South Africa. The effects included nearly 230,000 deaths, the displacement of 1.7 million people and economic losses of about $13 billion ($2016). On the north coast of Sumatra, the waves reached heights of 167 feet and advanced about three miles in the interior. The extent of the casualties can be partially asted when there is a lack of an official tsunami warning system in the Indian Ocean and limited information about tsunamis. March 27, 1964 Prince William Sound, Alaska (animation)—A magnitude 9.2 earthquake (the largest in U.S. history) produced a series of tsunamis that devastated Alaskan coastal communities with waves as high as 167 feet (and a 220 foot jump mark) and caused damage along the United States and the western coasts of Canada and Hawaii. Tsunami damage was about $1 billion ($2016). About 124 people were killed by the tsunami. THE NOAA National Tsunami Warning Center has been established in response to this tsunami. April 1, 1946 Aleut Islands, Alaska (animation)—created a devastating tsunami across the Pacific. Most of the 167 lives lost and $322 million ($2016) in damage took place in Hawaii, where waves reached up to 55 feet. The NOAA Pacific Tsunami Warning Center was established in response to this tsunami. November 1, 1755 Lisbon, Portugal (animation)—An 8.5 magnitude (estimated) earthquake in the Atlantic Ocean caused a tsunami affecting the coasts of Portugal, Spain, North Africa and the Caribbean. The earthquake and tsunami killed nearly 50,000 people and caused widespread destruction. January 26, 1700 Cascadia Subduction Zone (animation)—A 9.0 magnitude (estimated) earthquake created a tsunami in Japan that flooded the coast of Cascadia, including coastal villages on the other side of the Pacific Ocean, as well as Northern California, Oregon, Washington and Southern British Commology. Today, the Cascadia Subduction Zone is considered one of the biggest U.S. tsunami threats. Source: Global Historical Tsunami Database To learn more about Earthquakes, visit the U.S. Geological Survey Earthquake Hazards Program. 2.2.1 What kind of earthquakes create a tsunami? Most of the earthquakes that create tsunamis occur in push or reverse faults. These earthquakes are mainly caused by tectonic plates. other plunge zones. However, 10-15 percent of damaging tsunamis are produced by hit-and-slide earthquakes, where the movement of the earth is horizontal. These tsunamis are most likely created by associated landslides, the movement of a sloping ocean floor, or the presence of seamounts that are underwater mountains ,(it can act like shovels and push water horizontally). Tsunamis created by strike-slip earthquakes normally affect only areas near the source. To learn more about bugs, see the visual dictionary of the U.S. Geological Survey. 2.2.2 What was the biggest earthquake ever recorded? The largest earthquake ever recorded was a magnitude 9.5 earthquake off the coast of southern Chile on May 22, 1960. This earthquake and the second largest earthquake, magnitude 9.2 in 1964 in Prince William Sound, Alaska, both produced devastating tsunamis. Learn more about past earthquakes in the U.S. Geological Survey. 2.3 How do landslides create tsunamis? Regarding tsunami production, landslides are a general term that includes a number of types of ground movement, including rock falls, slope failures, debris flows, collapses, ice falls/avalanches and glacial upstream (breaking large pieces of ice in a glacier). Tsunamis can be created when a landslide enters the water and displaces from above (from the air) or before water and when an underwater (submarine) landslide is displaced behind it. Tsunami production depends on the amount of landslide material displacing water, the speed of movement and the depth at which it moves. Landslide-generated tsunamis can be larger than seismic tsunamis close to their source and no warning can affect the coastline in very few minutes, but they often lose energy quickly and rarely affect remote coasts. Creating tsunamis causes most landslide earthquakes, but other forces (such as gravity, wind, and increased precipitation) can cause extreme steep and otherwise unstable slopes that suddenly fail. Earthquakes that are not large enough to directly create a tsunami can be large enough to cause a landslide that in turn can create a tsunami. A landslide-generated tsunami can occur independently or directly in the form of a tsunami created by an earthquake, which complicate the warning process and compound losses. Examples of landslide tsunamis: July 17, 1998 In Papua New Guinea—A moderate 7.0 magnitude earthquake triggered a massive underwater landslide that created a deadly tsunami. The three highest waves, about 49 feet high, can hit the shore 20 minutes after the quake, destroying entire villages. Some 2,200 people were killed and more than 10,000 displaced. July 10, 1958 southeast Alaska—A magnitude 7.8 earthquake triggered a series of submarine landslides, rock falls, and ice falls that created tsunamis that killed five people. A rock fell into Lituya Bay, tossing water towards the other shore. Put around up to a maximum high of 1,720 meters. It is considered the largest tsunami ever recorded. November 18, 1929 Grand Banks, Newfoundland, Canada—A 7.3 magnitude earthquake in the Atlantic Ocean triggered a tsunami submarine landslide. Waves of up to 43 feet are responsible for 28 deaths and $14 million ($2016) damage off the coast of Newfoundland. Source: To learn more about the Global Historical Tsunami Database Landslide, visit the U.S. Geological Survey Landslide Hazards Program. 2.4 How volcanoes create tsunamis Tsunamis created by volcanoes, above and below water, are sparse, but volcanic activity can displace enough water to create various destructive tsunamis. These are: Pyroclastic currents (rock fragments, gas and ash flowing mixtures) Submarine eruptions relatively close to the formation of the ocean surface Caldera (volcanic collapse) Landslides (e.g., side collapse, debris currents) Lateral eruptions (eruptions to the sides) like other seismic tsunamis, as produced by these landslides, volcanic tsunamis often affect fast and rarely distant shores. Examples of volcano-induced tsunamis: August 27, 1883 Indonesia—The Krakatau volcano (Krakatoa) erupted and collapsed, creating one of the largest and most destructive tsunamis ever recorded. The 135-foot-high waves destroyed coastal towns and villages along the coasts of Java and Sumatra, killing more than 34,000 people. May 21, 1792 At the end of a four-month eruption of kyushu island, Japan-Unzen volcano, a side collapse produced a tsunami with waves reaching 180 meters high causing destruction around the Ariake Sea and more than 14,000 deaths. ~ 1610 BC Greece-Volkan Santorini (Thera) erupted, producing a tsunami that swept off the coast of nearby islands and contributed to the end of Minoan culture on the nearby island of Crete. Source: Global Historical Tsunami Database To learn more about Volcanoes, visit the U.S. Geological Survey's Volcano Hazards Program. 2.5 How does the weather create a tsunami? Air pressure disturbances are often associated with fast-moving weather systems, such as squall lines, that can produce tsunamis. This meteotsunamis is similar to the tsunami created by earthquakes. Their development depends on the intensity, direction and speed of air pressure degradation when traveling over the ocean and the depth of the ocean. Meteotsunamis are regional and some parts of the world are prone to them due to a combination of factors such as local weather patterns and the shape and characteristics of the earth's surface. Examples of meteotsunami: June 13, 2013 in the Northeastern United States (animation)—Tsunami-like waves crashed over new Jersey and the southern Massachusetts coast, despite clear skies and calm weather. In Barnegat Inlet, New Jersey, three people were injured when a 6-inch wave swept them off the pier. After ruling out other sources, scientists determined that the waves were created hours earlier by a derecho (a high-speed storm associated with a strong storm surge) that passed through the area. June 21, 1978 Vela Luka, Croatia—Without warning and in relatively good weather, floodwaves flooded the port city of Vela Luka. Scientists eventually detected the source atmospherically and considered it to be the strongest meteotsunami on record. This event featured waves of 19.5 meters, lasted several hours and caused millions of dollars in damage. What is Meteotsunami to learn more about meteotsunami? 2.6 Can near-world objects create a tsunami? It is very rare for a nearby Earth object, such as an asteroid or comet, to reach Earth, and there is still a lot of uncertainty about their potential to produce tsunamis and, if they do, the size and reach of these tsunamis. Scientists believe there are two ways earth's objects can create tsunamis. Large objects that pass through the Earth's atmosphere without burning (about 1,000 meters, 0.62 miles or more in diameter) can hit the ocean, replace water and create a collision tsunami. Smaller bodies tend to burn in the atmosphere, exploding before reaching the earth's surface. If this happens over the ocean, the explosion could release energy into the ocean and create an air burst tsunami. An example of a near-world object tsunami: Evidence suggests that the Chicxulub effect on Mexico's Yucatán Peninsula likely caused a mass extinction at the end of the Cretaceal period 65 million years ago, reaching hundreds of miles in the interior around the Gulf of Mexico may have produced a tsunami. 3.1 How many waves are there in the tsunami? A tsunami is a series of waves, not just one. These waves are often referred to as tsunami wave trains. A massive tsunami may continue throughout the day in some places. 3.2 How fast does the tsunami move? The speed of the tsunami depends on the depth of the water traveling in it. As deep as the water is; faster tsunami. In the deep ocean, tsunamis can move as fast as a jet plane, more than 500 miles, and cross all oceans in less than a day. As the waves enter shallow waters near the land, it slows to the speed of a car at about 20 or 30 mph. Tsunami speed can be calculated by taking the square root of the product of water depth and gravity acceleration (32.2 square meters). It's in 15,000 feet of water, going about 475 miles an hour. At such rates, a tsunami will travel to the Aleut Islands in Hawaii in about five hours; Or eight and a half hours from the Portuguese coast to North Carolina. 3.3 How big is the tsunami? In the deep ocean, the wavelength of a tsunami (the distance between waves) can be hundreds of kilometers, but the waves are barely noticeable and rarely higher than three meters. Sailors at sea don't normally notice tsunamis. As waves enter shallow waters near land and slow down, wavelengths decrease, their height grows and currents intensify. When they land, most tsunamis are less than 10 feet low, but in extreme cases, they can pass 30 meters when they come near the source. The first wave may not be the last or the largest. A massive tsunami could flood coastal areas lying less than a mile in the interior. All tsunamis act the same, and an individual tsunami can affect different coasts due to offshore and coastal features. Reefs, bays, entrances to rivers, underwater features, and the slope of the beach can affect the entire size, appearance, and tsunami effect when they strike ashore. Somewhere a small non-destructive tsunami can be very large and severe a few kilometers away. 3.4 What does a tsunami look like when it reaches shore? When a tsunami reaches the shore, it may look like a rapidly rising flood, or a wall of water (hole). Its appearance may vary at different points along a shoreline. It's not going to look like a normal wind wave. Tsunamis rarely have large rising breakage waves. Sometimes, before the water floods on land, it will suddenly re pull back, make the ocean floor, reefs and fish look like very low, low tides. 3.5 How long does the tsunami last? Large tsunamis can continue throughout the day in some places, often reaching their peak a few hours after arrival and gradually tapering off after that. The time between tsunami crests (tsunami period) varies from about five minutes to two hours. Dangerous tsunami currents can last for days. 3.6 What is the difference between a local and distant tsunami? Tsunamis are often referred to locally or remotely. The type of tsunami depends on the location of the tsunami source and where the land could strike. A local tsunami source is close to shore and could come in less than an hour. The danger is greatest for local tsunamis as the warning time is limited. A distant tsunami is created from a remote shore, so there is more time to respond to the problem and warnings. 3.7 How are tsunamis different from normal ocean waves? Most ocean waves are produced by the wind. Tsunamis are not the same as wind waves. First of all, they have different sources. In addition, as tsunamis move across the entire column of water, from the ocean surface to the ocean floor, wind waves only affect the ocean surface. Waves can also be defined by wavelength (horizontal distance between wavelengths), period (time between wavelengths) and their speed. These features highlight additional differences between tsunamis and wind waves. Wavelengths are measured in kilometers for tsunamis and in foot for wind waves. Periods are measured in minutes for tsunamis and seconds for wind waves. Although tsunamis are also faster than wind waves, and the height of the deep ocean is smaller, tsunamis can grow much higher and wind waves on the coast can cause much more destruction Wind Wave Source Earthquakes, landslides, volcanic activity, certain types of weather, Winds blowing across the energy surface near earth objects All water column, ocean floor ocean surface from ocean surface Wavelength 60-0 300 mph 300-600 feet Wave Period 5 minutes – 2 hours 5-20 seconds Wave Speed 500-600 miles per hour (in deep water) 20-30 miles per hour (near shore) 5-60 miles per hour (near shore) 5-60 miles per hour .1 Warning what are the responsibilities of tsunami centers? The NWS runs two Tsunami Warning Centers, which staff 24 hours a day, 7 days a week. The main mission of the warning centers is to help protect lives and property from tsunamis. To do this, monitor observation networks, analyze earthquakes, assess water-level information, issue tsunami messages, carry out public out out outs and coordinate with the National Tsunami Hazard Reduction Program and government, academic and international organizations to continuously improve their operations. 4.2 How are tsunamis detected? Tsunami Warning Centers depend on an observation system that includes seismic and water level networks from around the world to help them determine when and where to give tsunami messages. These networks are crucial to the ability of warning centers to send timely and accurate messages: Seismic Networks-When an earthquake occurs, seismic networks provide information about the location, depth, magnitude and other source characteristics of the earthquake. Warning centers analyze this information to determine whether the earthquake may have produced a tsunami and a tsunami message was required. Water Level Networks-If an earthquake meets certain criteria, warning centers are looking for changes in water level height that can indicate the presence and size of a tsunami, turn on water level information. The primary sources of information about water level change are a wide range of Deep Ocean Assessment and Tsunami Reporting (DART) systems and coastal water level stations. 4.3 What is a DART system? DART (Deep-ocean Assessment and Reporting of Tsunami) systems were developed by NOAA for early diagnosis, measurement and real-time reporting of tsunamis in the open ocean. NWS's National Data Buoy center operates and maintains the U.S. DART systems network, part of a larger international network. The U.S. network consists of 39 systems (as of 2016) strategically located along the Pacific and Atlantic Oceans, gulf of Mexico and Caribbean Sea. Each system consists of a subpressure recorder (BPR) anchored to the ocean floor and a separate anchored parity surface buoy. When a tsunami passes over a BPR, the device detects and records changes in the water pressure at the top. An acoustic connection ingeses information from the BPR to the surface buoy, which is ed to the warning centers where the information is included in the tsunami via satellite. Model. See how the DART system works (video). 4.4 What is a coastal water level station? Coastal water level stations collect important information about the height of the ocean in certain coastal areas. Their primary purpose is to monitor the tide for navigation purposes, so that located on the shore (unlike dart systems, which are in deep waters), often at ports in ports. Information from these stations is transmitted via satellite to warning centers where it is used to confirm the tsunami arrival time and height and is included in tsunami prediction models. A number of coastal water level stations are operated by national and international organizations. In the United States, most tsunami-capable coastal water level stations (i.e., data are available at one-minute intervals) are operated and maintained by the Noaa Center for Operational Oceanographic Products and Services as part of the National Water Level Observation Network. 4.5 How to predict tsunamis In most cases, the first sign of a potential tsunami is an earthquake. Seismic waves travel about 100 times faster than tsunamis, so information about any tsunami that could have produced information about an earthquake can be used before. Three key pieces of information about an earthquake help determine whether tsunami warning centers are capable of producing a tsunami: location, depth, and magnitude. Warning centers use this preliminary seismic information to decide whether they should send a tsunami message and what alert level (s) they should. Once a message is given, warning centers do additional seismic analysis and run tsunami prediction models using information from seismic and water level networks as it becomes available. These numerical models use real-time information and predetermined scenarios to simulate tsunami movement across the ocean and predict coastal impacts, including wave height and arrival times, coastal flood location and scope, and event time. The resulting forecasts, along with historical tsunami information and additional seismic analysis, help alert centers decide whether to send an updated or canceled message. These non-seismic tsunamis are harder to predict (such as landslides and volcanic tsunamis and meteotsunamiler), which may come with little warning. Even if a nonseismic tsunami is detected by a DART system or coastal water level station, there may not be time to develop a detailed estimate. In the case of Meteotsunamis, the NWS Weather Prediction Offices, with decision support from warning centers, may notify the public of the potential coastal threat given the presence or potential of certain weather conditions, along with observed water level measurements. 5.1 What are tsunami messages? Tsunami messages are issued by Tsunami Warning Centers to notify emergency managers and other local authorities, the public and other partners about the potential for the tsunami the event that produced a possible tsunami. For the United States, Canada, and the British Virgin Islands, these messages include alerts. There are four levels of tsunami warnings: alert, consultation, monitor, and information notification. The first tsunami messages include alert level(s), preliminary information about the earthquake and an assessment of the threat. If a tsunami is already suspicious, the message may also include wave arrival times, proposed life safety actions, and potential impacts. Subsequent posts, both updates and cancellations, are based on additional seismic analysis and results from tsunami prediction models and may include more refined, detailed, and targeted information. See examples of tsunami messages. 5.1.1 What is a tsunami warning? A tsunami warning is issued when a tsunami with the potential to create widespread flooding is near, expected, or occurring. Warnings warn the public that dangerous coastal flooding accompanied by strong currents is likely and may continue for several hours after initial arrival. Warnings alert emergency management officials to take action for the entire tsunami danger zone. Appropriate measures by local authorities could include evacuating low coastal areas and repositioning ships into deep waters when there is time to do so safely. Alerts can be updated, geographically adjusted, demoved, or canceled based on updated information and analysis. 5.1.2 What is tsunami advice? A tsunami advisory is given a tsunami that has the potential to create strong currents or waves dangerous near this or very close to water, expected, or occurring. The threat may continue for a few more hours after it first arrived, but no significant flooding is expected for areas under consultation. Appropriate measures by local authorities include closing beaches, evacuating ports and marinas and repositioning ships into deep waters when there is time to do so safely. Advisory recommendations can be updated, geographically adjusted, upgraded to alert, or cancelled based on updated information and analysis. 5.1.3 What is the tsunami time? The tsunami is then given a tsunami time that can affect the time area. The time can be upgraded to a warning or advisory, or canceled based on updated information and analysis. Emergency management officials and the public must act. 5.1.4 What is a tsunami information statement? A tsunami information statement is issued when an earthquake or tsunami message occurs of interest to recipients. In most cases, information statements are given to show that there is no threat of a devastating basin-wide tsunami and to prevent unnecessary evacuations. Information notifications for remote events that require evaluation can be upgraded to an alert, consultation, or monitoring based on updated information and analysis. 5.2 What is the tsunami threat message? A tsunami message for a tsunami threat message Partners in the Pacific and caribbean. The United States does not issue alerts for these partners. The main purpose of these messages is to help national authorities understand the threat to their shores, so they can determine what warnings can be published for their shores, if any. A threat message describes potential danger and tsunami threats based on the impact of humans, structures and ecosystems on land or in nearby marine environments. National authorities will determine the appropriate alert level for each country and provide additional or more refined information and instructions. The threat message can be updated based on new information, data, and analytics. Message recipients may be given interest in the aftermath of an earthquake or tsunami if there is little to no threat in an information statement, but a tsunami threat message can be raised if guaranteed. U.S. states and territories in the Pacific and Caribbean (American Samoa, Guam, Hawaii, Northern Mariana Islands, Puerto Rico, U.S. Virgin Islands) *Should only refer to pacific tsunami warning center messages. International tsunami threat messages from the Pacific Tsunami Warning Center may mention U.S. states and territories, but additional modeling and analysis made for fine-tuning estimates do not reflect and set alert levels for the United States and see instances of tsunami messages that should not be trusted by U.S. states and territories. 5.3 Who posts tsunami messages? Tsunami Warning Centers prepare and issue tsunami messages for their designated service areas. The primary recipients of these messages include the NWS Weather Prediction Offices, state emergency operations centers, the U.S. Coast Guard, U.S. military and designated international officials. Each of these recipients is responsible for forwarding the message to its components. 5.4 Who cancels tsunami messages? A cancellation issue, consultation, or monitoring, or additional damage to a tsunami has decreased to a level where additional damage is not expected after tsunami Warning Centers determined that a devastating tsunami would not affect an area under a warning. However, canceling a message does not mean that the zone is secure. The final decision that an area is safe is up to local and state emergency management officials. 5.5 What are the designated service areas of tsunami warning centers? Palmer, the National Tsunami Warning Center in Alaska, serves the United States, Alaska and Canada. The Honolulu Pacific Tsunami Warning Center serves Hawaii, directly from the Hawaii Islands, the U.S. Pacific and Caribbean territories and the British Virgin Islands, and is the primary international prediction center for the United Nations Education, Scientific and Cultural Organization of the Pacific and Intergovernmental Oceanographic Commission warning systems in the Caribbean and Neighboring Regions. 5.6 How tsunami warning centers what alert levels do they add to their messages? Tsunami Warning Centers received the first tsunami messages from seismic networks because the basic preliminary earthquake information (location, depth, and magnitude) was all the information available in the first few minutes after an earthquake. They use preset criteria (Atlantic, Pacific) to decide when to give a tsunami message and what alert(s) it will contain. Subsequent posts and warnings are based on additional seismic analysis, water level measurements, tsunami prediction model results and impact estimation resulting from historical tsunami information. Tsunami warnings are usually issued following coastal earthquakes magnitude 6.5 or larger for the Atlantic and Gulf coasts of the U.S. and Canada, and magnitude 7.1 or larger for all coasts along the Pacific Ocean and Caribbean Sea. Tsunami height also affects alert selection. In general, warning centers predict or issue a tsunami warning if the observed tsunami height exceeds 1.0 meters (3.3 feet) or the effect is unknown, and the forecast height is between 0.3 and 1.0 meters (0.98 and 3.3 feet) while a tsunami consultation or observed height is between 0.5 and 1.0 meters (1.6 and 3.3 feet). 5.7 How fast are tsunami messages issued? The time it takes for a Tsunami Warning Center to deliver a tsunami message depends on the density and distribution of the seismic network near the quake's exit point. In areas with high seismic network density, alert centers can send messages in five minutes. In areas with lower seismic network density, response time increases to 10-15 minutes. 5.8 How can you get tsunami messages? In the United States, tsunami messages are broadcast via local radio and television, sea radio, wireless emergency alerts, NOAA Air Radio, NOAA websites (such as Tsunami.gov) and social media accounts (Facebook and Twitter). It can also come via open sirens, local authorities, emails and text message alerts from state and local opt-in systems and phone notifications. In some cases, the publication of a message may depend on the alert level and/or local conditions, such as wireless emergency alerts that only broadcast the first tsunami alert. There may not always be enough time for an official alert, so it's important to understand natural alerts. Learn how to get alerts from Tsunami Warning Centers. 6.1 Why are tsunamis dangerous? The tsunami is one of the most powerful and destructive natural forces. It can produce unusually strong currents, quickly land and devastate coastal communities. Low areas such as beaches, bays, lagoons, ports, river mouths and areas along rivers and streams leading to the ocean are the most vulnerable areas. Most tsunami damage and destruction is caused by flooding, wave effects, strong currents, erosion, and debris. It can be as dangerous as returning to the sea, taking water, debris and people. In addition to loss of life and mass other potential impacts include damage and destruction of homes and businesses, cultural and natural resources, infrastructure and critical facilities. Floods and dangerous currents can last for days. Even small tsunamis can pose

a threat. Strong currents can hurt, strangle, damage and destroy boats in ports. Local tsunamis are particularly dangerous. They can hit a shore in a few minutes from the generation with little or no warning. 6.2 How can I prepare for a tsunami? Although tsunamis cannot be prevented, there are things you can do before a tsunami that can save your life and the lives of your family and friends. More importantly, find out if your home, school, workplace, or other places you usually visit are in the tsunami danger zone (U.S. tsunami maps). If you live or spend time in a tsunami danger zone: Educate yourself about tsunami warnings (official and natural) and make sure there are multiple ways to get official alerts. Get a NOAA Weather Radio in the United States, sign up for text message alerts from your local government, and confirm that your mobile devices receive wireless emergency alerts. Prepare an emergency plan with family communication and evacuation plans. Mapping routes from homes, businesses and other places is frequently visited on high ground or in the interior (remote water) and safe places outside the tsunami danger zone. Your community may have already identified evacuation routes and gathering areas (if they haven't, set a safe place at least 30 meters above sea level or at least 100 feet in the interior). You plan to evacuate on foot; roads may be impassable due to damage, closure or traffic jams. Practice your routes on foot, even in dark and bad weather. This will facilitate evacuation during an emergency. Prepare a portable disaster materials kit with items that you and your family (including pets) may need in case of an emergency. Prepare kits for business and cars. Set an example. Share your information and plans with others. If there are children at school in a tsunami danger zone, evacuate and learn the school's plans to keep the children safe. If you are visiting the coast, learn about local tsunami safety. Your hotel or campsite must have this information. For more information, visit the NWS Tsunami Safety and International Tsunami Information Center websites. 6.3 How do I know if the tsunami will come? There are two ways a tsunami can be warned coming: an official tsunami warning and a natural tsunami warning. They're both equally important. You may not get both. In the United States, an official tsunami warning is issued on local radio and television, sea radio, wireless emergency alerts, NOAA Air Radio and NOAA websites (such as Tsunami.gov) and social media accounts (Facebook and will be published on the It can also come via open sirens, local authorities, emails and text message alerts from state and local opt-in systems and phone notifications. It may not always be. Not. wait for an official tsunami warning. A natural tsunami warning may be the first, the best, or just warning that a tsunami is on its way. Natural tsunami warnings include strong or long earthquakes, loud roars (such as a train or plane) in the ocean, and unusual ocean behavior. The ocean may look like a rapidly rising flood or a wall of water (holes). Or it can suddenly remn it by making the ocean floor, reefs and fish look like very low tides. If you experience any of these warnings, even just one, a tsunami may be coming. 6.4 How should I respond to a tsunami warning? How you respond to a tsunami warning depends on where you are and the type of alert you receive (i.e. official or natural). Get ready to respond immediately to everything you hear or see first. If you are in a tsunami danger zone and receive an official tsunami warning: Stay away from water and remote beaches and waterways. Learn more about your radio, TV or mobile device (text or data) and stay informed throughout the event. If the authorities ask you to evacuate, follow your emergency plan and move quickly to safety. If you don't have a safe place or can't reach it, follow the evacuation signs to a safe place or go as high as possible or in the inn (far from water) (at least 30 metres above sea level or in the inn). If you are in a tsunami danger zone and you get a natural tsunami warning, a tsunami can come within minutes: In the event of an earthquake, protect yourself. Let go, turn it off and wait. Prepare for aftershocks. Every time the earth shakes, if it fall, cover it and hold it. Move. Do not expect any official warnings or instructions from the authorities. As soon as you can move safely, implement your emergency plan and move it to safe place quickly. If you don't have a safe place or can't reach it, follow the evacuation signs to a safe place or go as high as possible or in the inn (far from water) (at least 30 metres above sea level or in the inn). If there is earthquake damage, avoid falling power lines and avoid weakened structures. When you're in a safe place, learn more from your radio, TV, or mobile device (text or data). If you are on the beach or near the water and feel an earthquake of any size and length, you can move safely as soon as you move to high ground or interior (far) fast. Learn more from your radio, TV, or mobile device (text or data). If you are outside the tsunami danger zone and receive a warning, stay where you are unless the authorities say so. For your safety and others, always follow the instructions of the local authorities and stay out of the tsunami danger zone until they say it is safe. To find out if there is a tsunami danger zone in the United States, visit the Tsunami Maps web page For more information, visit the NWS Tsunami Safety and International Tsunami Information Center websites. 6.5 Who is the tsunami evacuation For all U.S. states and territories, evacuation requests/instructions are usually issued and coordinated by local emergency management officials. In the unique case of a tsunami warning issued for earthquakes in local Hawaii, the Pacific Tsunami Warning Center decides whether evacuations are necessary. When they are, local and state emergency management officials are responsible for coordinating them and determining when it is safe for people to return to an evacuated area. 6.6 Will I be safe from a tsunami in a high-level building? Most buildings are not designed to withstand tsunami effects. However, some powerful (e.g., reinforced concrete) and top stories of high-up buildings may be able to provide protection if no other option is available. If you're worried you won't be able to get to a safe place on time, consult your local emergency management office or hotel staff about vertical evacuation. Remember, such evacuations are not recommended in all areas. 6.7 What should I do if I was on a boat at the port or at sea during the tsunami? If you are on a boat and get a tsunami warning, your response will largely depend on where you are. In the United States, in general, it is recommended: if you receive a port and a tsunami warning, you should leave the boat and move quickly to a safe place on land (high ground or in the interior, away from the water). * If you are at sea and receive a tsunami warning, you must move to a safe depth and stay away from ports under warning until authorities have passed the threat. * Safe depths vary by region, but the minimum safe depth is 30 strokes (180 feet). The port master, port captain, U.S. Coast Guard and local and state emergency management offices are the best resources for safe depth and other tsunami safety information and regulations for boaters in your area. If you own or captain a boat, take extra steps to prepare for a tsunami: Make sure you have a way to get tsunami warnings on the water. The Coast Guard will broadcast emergency marine information broadcasts on channel 16 of your naval VHF radio. Additional information is available from NOAA Weather Radio. Make a plan and put together a disaster supplies kit to keep you on the boat. Keep in mind that coastal facilities may have been damaged, so if you were at sea during the tsunami, you may not be able to return to the port you left behind. Get ready to stay at sea for a day or more. More.