



Tsunami Education

Tsunami Messaging Project

Summary of Tsunami Messaging Project discussions and results through April 17, 2014

The Tsunami Messaging Project kicked off in December, 2013. Ten sessions were held every two weeks through April 3, 2014. Results of these discussions are below.

The Tsunami Messaging Project provides information about the tsunami phenomenon and how it is perceived by people, social science that impacts perception of the threat, and suggested wording of messages that may be adopted and adapted for use by those who communicate with people.

The content below is forming a Messaging Guide organized by:

1. Wording of messages for most impact
2. Definition of a tsunami
3. Causes of a tsunami
4. Tsunami characteristics
5. Tsunami terms
6. Tsunami dangers
7. Tsunami safety messages
8. Vertical evacuation
9. Maritime safety
10. Miscellaneous

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1. Wording of messages for most impact

Professionals in the science of how people read and understand verbal communication have provided tips for success in communicating information about tsunamis and related information:

- use shorter sentences.
- limit number of relative phrases and clauses.
- use active voice.
- line length 7-9 words.
- The analogy of something familiar – debris as a battering ram – allows the reader to form an image. Reading science proves this. Using common analogies improves comprehension and retention.
- The number of adjectives and concepts should be kept to a minimum – no more than one per sentence.
- Ensure that any time we use any of these simple descriptions, we should let them know that more information is available.
- Think about using terms that include “force” or “energy”
- If-then scenario is easiest to read

- Providing a context sets you up for the next sentence.
 - Change typeface for important instructions/call to action – such as a slightly different shade, but stay away from bold (too strong). Italics tends to be skipped.
 - The word “threat” is more conceptual than the word “danger.” Threats are potential things, but danger is more real and less ambiguous.
 - Include in context of why you are telling them this.
 - Declarative sentences are important.
 - When appropriate, put in a direction statement at the end. Calls to action or clear action directive statements once a reason has been provided are important.
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2. Definition of a tsunami

- A tsunami is a series of waves. These waves can cause dangerous surges of water. The surges can last for minutes, hours, or days.
- A tsunami is a series of waves that can cause dangerous surges of water along shorelines. These surges can last minutes, hours, or even days.
- A tsunami is a series of waves that can generate surges of water along shorelines causing dangerous inundations that can last minutes, hours or even days.
- A tsunami consists of a series of waves. Often the first wave may not be the largest. The danger from a tsunami can last for several hours or days after the arrival of the first wave.
- A tsunami is a series of long period waves generated by a displacement of water. Tsunami waves can last hours or days.
- A tsunami is (most often) (generally) a series of earthquake-generated waves that can cause (destructive) (catastrophic) (extreme) (damaging) flooding along shorelines and areas well inland.
- A tsunami is most often a series of earthquake-generated waves that can produce catastrophic damage and extreme flooding along shorelines and areas well inland.
- A tsunami is a series of waves in the ocean, most often caused by an earthquake which produces an uplift of the seafloor. The energy then spreads out horizontally and moves away from the source, eventually arriving at the coast and potentially causing damage from flooding and strong currents for many hours.
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Comments/Notes:

- Long period wave – hard to grasp. Consider using “wave interval.” Consider adopting what people on the street use. People don't perceive a tsunami from its wavelength, period, or interval.
- Okay to use word “wave” without having to use the technical terms like wavelength.
- The word “surge” is very weather-like.
- People in NorCal are not affected by confusion of the word “surge” with weather as people may be who live in hurricane-affected areas.

- Definition needs to differentiate why a tsunami is different from a wind wave or storm surge (see characteristics below).
 - “Wall of water” may be misleading. A tsunami is more insidious.
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3. Causes of a tsunami (also see definitions above)

- A tsunami is usually caused by an earthquake under the sea floor.
- A tsunami is caused by a vertical displacement under the sea floor.
- When a large amount of ocean water suddenly moves up and down, a tsunami can be the result.
- A tsunami is the vertical displacement of the entire water column of the (entire) ocean.
- A tsunami moved the entire thickness of the water from the bottom to the surface.
- A tsunami is the sudden vertical rise of the sea surface usually caused by an earthquake, volcanic activity, undersea landslide, etc.
- A tsunami is generated by large, sudden displacement of water.

Comments/Notes:

- Concern that a tsunami is not always generated by an earthquake. Other causes of tsunamis are very rare.
 - Using the term 'vertical displacement' helps differentiate which earthquakes cause a tsunami and which do not.
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4. Tsunami characteristics (timing, appearance, size, speed, comparison to ocean waves, etc.)

- A tsunami can occur during any season of the year and at any time, day or night.
- The waves can keep coming for hours and days.
- A tsunami flows over the land like a river.
- A tsunami is like a fast-rising flood.
- A tsunami looks different in different situations.
- Many people make the deadly mistake that a tsunami is like regular ocean waves. A tsunami is like a quickly rising tide. What you see is not what you get (at first.)
- Imagine a river that flows from a dam break – that is analagous to a tsunami. A tsunami will continue to rush on for many minutes, rather than about 10 second for a wave to run on shore, break, then pull out.
- Different ways that a tsunami manifests itself. It can look different in different times/places.
- A small wave out at sea will stay small as it reaches shore.
- As tsunamis move into shallow water, the wave height can increase by over 10 times. [Needs a visual that shows something three feet high reaching 30 feet high (three-story building,)]
- Some tsunamis can be very large. In coastal areas their height can be as great as 30 feet or more (130 feet in extreme cases), and they can move inland several miles.
- Tsunamis come in different sizes and some of them can travel miles inland. A tsunami will not behave exactly the same in all locations along the coastline.

- There are local variations for any tsunami that can make dramatic differences in tsunami height. Information on predicted wave height is provided when tsunami warnings are issued.
- Tsunamis move faster than a person can run.
- When at the beach, tsunamis can move faster than a person can run.
- If you wait until you can see a tsunami, it may be too late to get to safety.
- Tsunamis can travel over 500 mph in the open ocean, and 30mph when they strike land. You cannot outrun a tsunami.
- In open water, unnoticed tsunami waves can travel at the speed of a commercial jet plane, nearly 600 miles per hour.
- Tsunamis can move from one side of the Pacific Ocean to the other in less than a half day.
- People underestimate how large, fast, and deep tsunami waves penetrate.
- Tsunamis can travel up rivers and streams.
- The time and distance between the crests of tsunami waves is different from the time and distance between regular ocean waves.
- What makes a tsunami different from weather – it is a shallow wave.
- The motion of the water from a wind wave is confined to a relatively shallow depth beneath the ocean's surface. A tsunami means the energy of the wave goes through the entire depth of the ocean.
- A tsunami wave comes on shore for a long time. It is a series of waves, not just one.
- You cannot surf a tsunami.
- Tsunamis have a periodic nature.

Comments/Notes:

- Public doesn't really need to know about wavelength or wave period.
- Need to “unteach” the “wall of water.”
- From the ground perspective, consider the image of what someone sees. They don't see wave periods. They see a river of water that comes on shore.
- Look for something that people can base their action on. You can base your action on a “river of water” over a long period wave.
- Stay away from talking about the sea surface only. We're talking about a tremendous amount of energy traveling through the entire ocean.
- The “gee-whiz” element is that the entire ocean column moves.
- Energy in the water that could develop into different actions when it reaches the coast. (Put all of this energy in the ocean and this is what happens.)
- Why do people need to know that tsunamis can rise to great heights? When look out to sea, you won't see a big wall of water. You may see a wave growing as it approaches the shore.
- “As fast as a jet plane” – how fast they will get here across the ocean. Goal is to imply that a jet can fly over an ocean quickly.

5. Tsunami terms

Local, regional, and distant

- A distant source tsunami is capable of widespread destruction near its source and across the ocean. A large magnitude earthquake is usually the cause of a distant tsunami. Also called “teletsunami”, “far-field tsunami” or “distant tsunami.”
- A distant source tsunami has public safety implications. You will not feel the earthquake if it happens on the other side of the ocean.
- A regional source tsunami is capable of widespread destruction with travel times within 1 - 3 hours, such as within the Caribbean Sea. (You may or may not feel it.) A tsunami that falls between a distant source and a local source tsunami.

Technical terms

- Amplitude is the deviation between mean sea level to the wave height.
- Wave height: The vertical distance between the wave peak and adjacent trough. [Need to include in definition how “wave height” is understood by the public on the shore. Am I high enough?]
- Magnitude: a different term from amplitude. Related to earthquakes, not tsunamis.
- Runup: ocean water pushed onto shore by a tsunami.

Comments/Notes:

- “Distant source” or “local source” tsunami. (Makes it clearer for the general public)
- The term “distant” and “local” tsunami seem to be inherently understandable.
- Local tsunami has a distinctly different nature to it.
- In Oregon, they use “distant” and “local” tsunami terms. These are important because they are two different hazards.
- Terms like “far-field,” “distant,” or “ocean-wide” introduce confusion.

6. Tsunami dangers

General messages about tsunami dangers

- Being overtaken by tsunami waters and the need to get to high ground
- Water level or height can change very suddenly
- Water is moving a lot faster than they are expecting it to.
- Tsunamis can change quickly and unexpectedly.
- Even small tsunamis are dangerous. You do not even need inundation to experience danger.
- Start of tsunami (first expected wave) will not be the worst. Subsequent wave(s) will be worse than the initial wave.
- A tsunami can cause widespread destruction. The destruction can be in the immediate area of the earthquake that generates a tsunami.
- The force of some tsunamis is enormous. Tons of rocks, boats, and other large debris can move inland hundreds of feet. Debris can act like a battering ram. All this material and water can trap, kill or injure people, and damage property.

- When the water goes down, the danger is not over. Expect another round of flooding and debris.
- Receding wave can cause just as much damage and danger (you can get pulled out to sea.)
- After wave comes in, when it goes out (receding wave), it draws out with a lot of debris in it and it can cause damage and danger.
- During a tsunami when the water flows back out to sea, it can still be dangerous. It is filled with debris and swift currents.
- Successive waves often have more debris in them and can be more dangerous.

Near beaches and rivers

- Water from a tsunami can come from behind as well as from the ocean
- Water can travel further up rivers than expected
- Water in a confined space of a river will behave differently than on an open beach front.
- Beaches, harbors, bays, and other low-lying areas, like river mouths, are at greatest risk.
- Tsunamis can travel up rivers and streams.
- Tsunamis are tricky – dangers include fast-moving currents up stream that can cause a flood from the opposite direction.
- Because some tsunamis cause swift currents to flow up and down a river, being near the river bank is dangerous.
- It is not safe to be on the beach or shore of a river because tsunami waves can quickly overtake you. Quickly move to high ground.
- In certain areas where topography is flat, tsunamis can travel miles inland, especially up rivers or streams.

Comments/Notes:

- People may be used to seasonal river flooding and not understand that a tsunami is a flood coming from a different direction and velocity than what they are used to from previous flooding events.
- “what a tsunami is like” and “what it is capable of doing” are powerful and important.
- As the tsunami attacks the coastline, it can rise ... “tsunami attack” catches attention.
- Debris is a major hazard unto itself.
- The word “trap” makes the large debris “more real.”

7. Tsunami safety messages (general) (more safety discussions to come)

All tsunamis

- Know where your safest areas (high ground/safe place) are.
- Know where your high ground is whether you are on a beach or on a river leading to an ocean.
- If a tsunami will happen in minutes, you have to act fast.
- If a tsunami is imminent, you have to act fast. (preferred) [Imminent means “about to happen”]
- If a tsunami is fast-approaching, you have to act fast.

- Once you get to a safe place, stay there until local officials confirm that the danger has passed.
- Once you get to a safe place, stay away from the danger zones until the danger has passed.
- These messages are designed to improve your chances of surviving. (Don't guarantee survival.)

Local source tsunami

- Sense an environmental clue – you will have to respond quickly.
- You may not get a second warning sign. You don't need to see all environmental clues as an indication of a tsunami.
- If you are on the beach or along a river and feel an earthquake, no matter how small, move inland or to high ground immediately.
- Stay away from rivers and streams that lead to the ocean as you would stay away from the beach and ocean if there is a tsunami.
- If you are at an area in danger of a tsunami, if you feel an earthquake, you need to move away from the shore. Consider using: car (four wheel drive truck is best), motorcycle or ATV, bicycle.

Distant source tsunami

- Rely on a tsunami warning
- Stay on high ground until you hear from local media that it is safe. (stay out of the tsunami danger zone.)

Comments/Notes:

- We need to keep in consideration of where we are relative to the event that causes the tsunami.
- In HI, response/considerations need to be distinct for local vs. distant. People don't always appreciate the distinction between them. They hear “tsunami warning” and assume the worst. In the past, most outreach was so focused on the local scenario (just run to high ground) that people tend to overreact to warnings, which are almost always distant. We want to educate people about the different types of threats, messages, and appropriate responses for each case.
- Localities need to be clearly designated and signed properly so they can see where the assembly points are.
- Thinking about “high ground” as being accessible by driving a car to get to. This is a problem – stuck in traffic, get trapped and potentially injured or killed. (especially if people have not done a tsunami walk drill.)

8. Vertical evacuation

- If you are blocked from reaching your identified high ground due to downed power lines, damaged roads or bridges, or mudslides, then look for secondary high ground and go there. If no secondary high ground exists or is also blocked, then consider other options. First look for the highest strongest building that you can reach before the wave arrives. If one exists then go up as high in the building as you can go. If no buildings are available, then climb a tree, etc.
- Short message: Try to go to alternate high ground, but if you can't, go to an alternate site.
- Have a backup plan. (leverage notion of vertical evacuation.)
- Find the tallest, strongest building as far inland as you can get (before the tsunami arrives). Go up as high in that building as you can.
- Vertical evacuation is a good option when moving inland to high ground is not available or you don't have enough time.

- Do not count on the roads – go into a building and up to (which) floor, climb a tree, climb onto something that floats.
- If a tsunami is on its way and you are not within walking distance before wave arrival...
- If your access to high ground has been blocked....
- If you cannot get to high ground (road or path is blocked)...
- When higher ground is inaccessible...

Comments/Notes:

- Messages are situation-dependent:
 1. Rural, sparse population that is close to the coast
 1. No strong multi-story buildings or other options for vertical evacuation
 1. High ground is too far away to reach by foot before wave arrival
 1. Access is blocked such as high power/high current transmission lines or a small bridge
 - How many floors high? In Japan, the tsunami reached the 5th floor of at least one building.
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9. Maritime safety

- In past tsunamis, currents have been known to exceed (x) knots within ports and harbors.
- Even if the surface of the water does not look turbulent, currents can still be dangerous and damaging.
- Currents are just as dangerous as tsunamis inundating land.
- Dangerous currents cannot necessarily be seen from the surface.
- If natural warnings indicate that a tsunami could arrive within minutes, then leave your boat and go to high ground on foot as soon as possible. You do not have time to save your boat in this situation and could die if you try to.
- If you are on the water but very near shore and can beach or dock your boat and get to high ground on foot within ten minutes of a natural warning, then this is your best chance. If that is not possible, head to deep water as quickly as possible.
- If you are in deep water or very close to deep water (30 fathoms - 180 feet), then you are safe from tsunamis. [This is not officially adopted language yet. Used to say 100 fathoms, but new research is showing that a more shallow recommendation will be what's to be used. Based on modeling of five areas in California based on various scenarios.]
- If you are in deep water but not quite 30 fathoms, head to deeper water.
- Since tsunami wave activity is imperceptible in the open ocean, do not return to port if you are at sea and a tsunami warning has been issued for your area. Tsunamis can cause rapid changes in water level and unpredictable dangerous currents in harbors and ports.
- If you are out in the ocean while a tsunami is going on, you may need to stay out for a long period of time.
- Considerations when deciding to head out to sea:
 1. do you have enough fuel, food, water to remain at sea for an extended period of time
 1. there are places within harbors that have more damaging currents than others. There are opportunities to reposition boats

to other places within harbors for boater safety.

1. it is possible to apply lessons about current behavior to construct harbors to be more safe during a tsunami event.
1. how significantly different a tsunami can be from one harbor to the next. Just because one harbor is safe, the neighboring harbor may not be.
1. a tsunami is different from moment to moment and location to location.

End of event

- Message is “it is safe to return” (with local context of where safe.)
- For boaters out on the water: When an event is canceled, contact the port authority for specifics about that port and its safety to return.
- Boats trying to return too soon cause life-safety problems for both the boaters and the authorities. Entering a harbor entrance when currents are too strong for navigation can possibly cause some boats to be damaged or to sink.

10. Misc.

These messages have not yet been covered in a webinar, but were mentioned in prior calls and are noted here for future reference:

- There is no “all clear” for tsunamis as there once was for nuclear attack (outdated language carried forward by the process of folklore.)

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Tsunami Education

Tsunami Messaging Project

Summary of Tsunami Messaging Project discussions and results from May 1 through July 24

Since the last summary of progress from December 19, 2013, through April 17, 2014, six more web-enabled discussion sessions were held for this project. Results of these discussions are below.

10. Tsunami warning signs (environmental clues) – local tsunami events

General:

- A natural tsunami warning means there may be a reason to be concerned. Do not rely solely on a natural warning. Get more information if you sense a natural warning. (Note: This conflicts with later discussions. Depends where you are. If you are on the beach, get to safety first.)
- You will be lucky if you sense ONE natural warning. You may not sense them all.
- You cannot outrun a tsunami. (Not: it is too late to save your life if you observe these natural warnings.)

Earthquake:

- In case of earthquake, go to high ground or inland. (CA sign)
- If you feel a long earthquake...
- After feeling an earthquake that lasts a long time...
- If you feel the ground shake, get to high ground.

Abnormal ocean activity (ocean looks strange):

- ...a sudden rise or fall of the ocean...
- ...ocean pulls away like a very sudden, very low tide exposing the ocean floor, reefs and fish...
- A tsunami may look like a fast-rising flood or wall of water.
- If you see the ocean behaving this way, you need to take action immediately. (alt: take action steps)

Sound (ocean sounds strange):

- ...a loud roar like a train, airplane, or truck; gravel swishing; bubbling sounds; dead quiet...

Comments/Notes:

- Use “nature” or “natural” vs. “environmental” warnings. Why? The word “environmental” is complex.
 - It is ok to call them nature's warning signs or natural warning signs.
 - People gauge the strength and duration of earthquake shaking differently.
 - Ground shaking may not be strong, but it may still cause a tsunami (e.g., tsunami earthquake, earthquake that causes a landslide-generated tsunami).
 - Science – sound will precede ocean behavior change.
 - Use existing messages about sound.
 - Some later discussions suggested using the word rolling to describe the earthquake.
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11. Tsunami safety – Earthquake at the Beach

There is much more discussion, background, and informative research on [on this page](#).

- If you are on the beach and feel shaking of an earthquake, get off the beach and find out if you need to keep going and move to a safe location. (Note: This conflicts with information from other discussions, which suggested getting to safety - high ground - before getting information.)

Comments/Notes:

- The message above may need to be adjusted for readability, but the main points are, if on the beach and feel earthquake shaking, leave the beach, find out more information, and go to a tsunami-safe area if additional info indicates you need to do so.
 - Because it takes longer to rupture a long fault than it takes to rupture a short fault and long fault earthquakes are more likely to produce a tsunami.
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12. Tsunami Safety

There were four discussions about tsunami safety:

During Alerts:

General:

- Tsunami advisories and warnings are issued by NOAA. Radio and TV stations will carry official shoreline evacuation instructions through the Emergency Alert System.

Warning:

- Both natural and official tsunami warnings are equally important. Respond to whatever you hear or observe first!
- Do not rely on a siren or wireless emergency alert. Use the natural warning as your indicator to take action.
- If you are at home and hear there is a tsunami warning, you should make sure your entire family is aware of the warning.
- If you are in school and hear there is a tsunami warning, you should follow the advice of teachers and other school personnel.
- Move away from the beach. Get more information from local radio or TV stations or your mobile device.
- Follow the directions of emergency personnel. They may ask you to evacuate beaches and low-lying coastal areas.
- Limit phone calls to life-threatening emergencies.
- Keep listening to NOAA Weather Radio and local radio or TV for the latest updates.
- If you are in a safe area, stay where you are.

Advisory:

- If near the coast, stay away from bodies of water.
- There may be possible strong and dangerous currents. Listen carefully to TV and radio and act.
- Clear the beach. Stay away from the harbor.
- Locate loved-ones and review evacuation plans. Be ready to move quickly if a tsunami warning is issued.

Watch:

- If you hear about a Tsunami Watch, stay tuned. It may change.

Comments/Notes:

- Use If ... and ... then statements to construct the sentences with messages like this. For example, if you are at (location) and (this happens) then (do this).

Evacuation and use of signage:

- Are you in the zone?
- Are you in a safe area? If yes, stay there. If no, go to a safe place.
- If you are in a [yellow zone] on the map, go to safety and get more information.
- If you are in a [yellow zone] on the map, then you should leave (evacuate on foot) after feeling an earthquake that lasts a long time.
- If you are in the [insert type/color] hazard zone on the map and you feel an earthquake that lasts a long time, then get out of the hazard zone and get more information.
- An assembly area is a designated safe place for people to gather during a tsunami warning. You do not have to go far to get out of the hazard zone. (Alt name: evacuation site)

Comments/Notes:

- May have to differentiate between an assembly area and a shelter.

Safety zones and evacuation:

- If you are on the beach and feel a long, rolling earthquake, protect yourself from the earthquake (drop, cover and hold on), then move off the beach to high ground, and get more information. (Note: earlier discussions emphasized getting information first - in part to avoid overevacuation.)
- In case of earthquake, go to high ground or inland. (CA signs)
- In case of earthquake, go to a safe place or inland.
- Know where your safe high ground is.
- If you know where your zone is, you will be better prepared to evacuate properly.
- A "Leaving Tsunami Zone" sign means that you have gone far enough.
- How high and how far you need to go to get to a safe place will vary by location. Tsunami evacuation maps will provide more specific information.
- When you have no map, signs, or other information to guide you, listen to local media (TV, radio), ask a local resident, or move to an area 100 feet above sea level or two miles inland.

Comments/Notes:

- East Coast prefers: "Go inland" first THEN to "high ground."
- "The biggest tsunami ever (here) was as high as..." helps to recast their understanding.
- 100 feet above sea level or two miles inland is a general guideline that errs on the side of safety.

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