Tsunamis IN HAWAI'I

prepared by
Tsunami Memorial Institute

compiled by
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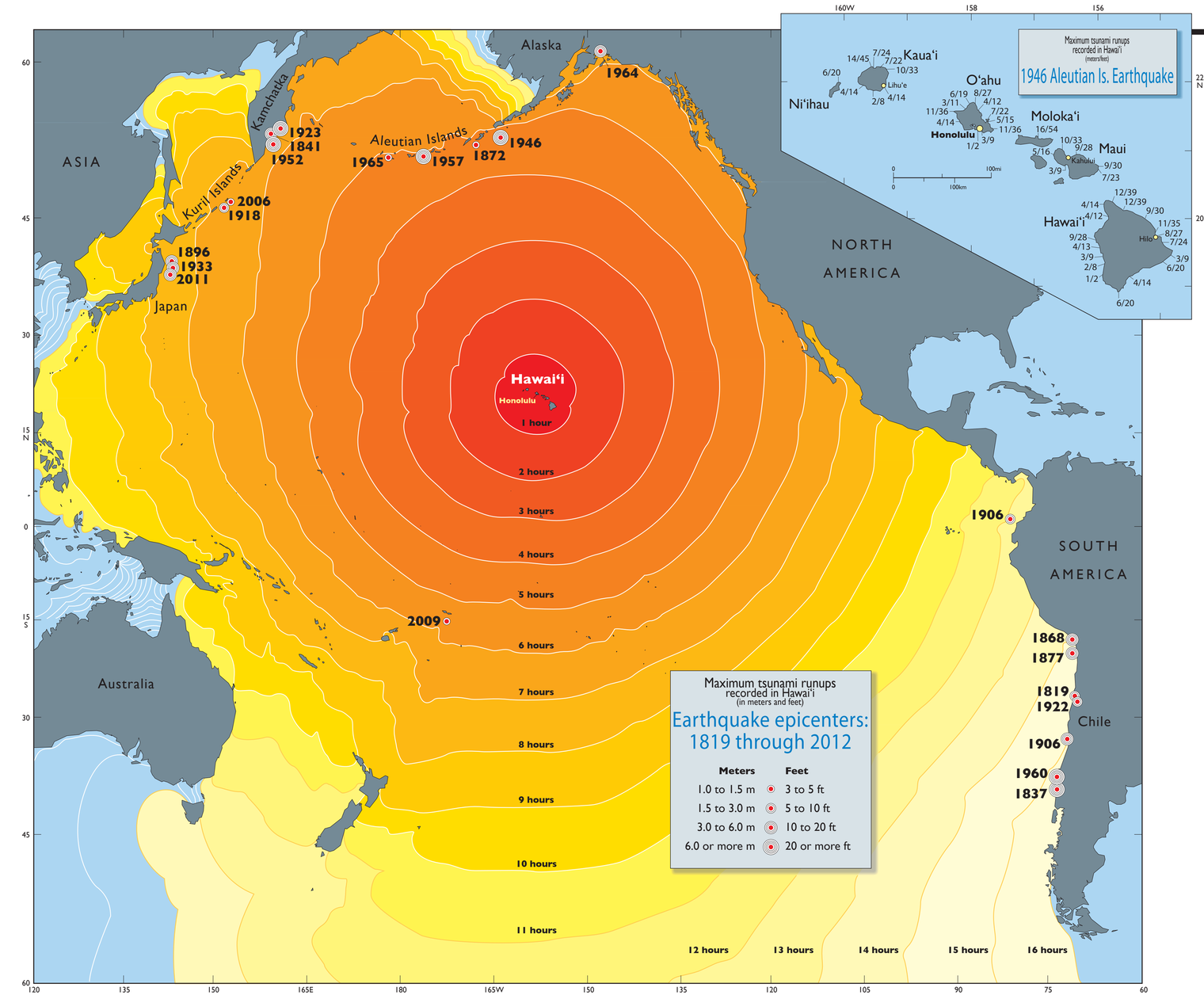


'Iliki ke kai i ka 'ope'ope la, lilo;
i lilo no he hawawā.

Literal translation
The sea snatches the bundle, it is gone;
it goes when one is not watchful.

Interpretations
A person who fails to watch out often loses.
Never turn your back on the sea.

Data shown in the main map are the source locations and years of origin for Pacific-wide tsunamis from 1819 through 2012. Also shown are the maximum reported wave heights on land in low-lying coastal areas of the Hawaiian Islands for these tsunamis. Such measures of tsunami wave heights or amplitudes are also referred to as **runups**. Similarly, the horizontal distance inland that is flooded by a tsunami is referred to as **inundation**. Contours indicate the travel times (in hours) to Honolulu of a tsunami with an origin lying along a given contour. For example, tsunamis originating in Chile might take 15 hours to reach Honolulu, and some tsunamis originating in the Aleutian Islands would arrive in about five hours.

Runup values throughout the main Hawaiian Islands for the 1 April 1946 tsunami, originating in the Aleutian Islands, are given in the inset map (upper right corner of the main map).

Maximum reported runup values are shown in the figure to the right for all large Pacific-wide and locally generated tsunamis (i.e. runups ≥ 1 meter or 3.28 feet) from 1900 through 2012. Islands on which these runups were measured are indicated for the largest tsunamis. All runups for locally generated tsunamis were measured on the island of Hawai'i.

Although devastating tsunamis have not struck Hawai'i in recent years, their recurrence is inevitable. Therefore, residents and visitors in low-lying coastal areas should be aware of the facts and suggestions given in the "What you should KNOW" , "What you should DO", and "Tsunamis and SURFING WAVES" sections below.

Recommendations for further reading
For interesting discussions and first person testimonies on the devastating and tragic effects of past tsunamis in Hawai'i, we recommend *Tsunami!* by Walter Dudley and Min Lee (1998). For more information on confirmed locally generated tsunamis refer to Cox and Morgan, (1977), Lander and Lockridge (1989), or Walker (1999). Additional testimonies and educational displays may be found at the Pacific Tsunami Museum in Hilo.

We also recommend publications available from NOAA's International Tsunami Information Center in Honolulu (http://www.tsunamiwave.info).

Graphics and design by Brooks Bays, and travel time contours by Pāl Wessel.

References

Cox, D.C. and J. Morgan, 1977, *Local Tsunamis and Possible Local Tsunamis in Hawai'i*, HIG-77-14, Hawai'i Inst. of Geophysics, 118 pp.

Dudley, W. and M. Lee, 1998, *Tsunami!*, Univ. of Hawai'i Press, Honolulu, Hawai'i, 362 pp.

Lander, J.F. and P.A. Lockridge, 1989, *United States Tsunamis (including United States possessions) 1690–1988*, National Geophysical Data Center, Publication 41-2, Boulder, Colorado, 265 pp.

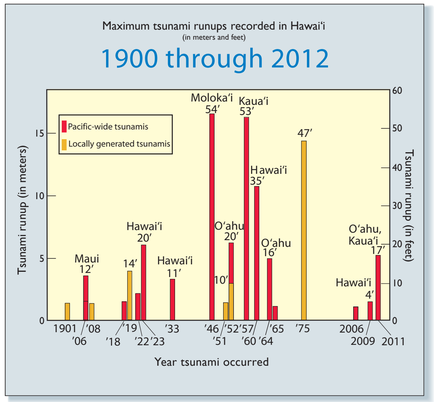
Miller, J. and V. Roeber, 2012, *Final Report Tsunami Observer Program and the Tsunami of March 11, 2011*, Environmental Center, Univ. of Hawai'i, 24 pp.

Trusdell, F.A., Chadderton, A., Hinchliffe, G., Hara, A. Patenge, B., and T Weber, 2012, *Tohoku-Oki earthquake tsunami runup and inundation data for sites around the Island of Hawai'i*, U.S. Geological Survey Open-File Report 2012–1229, 36 pp.

Walker, D.A., 1993, *Pacific-wide Tsunamis Reported in Hawai'i from 1819 through 1990: Runups, Magnitudes, Moments, and Implications for Warning Systems*, School of Ocean and Earth Science and Technology Report 93-02, Univ. of Hawai'i, 17 pp.

Walker, D.A., 1999, *Issues Related to Local Tsunamis in Hawaii, Science of Tsunami Hazards (available on-line), 17-2, p. 71-84.*

Walker, D.A., 2000, Twentieth Century Ms and Mw Values as Tsunamigenic Indicators for Hawaii, Science of Tsunami Hazards (available on-line), 18-2, p. 69-76.



Dedicated to the young at heart
and the respectful enjoyment of Hawai'i's coastal environment.

WHAT YOU SHOULD KNOW

- A tsunami is an unusual increase in sea level that floods, or inundates, low-lying coastal areas. Tsunamis are usually generated by earthquakes that produce sudden shifts or displacements of the ocean floor. Tsunamis can occur at any time.
- Earthquakes that cause tsunamis in the Hawaiian Islands might occur far away (for example, along the Pacific margins of South America, Alaska, the Aleutian Islands, Kamchatka, the Kuril Islands, or Japan), or nearby (for example, on the Big Island or Maui).
- 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 after the arrival of the first wave. Tsunamis can wrap around islands and inundate all low-lying coastal areas.
- The first indication of some tsunamis might be the unusual disappearance of water, exposing the ocean floor and reefs. For other tsunamis the first indication might be an unusual wall of water. In other instances a tsunami may be a gradual flooding of low-lying areas.
- Some tsunamis in Hawai'i can be very large. On land, in low-lying areas, water levels can be as great as 50 feet or more above sea level, and tsunamis can sweep inland hundreds of feet. In coastal areas tsunamis can move faster than a person can run.
- Large tsunamis generated by earthquakes on, or near, the island of Hawai'i are also a risk for residents of, and visitors to, that island. In 1868 and 1975 runups as great as 47 feet were measured. Five other significant locally generated tsunamis have occurred in the 20th century.
- Although significant locally generated tsunamis have not struck any other Hawaiian islands in recorded history, such occurrences are possible.
- Shaking of the ground may be an early warning that a local tsunami may have been generated.
- Tsunamis can travel great distances up low-lying valleys and along the channels of rivers and streams.
- The force of some tsunamis is enormous. Objects weighing several tons are moved hundreds of feet, and homes and other buildings are destroyed. Without proper warnings many people could be killed or injured by tsunamis.
- The unusual currents and loosened debris associated with a tsunami can also be very dangerous and destructive.
- Although scientists can provide accurate estimates of the arrival times of tsunamis, they cannot yet provide totally accurate predictions of their destructive potential. More research and instrumentation is needed to improve the reliability of tsunami warnings.
- Be aware of the fact that if you are in a remote area, you might not be close enough to hear the nearest warning siren. In other areas, large volumes of noise generated by heavy surf or wind could make it difficult to hear warning sirens. Also, in the event of a local tsunami, some sirens may not be turned on before the area is struck by the tsunami.

More information is available at the Hawaii State Civil Defense website (http://www.scd.hawaii.gov).

WHAT YOU SHOULD DO

- Read "What you should KNOW". This knowledge could save your life!
- Tell friends and relatives about these facts. This knowledge could save their lives, too!
- If you are not certain, find out now before the next tsunami warning whether you live, work, or play in a tsunami evacuation zone. These areas, as well as the locations of public shelters and refuge areas may be found in the front pages of your telephone book.
- Discuss evacuation plans with friends or family now, so that sufficient telephone lines will be available for emergency personnel during a tsunami watch or warning.
- If you might need assistance, arrange to have a friend or neighbor help you in moving to an evacuation site, or to any safe place outside your evacuation zone.
- If you are a student at school and you hear sirens, you should follow the advice of your teachers or other school personnel.
- Some high, reinforced concrete buildings in low-lying areas may be strong enough to withstand most tsunamis and have adequate space for safe evacuations to higher floors. In the event of a tsunami watch or warning, check with building management personnel on what you should do.
- **If you are at the beach or in a low-lying coastal area and you feel the earth shake, move immediately to higher ground. Do not wait for the sirens to sound. A tsunami from a local earthquake could strike some areas before the sirens could be turned on. Even if you don't feel the earth shake, be aware of any unusual movement of the ocean. Some destructive, highly localized tsunamis could be generated by small earthquakes or submarine landslides for which the shaking of the earth is so small that it might not be felt in your coastal area.**
- Tsunamis don't happen very often. So you should enjoy Hawai'i's beaches and coastlines, but pay attention to possible signs of a tsunami and warning sirens. If you think a tsunami may be coming or you hear sirens, tell others, and move as quickly and safely as possible to higher ground, and try to find out what is happening once you are in a safe location.

TSUNAMIS AND SURFING WAVES

- Even though destructive tsunamis may have the same height as large surfing waves, they are much more powerful. Unlike surfing waves, the next tsunami wave is not one or two hundred feet behind its earlier wave. The crest of the next tsunami wave is out on the horizon. In other words, all of the ocean that you can see is one of the tsunami's waves. As a result, unlike a large surfing wave which quickly washes up and down the shore, the water keeps coming inland for many minutes with tremendous power when a tsunami floods low-lying areas.
- As these large volumes of debris laden water (i.e., with rocks, trees, rubbish, dirt, buildings, cars, etc.) recede back into the ocean, unpredictable powerful ocean currents are produced. Also, these outgoing waves can run into other onrushing tsunami waves resulting in walls of water with enormous power in a turbulent, unpredictable, and debris filled ocean. It is hard to imagine that a person who really understands the destructive potential of tsunamis would even attempt to watch a tsunami from a low-lying shoreline area, let alone try to surf a tsunami. **Such a ride could be short and deadly. Spectators in areas that are normally safe in big surf could also risk their lives.**

International Tsunami Information Center
National Oceanic and Atmospheric Administration (NOAA), National Weather Service