

# **Communications Plan for the Tsunami Warning System in the Pacific**

## **2005 2<sup>nd</sup> Draft Edition**

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## **SECTION 1: INTRODUCTION**

### **1.1. COMMUNICATION PLAN - OBJECTIVE**

The primary purpose of the Communication Plan for the Tsunami Warning System in the Pacific (TWSP) is to serve as the communications operating manual for the Pacific Tsunami Warning Center (PTWC) and for participants of the TWSP. For each country participating in the TWSP, Section 7 lists the contact points in each country, state, or dependency which receive Tsunami Warning, Watch, and Information Bulletins and the communication methods by which bulletins are sent from PTWC to those entities.

A secondary purpose of the Communication Plan is to provide a general overview of the nature of tsunamis and the operational procedures of PTWC. Accordingly, Sections 2 through 6 discuss the general nature of tsunamis, the operation of the TWSP, the communication methods and procedures for data acquisition from seismological and sea level stations and the dissemination of information to participating agencies.

### **1.2 ADMINISTRATIVE PROCEDURES**

The United States Department of Commerce, National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS) operates and administers the tsunami warning program for the United States. The Pacific Tsunami Warning Center in Ewa Beach, Hawaii has mission responsibility as the operational center for the TWSP, is the U.S. National Tsunami Warning Center for U.S. national interests throughout the Pacific basin, and is also as the Hawaii Regional Tsunami Warning Center. The other U.S. center is the West Coast / Alaska Tsunami Warning Center in Palmer, Alaska. It has responsibility for Alaska and U.S. West Coast as well as for the Canadian Province of British Columbia. U.S. program management is the responsibility of the Director, NWS Pacific Region, in Honolulu, Hawaii. He is also the U.S. National Contact to the International Coordination Group for the TWSP (ICG/ITSU), a subsidiary body of the UNESCO Intergovernmental Oceanographic Commission. His mailing address is:

Director  
NWS Pacific Region  
737 Bishop Street, Suite 2200  
Honolulu, Hawaii 96813  
U.S.A.

Internationally, participating countries are organized under the UNESCO Intergovernmental Oceanographic Commission (IOC) as the International Coordination Group for the TWSP (ICG/ITSU). The PTWC is the operational center for the TWSP. The International Tsunami Information Centre (ITIC), located in Honolulu, Hawaii, was established upon the request of IOC and is maintained by the

## Communications Plan TWSP

### Page 2

U.S. National Weather Service. ITIC serves many roles in assisting participating countries in planning for and mitigating the effects of tsunamis. The mailing address for ITIC is:

Director  
International Tsunami Information Centre  
737 Bishop Street, Suite 2200  
Honolulu, Hawaii 96813  
U.S.A.

PTWC is responsible for the preparation and dissemination of the Communication Plan for the TWS and the issuance of changes thereto. All changes and comments concerning the Communication Plan should be submitted to PTWC for inclusion in future editions of the Communication Plan. The blank form in section 7 of this Communication Plan may be copied and used for this purpose. Additional copies of the Communication Plan may be obtained from PTWC. The mailing address for PTWC is:

Director  
Pacific Tsunami Warning Center  
91-270 Fort Weaver Road  
Ewa Beach, Hawaii 96706  
U.S.A.

The following organizations will maintain up-to-date copies of the Communication Plan: Tsunami Warning Centers; NWS Alaska Region, Pacific Region, Western Region and National Headquarters; the ITIC; IOC Headquarters; ICG/ITSU National Contacts; all designated operational contact points for receiving Tsunami Warning, Watch, and Information bulletins; communication centers serving the above; and others who have a demonstrable need for the Plan.

## **SECTION 2: TSUNAMI**

### **2.1 TERMINOLOGY**

"Tsunami" is the Japanese term meaning harbor wave. As such it is most descriptive of the observed phenomenon sometimes referred to as tidal wave or seismic sea wave. In South America, the term "maremoto", or moving sea, is frequently used. However the word "tsunami" is most commonly accepted by scientists and by most of the lay public in Pacific basin countries.

For the PTWS, tsunamis can be categorized as local, regional, or Pacific-wide, with those terms being used to describe the extent of potential destruction relative to the tsunami source area. Local tsunamis are those with destruction generally limited to within 100 km of their source. They can be generated by earthquakes but are often associated with submarine or subaerial landslides or volcanic explosions. An extreme example of a local tsunami is the one that occurred on July 9, 1958, at Lituya Bay, Alaska. Wave run-up exceeded 485 meters but the destruction was confined to a very limited area. Destructive local tsunamis with runups of no more than a few tens of meters are more common.

Regional tsunamis are those with destruction generally limited to within 1000 km of their source. Destruction may be limited in areal extent either because the energy released was not sufficient to generate a destructive Pacific-wide tsunami, or because the geomorphology of the source area limited the destructive potential of the tsunami.

Pacific-wide destructive tsunamis are much less frequent, but still occur a few times each century. Such tsunamis can have disastrous consequences because their source area is large, initial wave heights are great, and even distant coastal areas are subject to impact. The Pacific-wide tsunami of May 22, 1960, spread death and destruction across the Pacific from Chile to Hawaii, Japan, and the Philippines.

### **2.2 TSUNAMI GENERATION**

A tsunami is a series of very long ocean waves usually formed as a result of a large-scale vertical displacement of the sea over a short duration in time. Gravity returns the sea to equilibrium through a series of oscillations or waves that propagate outward from the source region. Most tsunamis are caused by vertical displacements of the seafloor associated with the occurrence of great earthquakes. However, tsunamis can also be generated by submarine volcanic eruptions, by the movement of submarine sediments, by coastal landslides, and even by meteor impacts.

Every major earthquake generates seismic waves or vibrations that can be detected and measured by seismic stations throughout the world. However, not all major coastal or near-coastal earthquakes produce tsunamis. At present, there is no operational method to determine from the seismic data alone if a tsunami has been generated. The seismic data only indicates a level of tsunamigenic potential and it is necessary to detect the arrival of the characteristic tsunami waves with a network of coastal or deep ocean sea level stations.

### **2.3 EARTHQUAKE SEISMOLOGY**

When a major earthquake occurs, the resultant energy released into the earth will propagate with a wide range of frequencies and velocities. Although earth movements discernible to a person may be confined to a region near the earthquake epicenter, the various seismic waves propagating throughout the earth result in small, but measurable, ground motion which can be detected by a seismometer. Such signals can be recorded in digital form for analysis on a computer.

For tsunami warning purposes, probably the most important earthquake early signal is the P-wave. It is a compressional or pressure wave that travels through the earth's interior at a velocity that varies from approximately 8.0 km/second near the crust-mantle boundary to about 13.5 km/second at the mantle-core boundary. It is the first seismic phase to be recorded at each seismic station and it provides the

earliest indication that a distant earthquake has occurred. P-wave travel times in the earth as a function of distance from and depth of the epicenter are known. Thus, the location and depth of the earthquake can be determined by finding the best fit to the pattern of P-wave arrival times from many stations. The earthquake moment magnitude,  $M_w$ , can also be quickly estimated from long period P waves recorded by broad-band seismometers. This type of measurement of  $M_w$  is called  $M_{wp}$ .

Another kind of seismic energy is trapped within the upper layers of the earth. These waves, called surface waves, are the basis for measuring an earthquake's mantle magnitude,  $M_m$ , using vibrations with periods (the time of one wave cycle) between 50 and 400 seconds. There is a simple direct relation between the mantle magnitude and the moment magnitude. For earthquakes with magnitudes greater than 8.0 as well as for slow-rupturing earthquakes, the moment magnitude computed using the mantle magnitude is more accurate than  $M_{wp}$ . However, because the surface waves travel move slowly than the P-waves,  $M_w$  based on  $M_m$  is typically not available for tens of minutes after the initial earthquake evaluation based on  $M_{wp}$ .

## **2.4 TSUNAMI PROPAGATION**

Tsunami waves travel outward in all directions from the generating area, with the direction of the main energy propagation generally being  $90^\circ$  to the direction of the earthquake fracture zone. A key characteristic that makes tsunami waves differ from other ocean waves such as wind waves or tides is their period, the time of one wave cycle. Tsunami wave periods range from 5 minutes to as much as 60 minutes compared with just a few seconds for wind waves and many hours for tides. Their speed depends on the depth of water, and the speed and direction of the tsunami waves change as they pass through an ocean of varying depth. In the deep ocean, they typically travel at speeds of 500 to 1,000 kilometers per hour (300 to 600 miles per hour), and the distance between successive wave crests can be as much as 500 to 650 kilometers (300 to 400 miles). However, in the deep ocean, the height of potentially destructive tsunami waves may be no more than a few centimeters (1 to 3 inches), and is usually no more than a meter. Variations in the strength of propagating tsunami waves are due to the shape and size of the source region, absorptions and reflections at coasts, and to focusing or defocusing by the bathymetric features of the seafloor. Tsunamis have the characteristic that the wave energy extends through the entire water column from sea surface to the ocean bottom, even in mid ocean. It is this characteristic that accounts for the great amount of energy transmitted by a tsunami.

Waves of a tsunami in the deep sea have such great length and so little height they are not visually recognizable from a surface vessel or from an airplane. The passing waves produce only a gentle rise and fall of the sea surface over a long time period. During the April 1946 tsunami in Hawaii, ships standing off the coast observed tremendous waves striking the shore but did not undergo any perceptible change in sea level at their offshore locations.

## **2.5 TSUNAMI IMPACT**

Upon reaching shallower water, the speed of an advancing tsunami wave diminishes to the speed of more ordinary wind-driven swell, its wave length decreases, and its height may increase greatly, owing to a compression of its energy and a piling up of the water. The configuration of the coastline, shape of the ocean floor, and character of the advancing waves play an important role in the destruction wrought by tsunamis along any coast, whether near the generating area or thousands of kilometers away. Consequently, detection of even relatively small tsunami waves at any locality warrants immediate reporting to the PTWC to assist in its evaluation of the tsunami and facilitate warning against further impacts.

Detection of tsunamis is usually made by sea level stations at the shore where the shoaling effect can be observed. The first visible indication of an approaching tsunami can be a recession of water caused by the trough preceding an advancing wave. Any withdrawal of the sea, therefore, should be considered a natural warning of an approaching tsunami wave. A rise in water level also may be the first event.

The force and destructive effects of tsunamis should not be underestimated. At some places, an advancing turbulent front is the most destructive part of the wave. Where the rise is quiet, the outflow of water to the sea between crests may be rapid and destructive, sweeping all before it and undermining roads, buildings, and other works of man with its swift currents. Debris picked up and carried by the strong and persistent currents can cause great damage. Most people killed by tsunamis are crushed, not drowned. Ships, unless moved away from shore, can be thrown against breakwaters, wharves, and other craft, or washed ashore and left grounded during withdrawals of the sea.

In the shallow waters of bays and harbors, a tsunami frequently will initiate seicheing – an almost frictionless slow oscillation of the body of water back and forth. If the tsunami period is related closely to that of the bay, the seiche is amplified by the succeeding waves. Under these circumstances, maximum wave activity often is observed much later than the arrival of the first wave.

A tsunami is not one wave, but a series of waves. The time that elapses between passage of successive wave crests at a given point can range from 5 to 60 minutes. Oscillations of destructive proportions may continue for several hours, and even several days may pass before the sea returns to its normal state.

During the 101-year period from 1900 to 2001, 796 tsunamis were observed or recorded in the Pacific Ocean according to the Tsunami Laboratory in Novosibirsk. 117 caused casualties and damage most near the source only; at least nine caused widespread destruction throughout the Pacific. The greatest number of tsunamis during any 1 year was 19 in 1938, but all were minor and caused no damage. There was no single year of the period that was free of tsunamis.

17 percent of the total tsunamis were generated in or near Japan. The distribution of tsunami generation in other areas is as follows: South America, 15 percent; New Guinea Solomon Islands, 13 percent; Indonesia, 11 percent; Kuril Islands and Kamchatka, 10 percent; Mexico and Central America, 10 percent; Philippines, 9 percent; New Zealand and Tonga, 7 percent; Alaska and West Coasts of Canada and the United States, 7 percent; and Hawaii, 3 percent.

## 2.6 REFERENCES

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- Pararas-Carayannis, George, Catalog of Tsunamis in Hawaii, Revised 1977, World Data Center A for Solid Earth Geophysics, NOAA/Environmental Data Service. National Geophysical Data Center, 1977.
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## **SECTION 3: THE TSUNAMI WARNING SYSTEM IN THE PACIFIC**

### **3.1 OBJECTIVE**

The primary operational objective of the TWSP is to detect and locate major earthquakes in the Pacific region, to determine whether they have generated tsunamis, and to provide timely and effective tsunami information and warnings to coastal communities in the Pacific to minimize the hazards of tsunamis, especially to human life and welfare. To achieve this objective, the TWSP continuously monitors the seismic and sea level activity of the Pacific Basin.

### **3.2 DESCRIPTION**

The TWSP is an international program requiring the participation of many seismic, sea level, communication, and dissemination facilities operated by many nations throughout the Pacific Region. Administratively, participating nations are organized under the IOC as the International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU). The ITIC was established upon request of IOC and serves many roles in assisting ICG/ITSU member nations in mitigating the effects of tsunamis throughout the Pacific. The PTWC serves as the operational center for the TWSP. PTWC collects and evaluates data provided by participating countries, and issues appropriate bulletins to both participants and other nations, states or dependencies within or bordering the Pacific Ocean basin regarding the occurrence of a major earthquake and possible or confirmed tsunami generation.

### **3.3 OPERATIONAL PROCEDURES**

Functioning of the system begins with the detection of an earthquake of sufficient size to trigger an alarm at PTWC. Generally this will occur for any earthquake in the Pacific region with a magnitude above 5.7. Duty personnel respond immediately and begin their analysis of the event. This will include automatic and interactive processes for determining the earthquake's epicenter, depth, and origin time, as well as its magnitude.

Based on these parameters, a decision is made concerning further action. If the earthquake is within or near the Pacific Ocean basin and its moment magnitude is greater than 6.5, but less than or equal to 7.5, or if it has a larger magnitude but is deep within the earth or located clearly on land, then a Tsunami Information Bulletin is issued to the TWSP participants. Tsunami Warning/Watch Bulletins are issued to the dissemination agencies for earthquakes of magnitude 7.8 or greater, alerting them to the possibility that a tsunami has been generated and providing data that can be relayed to the public so that necessary preliminary precautions can be taken.

If the earthquake appears to be strong enough to cause a tsunami and is located in an area where tsunami generation is possible, PTWC will check water level data from automatic tide stations located near the epicenter for evidence of a tsunami. If they show that a tsunami has been generated that poses a threat to the population in part or all of the Pacific, the Tsunami Warning/Watch Bulletin is extended until there is no longer the threat of a destructive tsunami or it is upgraded to a Warning for the whole Pacific. The dissemination agencies then implement predetermined plans to evacuate people from endangered areas. If the tide station data indicate that either a negligible tsunami or no tsunami has been generated, PTWC issues a cancellation of its previously disseminated Tsunami Warning/Watch.

### **3.4 NATIONAL AND REGIONAL TSUNAMI WARNING SYSTEMS**

In some areas of the Pacific Basin national or regional tsunami warning systems function to provide timely and effective tsunami information and warnings to affected populations. For those coastal areas nearest the tsunami source region, the need for rapid data handling and communication becomes obvious. Because of the time spent in collecting seismic and sea level data, the warnings issued by

PTWC cannot protect all areas in the Pacific against tsunamis generated in adjacent waters. To provide some measure of protection within the first hour after generation for tsunamis in the local area, national and regional warning systems have been established by some countries. Among the most sophisticated of the national systems are those of France (French Polynesia), Japan, Russia, Chile and the U.S.A. Regional systems provide the earliest possible alert to the population within the immediate vicinity of the earthquake epicenter by issuing immediate warnings based on earthquake information without waiting for tsunami wave confirmation.

A Regional (or Local) Tsunami Warning Center is responsible for the detection of tsunamis originating within the regional area of responsibility, the prediction of their arrival time within the region and, if possible, coastal impact, and the provision of the earliest possible information and warnings to those national interests responsible for the life and safety of the population of those coastal areas nearest the tsunami source. To function effectively, these regional systems generally have data from a number of seismic and tidal stations telemetered to a central headquarters. Nearby earthquakes are located, usually in 15 minutes or less, and a warning based on seismological evidence is released to the population of the area. Since the warning is issued on the basis of seismic data alone, one may anticipate that warnings occasionally will be issued when tsunamis have not been generated. Since the warnings are issued only to a restricted area and confirmation of the existence or nonexistence of a tsunami is obtained rapidly, disruptions are minimized while a higher level of protection is obtained.

PTWC acts as the Hawaii Regional Tsunami Warning Center for tsunami generated within the Hawaiian Islands. A description of the Japanese regional warning system may be found in publications cited in Section 3.5. A description of the U.S. regional system for Alaska, Canada and the U.S. west coast is documented in through the NWS Tsunami Directives reference in Section 3.5.

A National Tsunami Warning Center is responsible for the detection of tsunamis that pose a threat to the national interests located outside the boundaries of the nation. For the United States, PTWC has responsibility as the U.S. National Tsunami Warning Center to provide tsunami warning services for any tsunami impacting U.S. national interests. A National Tsunami Warning Center predicts the tsunami's arrival time, coastal impact if possible, and provides timely and effective information and warnings to all national interests to minimize the hazards to human life and safety. Such information and warnings should be provided in the least possible time (generally within 10 minutes of when the threat has been determined) to allow national interests to implement the required safety procedures. If a threat has been determined to national interest and is located within the area of responsibility of a Regional Tsunami Warning Center, it should make provision to receive and heed these regional or local warnings as well.

### **3.5 REFERENCES**

Japan Meteorological Agency, "Tsunami Warning Service in Japan", paper presented in Agenda 1 (Summary of the Present System) of the Intergovernmental Oceanographic Commission Working Group on International Aspects of the Tsunami Warning System in the Pacific meeting at Honolulu, Hawaii. April 27-30. 1965. Tokyo. 1965.

National Weather Service, NOM, Operations Manual, Part F, Chapter 60, "Tsunami Warning Service".

Wadati, K.; Hirono, T.: and Hisamoto, S., "On the Tsunami Warning Service in Japan", International Union of Geodesy and Geophysics Monograph 24, Proceedings of the Tsunami Meetings Associated With the Tenth Pacific Science Congress, University of Hawaii, August-September 1961, Imprime par L'institut Geographique National, Paris, France, July 1963.

## SECTION 4: MESSAGE COMMUNICATIONS

### 4.1 OBJECTIVE

To ensure the timely and effective dissemination of tsunami warnings and information, communication methods capable of rapidly reaching all TWSP participants are essential. Since such traffic is relatively infrequent, existing communication channels are used instead of establishing a separate communication system. These include communications systems of the World Meteorological Organization, the International Civil Aviation Organization, the U.S. National Weather Service, the U.S. Defense Information Systems Agency and other more common systems such as telephone circuits and the internet.

### 4.2 Communications Services Available

PTWC utilizes the following communications services:

Service	TWSP User Audience
AUTODIN	U.S. Department of Defense and State Department facilities
AFTN	U.S. Federal Aviation Administration and International affiliates
NMC	US and International weather service offices
NWW	National Weather Service forecast subscribers and U.S. emergency service agencies
IDN	State of Hawaii Civil Defense offices
TELEX	Emergency service agencies in some South America and Pacific island states
INTERNET	Many international and domestic government agencies and academic institutions
FAX	All the above
NAWAS	U.S. emergency management agencies
HAWAS	Hawaii emergency management agencies
GTS	National Weather Service forecast subscribers
EMWIN	National Weather Service forecast and other subscribers



### **4.2.1 Description of Services**

#### **○ AUTODIN**

To disseminate tsunami messages to the U.S. Department of Defense, PTWC maintains an AUTODIN GateGuard terminal from which messages are uploaded through a secure telephone into the U.S. Defense Messaging System. The U.S. Pacific Command maintains a collective address, RUCRTWP – Tsunami Warning Pacific, to reach about 200 separate commands and agencies requiring PTWC's tsunami products.

#### **○ AFTN**

The Aeronautical Fixed Telecommunications Network (AFTN) is a world-wide system of circuits for the exchange of messages and/or digital data primarily for the safety of air navigation and for the regular, efficient and economical operation of air services. Since many flight service facilities must operate on a 24x7 basis they are logical contact points for tsunami messages that may require an immediate response.

#### **○ NMC**

The National Meteorological Center (NMC) circuit at the PTWC is a dedicated ASCII serial communication line between PTWC in Ewa Beach, Hawaii and the U.S. National Weather Service Telecommunications Gateway (NWSTG) in Silver Spring Maryland. This NMC circuit is used as a PTWC's means of sending Tsunami Bulletins into the international Global Telecommunications System (GTS) and into the domestic NWS AWIPS system. The primary audience for messages sent on the NMC circuit are meteorological agencies. Messages are transmitted with World Meteorological Organization (WMO) headers. All WMO headers describe a weather broadcast product. The NWSTG in Silver Spring MD maintains a database (the switching directory) that directs these products to the appropriate subscribers' circuits automatically. This is also the means by which PTWC receives much of its sea level data from stations throughout the Pacific Basin. Some meteorological agencies that operate and maintain seismic networks within their country submit seismic phase pick information to PTWC by the GTS.

#### **○ NWW**

The NOAA Weather Wire is a satellite broadcast service maintained by the NWS to disseminate weather products domestically. Both the Alaska Tsunami Warning Center and PTWC have uplink and downlink capability on the NWW system. Users of the the NWW system are comprised of Weather Service Offices and emergency management agencies. Receiver sites can program their selector box to receive any number of selected NWS products (or messages).

#### **○ IDN**

The Hawaii State Civil Defense maintains the Interisland Data Network that connects PTWC and all Hawaii State and County Civil Defense offices. Messages transmitted on this system are copied simultaneously to all IDN participants.

#### **○ Telex**

A commercial Telex service (MCI) is maintained. The primary audience for Telex messages are remote stations or dissemination agencies that do not have access to the other services available at PTWC.

#### **○ Internet**

PTWC is connected to the Internet by a high speed link. The Internet is used to send tsunami messages by email, to maintain its web site, and to receive seismic and sea level data.

○ **NAWAS**

The National Warning System is a nationwide dedicated voice telephone system connecting selected national defense, emergency management, and Coast Guard agencies. The circuit is supported by the Federal Emergency Management Agency (FEMA). Control over transmissions on the circuit is maintained by the National Warning Center at the Cheyenne Mountain Complex in Colorado.

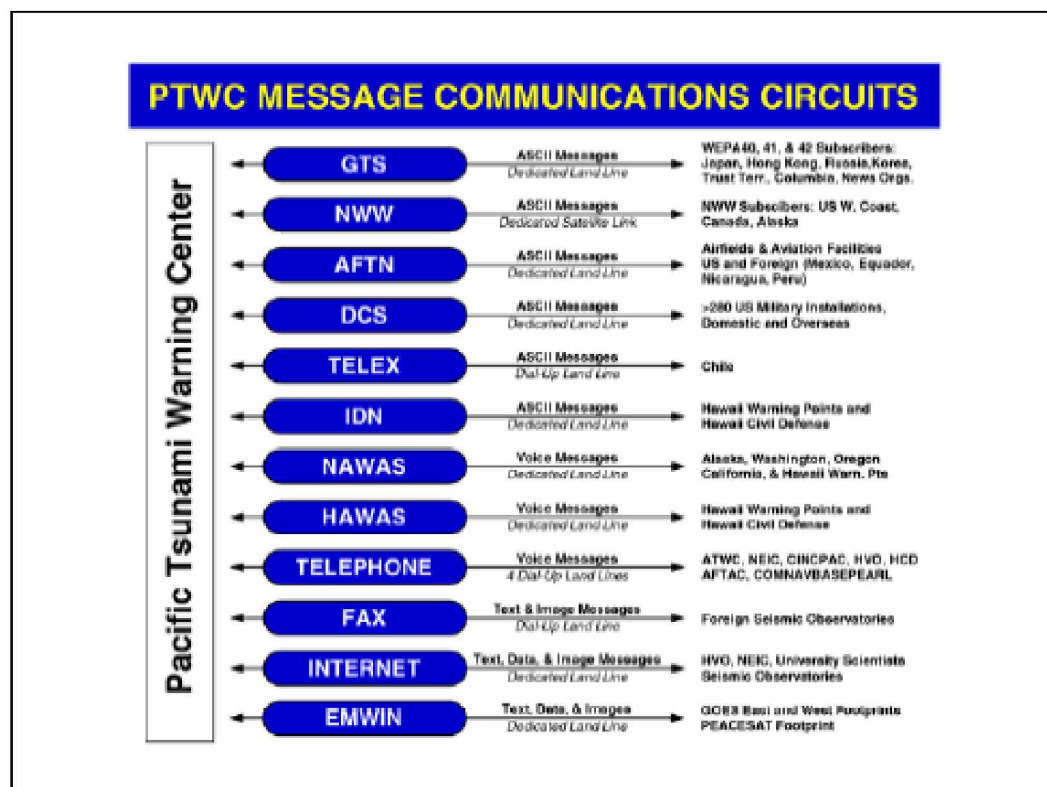
○ **HAWAS**

The Hawaii Warning System is a statewide dedicated voice telephone system connecting selected State Civil Defense, National Guard, Law Enforcement and Weather Service Offices. The circuit is supported by FEMA and Hawaii State Civil Defense. Control over transmissions on the circuit is maintained by the State Warning Point.

○ **GTS**

○ **EMWIN**

The Emergency Managers Weather Information Network -- EMWIN -- is a service that allows users to obtain weather forecasts, warnings, and other information directly from the National Weather Service (NWS) in almost real time. EMWIN is intended to be used primarily by emergency managers and public safety officials who need timely weather information to make critical decisions. EMWIN is a suite of data access methods which make available a live stream of weather and other critical emergency information. Each method has unique advantages. EMWIN's present methods in use or under development for disseminating the basic datastream include: radio, internet and satellite.



## **SECTION 5: SEISMIC AND SEA LEVEL STATIONS**

### **5.1 GENERAL**

The rapid acquisition of seismic and sea level data by PTWC is critical for operation of the TWSP. Most some seismic and sea level data are telemetered directly to PTWC in real or near real-time over the internet or dedicated circuits.

### **5.2 SEISMIC STATIONS**

#### **5.2.1 FUNCTION**

Data from seismic stations around the Pacific are the basis for the determination of earthquake epicenters and magnitudes by PTWC. Most of these data are provided to PTWC by the U.S. Geological Survey and the Global Seismic Network. The extent of the seismic network is shown in the figure below.

Standard short-period (0.5-2 sec/cycle) and long-period (18-22 sec/cycle) seismometers provide data to locate and size the earthquake. Data from broadband (0.01-100 sec/cycle) seismometers must be used for both of the above purposes and also for computing seismic moment, a better measure of size for the largest and most potentially tsunamigenic earthquakes. Seismic data is sent to the centers in real or near real time in the form of continuous waveforms, triggered waveforms, or parametric data (for example, P wave arrival times) using a variety of short and long range communications techniques. In certain cases, seismic data is completely processed by another observatory, and only earthquake location and magnitude are sent.

#### **5.2.2 DUTIES AND RESPONSIBILITIES**

Seismological stations report to PTWC as soon as possible after they have recorded P-phase arrival times for any large earthquakes in the Pacific. Individual observatories may be alerted that an earthquake has occurred either by an alarm attached to one of their instruments or by the arrival of a request for data.

### **5.3 SEA LEVEL STATIONS**

Tide gauge Data Collection Platforms (DCP) report water level data to PTWC on a near realtime basis continuously. There are approximately 100 such DCP's operating in the Pacific Basin. The extent of the Water Level Network is shown in Figure below.

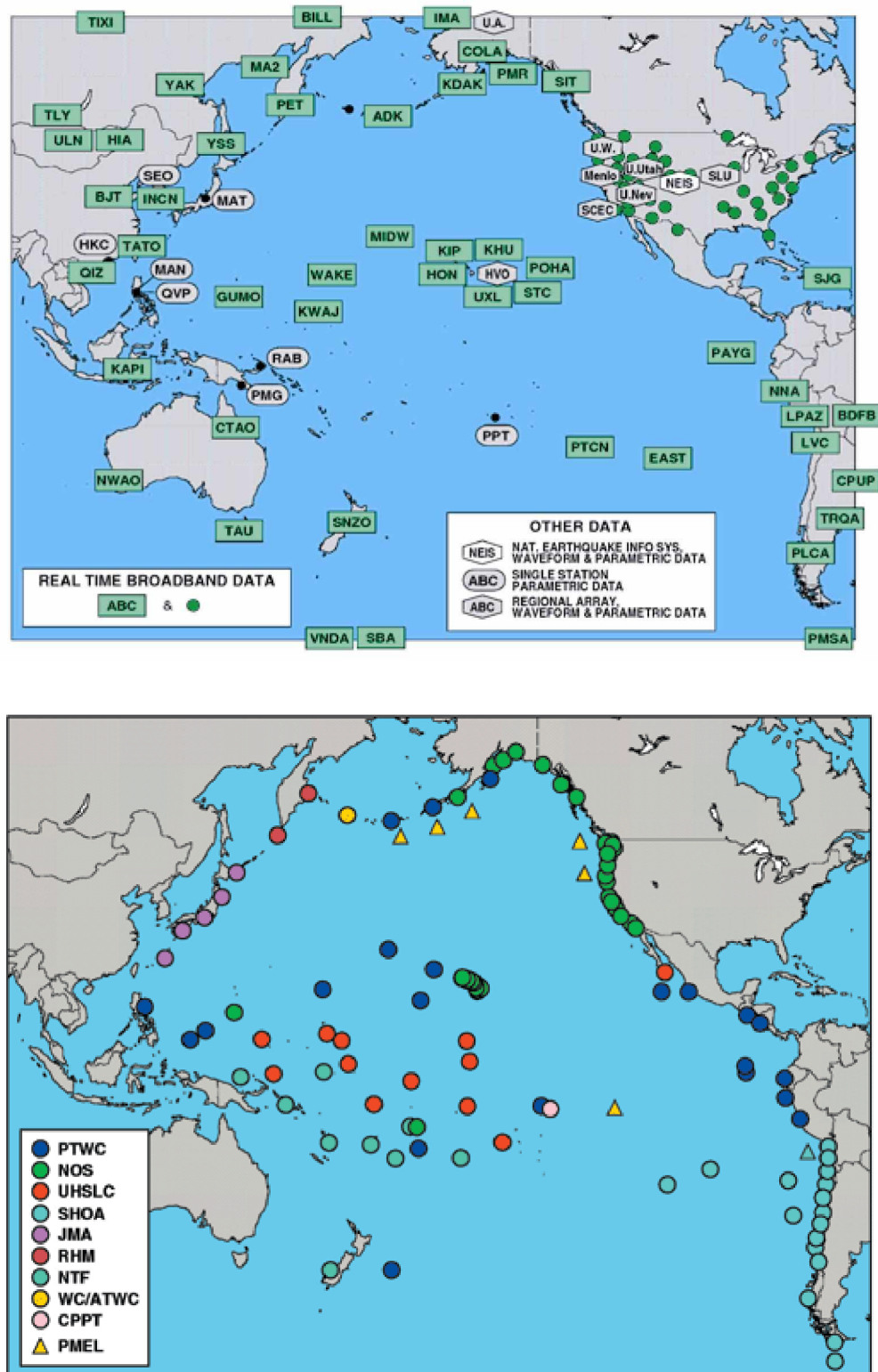


Fig 1: Seismic (top) and Water Level (bottom) Networks

## **SECTION 6: DISSEMINATION OF TSUNAMI WATCH AND WARNING INFORMATION**

### **6.1 DISSEMINATION AGENCIES**

#### **6.1.1 SELECTION OF AGENCY**

Tsunami Warning, Watch and Information bulletins are generally issued to only one authoritative agency in each country, territory, or administrative area. This contact point is designated by the central government or administrative head of the area concerned and has fundamental responsibilities for public safety and disaster mitigation. To ensure the proper operation of the warning system, the agency designated to receive tsunami warnings must submit to PTWC the names and/or offices of the responsible administrators and the communication procedures for reaching at any hour the head of the dissemination agency or a responsible assistant.

#### **6.1.2 FUNCTION AND RESPONSIBILITIES OF DISSEMINATION AGENCY**

The dissemination agency provides the last vital link between the TWS and the public, the ultimate user of the warning information. As such, the dissemination agency must motivate the public (by both education and, where possible, by law) to take necessary and desired actions to protect life and property. The dissemination agency and/or the governing body of an area subject to tsunami danger has the continuing responsibility for educating the public as to the dangers of tsunamis and for developing safety measures that must be taken to avoid loss of life and to reduce property damage.

It is the ultimate responsibility of the dissemination agency to evaluate the tsunami information received from PTWC and to decide on appropriate action after the receipt of a Tsunami Warning/Watch and Warning. Responsible agencies should have well-developed emergency plans for all threatened localities. These plans should clearly delineate areas of possible inundation. Evacuation routes should be designated and safe areas should be marked. The amount of advance warning necessary to ensure evacuation from danger areas also should be known. Emergency duties and responsibilities should be designated, and all affected officials should be thoroughly familiar with their duties. Tsunami Watch and Warning information may be passed (depending on the time and facilities available) to the coastal population by any or all of the following methods: radio, television, sirens, bells, whistles, warning flags, mobile loud speakers, and personal contact.

The U.S. National Weather Service, through PTWC and the International ITIC, will cooperate as far as possible in making available educational material for reproduction and distribution.

### **6.2 INFORMATION DISSEMINATION BY PTWC**

#### **6.2.1 DEFINITIONS**

The PTWC Pacific Tsunami Warning Center issues five basic types of messages as summarized below:

A. Pacific-Wide Tsunami Warning Bulletin - A message issued to all participants on a Pacific-wide basis after confirmation has been received that a tsunami capable of causing destruction beyond the local area has been generated and that poses a threat to the population in part or all of the Pacific. Approximately each hour updated information will be sent until the Pacific-wide Tsunami Warning is canceled.

B. Regional Expanding Tsunami Warning and Watch Bulletin - A message issued initially using only seismic information to alert all participants of the possibility of a tsunami and advise that a tsunami

investigation is underway. Tsunami Warning status will encompass regions having less than 3 hours until the estimated time of tsunami arrival. Those areas having 3 to 6 hours will be placed in a Watch status. Additional bulletins will be issued hourly or sooner until either a Pacific-wide tsunami is confirmed or no further tsunami threat exists.

C. Regional Fixed Tsunami Warning Bulletin - A message issued initially using only seismic information to alert all participants of the possibility of a tsunami and advise that a tsunami investigation is underway. The area placed in Tsunami Warning status encompasses coastal regions within 1000-km of the earthquake epicenter. A Regional Fixed Tsunami Warning will be followed by additional bulletins without expanding the warning area until it is either upgraded or is canceled.

D. Tsunami Information Bulletin - A message issued to advise participants of the occurrence of a major earthquake in the Pacific or near-Pacific area, with the evaluation that either (a) A Pacific-wide tsunami was not generated based on earthquake and historical tsunami data. This will be the only bulletin issued. No Pacific-wide tsunami warning is in effect; (b) An investigation is underway to determine if a Pacific-wide tsunami has been generated. Additional bulletins will be issued hourly or sooner as information becomes available. No Pacific-wide tsunami warning is in effect; or (c) No destructive Pacific-wide tsunami threat exists. However, some areas may experience small sea level changes. This will be the final bulletin issued unless additional information becomes available. No Pacific-wide tsunami warning is in effect.

If the event occurs in ATWC's area of responsibility and exceeds the ATWC Regional Warning threshold but is less than the PTWC Warning/Watch threshold, an investigation will be initiated by PTWC and additional Tsunami Information Bulletins will be issued until the investigation is concluded. Sections 6.2.5 and 6.2.7 provide further explanation and sample text.

D. Tsunami Communication Test Dummy Message - Test message issued by PTWC at unannounced times on a monthly basis to determine writer-to-reader delays in disseminating tsunami information, to test the operation of the warning system by the evaluation of two-way communications with interactive personnel response, and to keep communication operating personnel familiar with the procedures for handling message traffic pertaining to the TWS Tsunami Warning System. Sections 4.2, 6.2.6, and 6.2.7 provide further explanation and sample text.

## 6.2.2 SUMMARY OF OPERATIONAL PROCEDURES

A summary outline of the operational procedures used by PTWC for the issuance of the above bulletins as related to earthquake moment magnitude is as follows:

EARTHQUAKE MAGNITUDE	PTWC ACTION
A. Mw greater than Alarm threshold.	Issue an <b>OBSERVATORY MESSAGE</b> providing P-wave arrival time data and preliminary earthquake parameters to the USGS/NEIC and other observatories.
B. Pacific region event with Mw greater than 6.5, but less than or equal to 7.5. Or earthquake is larger but is deep inside the earth, clearly inland, or outside the Pacific Basin.	Issue a <b>TSUNAMI INFORMATION BULLETIN</b> , with the evaluation that a Pacific wide tsunami was not generated.
C. Shallow undersea Pacific Basin event with Mw greater than 7.5, but less than or equal to 7.8.	Issue a <b>REGIONAL TSUNAMI WARNING BULLETIN</b> for coastal areas within 1000 km of the epicenter. Update hourly until sea level gauge readings confirm no further threat exists.

D. Shallow undersea Pacific Basin event with Mw greater than 7.8	Issue a <b>REGIONAL TSUNAMI WARNING WATCH BULLETIN</b> putting coastal areas within 3 hours tsunami ETA into a warning and areas within 3-6 hours tsunami ETA into a Watch. Update hourly, expanding warning and watch areas appropriately, until sea level data confirm no further threat exists or until a Pacific-wide destructive tsunami is detected.
E. Confirmed Pacific-wide destructive tsunami	Issue a <b>PACIFIC-WIDE TSUNAMI WARNING BULLETIN</b> putting all coastal areas in the Pacific Basin in a Warning. Update hourly until sea level data confirm no further threat exists or until the tsunami has crossed the entire Pacific.

### 6.2.3 PACIFIC-WIDE TSUNAMI WARNING BULLETIN

When a major tsunami with Pacific-wide destructive potential is confirmed, a Pacific-Wide Tsunami Warning Bulletin will be sent to all participants of the TWSP. Pacific-wide Tsunami Warnings will contain estimated times of tsunami arrival (ETA) at specific forecast points in the warning system. Pacific-Wide Tsunami Warning Bulletins also normally will carry information on wave heights and other information as deemed appropriate by PTWC.

The Pacific-wide Tsunami Warning will be cancelled when it is determined that the tsunami threat is over for the entire Pacific Basin. A cancellation will also be issued if the Tsunami Warning was issued on the basis of erroneous data or if PTWC determines from subsequent information that only an insignificant wave has been generated. In addition, a Pacific-wide Tsunami Warning may be cancelled on a selective basis when a significant wave that has been generated clearly poses no threat to one or more of the areas PTWC warns, either because of intervening continents or islands which screen them or because the orientation of the generating area causes the tsunami to be directed away from these areas.

At present, PTWC does not have enough data available to enable it to determine when danger has passed in many for any given areas. Local conditions can cause wide variations in tsunami wave action. Consequently, all-clear determinations must be made by the local action agencies and not PTWC. In general, after receipt of a Tsunami Warning, action agencies can assume all-clear status when their area is free from damaging waves for 2 hours unless additional ETA's have been announced by PTWC or local conditions, particularly strong currents in channels and harbors, warrant the continuation of the Tsunami Warning status. If no wave or only insignificant waves occur, action agencies may assume all-clear status 2 hours after the latest ETA announced by PTWC, again taking caution as to the presence of strong currents in channels and harbors.

### 6.2.4 REGIONAL TSUNAMI WARNING/WATCH BULLETIN

A Regional Tsunami Warning/Watch Bulletin will be issued to all participants in the Pacific informing them of the occurrence of a major earthquake which could generate a potentially destructive tsunami for the Pacific community. (See Note below). A Regional Tsunami Warning/Watch Bulletin is transmitted to the same addressees and with the same precedence and priority as a Pacific-wide Tsunami Warning, i.e., FLASH precedence on AUTODIN circuits (using the CAD/CRI Tsunami Warning Pacific as listed in Section 4.3.4), on AFOS with priority 1, and on AFTN circuits with SS priority.

A Regional Tsunami Warning/Watch is issued based on earthquake location and moment magnitude, generally exceeding 7.8. The area within 3 hours tsunami travel-time of the epicenter will be placed in

a Tsunami Warning status, with the area within a 3-6 hour travel-time zone placed in a Watch status. Tsunami ETA's will be disseminated for the tidal stations within the Tsunami Warning and Watch areas. Action agencies so designated should evaluate the probability of a tsunami having been generated and decide on appropriate action. It must be emphasized that a Tsunami Warning/Watch is issued by PTWC based on earthquake information only, without confirmation of wave activity. Meanwhile, PTWC will have initiated an investigation by sending queries to the nearest tidal stations.

Bulletins subsequent to the first Tsunami Warning/Watch Bulletin will be issued on an hourly basis. This policy will be adhered to even when no new data are available. Additional bulletins will be issued until the Tsunami Warning/Watch is upgraded to a Tsunami Warning, or until PTWC determines that no tsunami was generated, at which time the Tsunami Warning/Watch will be canceled. If a small tsunami is detected, PTWC may extend the Tsunami Warning/Watch status until certain that no danger exists to further areas.

Note: For Alaska, British Columbia, Washington, Oregon and California. PTWC in its role as the international operational center for the TWS in the Pacific is the responsible warning center to all ICG/ITSU nations for tsunamis originating anywhere in the Pacific. PTWC in its role as the U.S. National Tsunami Warning Center is the responsible warning center to all U.S. national interests for tsunamis originating anywhere in the Pacific. The West Coast / Alaska Tsunami Warning Center (ATWC) functions as the Regional Tsunami Warning Center for Alaska and for the west coast of North America for tsunamis generated from Attu, Alaska to the southern California border. For tsunamis generated in the region from Attu to the southern California border PTWC Regional Tsunami Warning/Watch Bulletins will include a statement that the ATWC has issued a Regional Tsunami Warning. This is to minimize possible confusion for those dissemination agencies receiving both a Regional Tsunami WARNING/WATCH from PTWC and a Regional Tsunami WARNING from ATWC. Because ATWC's message is a Tsunami warning is the Regional Tsunami Warning Center and as such should have the most specific and timely information, its message it should be acted upon first by agencies in those areas.

## **6.2.5 TSUNAMI INFORMATION BULLETIN**

When a major earthquake occurs in a coastal or near-coastal location, or within the Pacific basin, generally with a moment magnitude from 6.5 to 7.8, PTWC will issue a Tsunami Information Bulletin, with the evaluation that a Pacific-wide tsunami was not generated. If PTWC's evaluation is such that tsunami generation is possible, queries will be sent to the nearest tidal stations will be monitored. A Tsunami Information Bulletin is transmitted on AUTODIN circuits with IMMEDIATE precedence (using the CAD/CRI Tsunami Warning Pacific), on AFOS with priority 1, and on AFTN circuits with SS priority. If ATWC issues a Regional Tsunami Warning for an event that is less than PTWC's Warning/Watch threshold, a Tsunami Information Bulletin will be issued by PTWC advising that an investigation is underway, and acknowledging that ATWC has issued a Regional Warning/Watch for (area).

On initiation of a tsunami investigation, additional bulletins will be issued hourly until the investigation is canceled, or positive information is received that a potentially destructive tsunami has been generated, at which

## **6.2.6 TSUNAMI COMMUNICATION TEST (DUMMY) MESSAGES**

A communication test is conducted about once a month. It is primarily intended to evaluate the communication capability from PTWC to selected dissemination agencies.

Tsunami Communication test Dummy or test messages (as described in Sections 6.2.1, and 6.2.6) are sent at unannounced time on a monthly basis to various selected dissemination agencies to test the operation of the warning system, to keep communication operating personnel familiar with the procedures for handling message traffic pertaining to the system, and to determine transmission times.



Tsunami Communication test Dummy messages from PTWC to dissemination agencies are transmitted via SS priority for AFTN circuits, priority 1 for AFOS, and FLASH precedence (using the CAD/CRI Tsunami Warning Pacific) for AUTODIN circuits to evaluate the effectiveness of real event communication. Responses from dissemination agencies may utilize a routine priority or Precedence for test messages.

The text of test messages, and ONLY test messages, will begin with the words "TSUNAMI COMMUNICATION TEST DUMMY" to distinguish these messages from other action bulletins transmitted by PTWC.

Samples of message text for a Tsunami Communication TestDummy are included in Section 6.2.7 for a dissemination agency.

## 6.2.7 SAMPLE MESSAGE TEXTS

TSUNAMI BULLETIN NUMBER 001  
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS  
ISSUED AT 2343Z 25 FEB 2005

THIS BULLETIN IS FOR ALL AREAS OF THE PACIFIC BASIN EXCEPT  
ALASKA - BRITISH COLUMBIA - WASHINGTON - OREGON - CALIFORNIA.

... TSUNAMI INFORMATION BULLETIN ...

THIS MESSAGE IS FOR INFORMATION ONLY. THERE IS NO TSUNAMI WARNING  
OR WATCH IN EFFECT.

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS

ORIGIN TIME - 2304Z 25 FEB 2005  
COORDINATES - 52.3 NORTH 160.7 EAST  
LOCATION - OFF EAST COAST OF KAMCHATKA  
MAGNITUDE - 6.7

EVALUATION

NO DESTRUCTIVE PACIFIC-WIDE TSUNAMI THREAT EXISTS BASED ON  
HISTORICAL EARTHQUAKE AND TSUNAMI DATA.

HOWEVER - EARTHQUAKES OF THIS SIZE SOMETIMES GENERATE LOCAL  
TSUNAMIS THAT CAN BE DESTRUCTIVE ALONG COASTS LOCATED WITHIN  
A HUNDRED KILOMETERS OF THE EARTHQUAKE EPICENTER. AUTHORITIES  
IN THE REGION OF THE EPICENTER SHOULD BE AWARE OF THIS  
POSSIBILITY AND TAKE APPROPRIATE ACTION.

THIS WILL BE THE ONLY BULLETIN ISSUED FOR THIS EVENT UNLESS  
ADDITIONAL INFORMATION BECOMES AVAILABLE.  
THE WEST COAST/ALASKA TSUNAMI WARNING CENTER WILL ISSUE BULLETINS  
FOR ALASKA - BRITISH COLUMBIA - WASHINGTON - OREGON - CALIFORNIA.

Communications Plan TWSP  
Page 18

TSUNAMI BULLETIN NUMBER 001  
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS  
ISSUED AT 2345Z 25 FEB 2005

THIS BULLETIN IS FOR ALL AREAS OF THE PACIFIC BASIN EXCEPT  
ALASKA - BRITISH COLUMBIA - WASHINGTON - OREGON - CALIFORNIA.

... TSUNAMI INFORMATION BULLETIN ...

THIS MESSAGE IS FOR INFORMATION ONLY. THERE IS NO TSUNAMI WARNING  
OR WATCH IN EFFECT.

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS

ORIGIN TIME - 2304Z 25 FEB 2005  
COORDINATES - 52.3 NORTH 160.7 EAST  
DEPTH - 238 KM  
LOCATION - OFF EAST COAST OF KAMCHATKA  
MAGNITUDE - 6.7

EVALUATION

A DESTRUCTIVE TSUNAMI WAS NOT GENERATED BASED ON EARTHQUAKE AND  
HISTORICAL TSUNAMI DATA.

THIS WILL BE THE ONLY BULLETIN ISSUED FOR THIS EVENT UNLESS  
ADDITIONAL INFORMATION BECOMES AVAILABLE.

THE WEST COAST/ALASKA TSUNAMI WARNING CENTER WILL ISSUE BULLETINS  
FOR ALASKA - BRITISH COLUMBIA - WASHINGTON - OREGON - CALIFORNIA.

TSUNAMI BULLETIN NUMBER 002  
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS  
ISSUED AT 0252Z 26 FEB 2005

THIS BULLETIN IS FOR ALL AREAS OF THE PACIFIC BASIN EXCEPT  
ALASKA - BRITISH COLUMBIA - WASHINGTON - OREGON - CALIFORNIA.

... A TSUNAMI WARNING IS IN EFFECT ...

A TSUNAMI WARNING IS IN EFFECT FOR

RUSSIA

FOR ALL OTHER PACIFIC AREAS, THIS MESSAGE IS AN ADVISORY ONLY.

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS

ORIGIN TIME - 1904Z 25 FEB 2005  
COORDINATES - 52.3 NORTH 160.7 EAST  
LOCATION - OFF EAST COAST OF KAMCHATKA  
MAGNITUDE - 7.7

#### EVALUATION

IT IS NOT KNOWN THAT A TSUNAMI WAS GENERATED. THIS WARNING IS BASED ONLY ON THE EARTHQUAKE EVALUATION. AN EARTHQUAKE OF THIS SIZE HAS THE POTENTIAL TO GENERATE A DESTRUCTIVE TSUNAMI THAT CAN STRIKE COASTLINES IN THE REGION NEAR THE EPICENTER WITHIN MINUTES TO HOURS. AUTHORITIES IN THE REGION SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS POSSIBILITY. THIS CENTER WILL MONITOR SEA LEVEL GAUGES NEAREST THE REGION AND REPORT IF ANY TSUNAMI WAVE ACTIVITY IS OBSERVED. THE WARNING WILL NOT EXPAND TO OTHER AREAS OF THE PACIFIC UNLESS ADDITIONAL DATA ARE RECEIVED TO WARRANT SUCH AN EXPANSION.

ESTIMATED INITIAL TSUNAMI WAVE ARRIVAL TIMES. ACTUAL ARRIVAL TIMES MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. THE TIME BETWEEN SUCCESSIVE TSUNAMI WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION		COORDINATES	ARRIVAL TIME
-----		-----	-----
RUSSIA	PETROPAVLOVSK-K	52.9N 158.3E	1926Z 25 FEB
	UST KAMCHATSK	56.2N 162.5E	1943Z 25 FEB
	MEDNNY IS	54.6N 167.6E	1946Z 25 FEB
	SEVERO KURILSK	50.6N 156.3E	2000Z 25 FEB
	URUP IS	45.9N 150.2E	2031Z 25 FEB

BULLETINS WILL BE ISSUED HOURLY OR SOONER IF CONDITIONS WARRANT.  
THE TSUNAMI WARNING WILL REMAIN IN EFFECT UNTIL FURTHER NOTICE.

THE WEST COAST/ALASKA TSUNAMI WARNING CENTER WILL ISSUE BULLETINS  
FOR ALASKA - BRITISH COLUMBIA - WASHINGTON - OREGON - CALIFORNIA.

Communications Plan TWSP  
Page 20

TSUNAMI BULLETIN NUMBER 002  
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS  
ISSUED AT 0253Z 26 FEB 2005

THIS BULLETIN IS FOR ALL AREAS OF THE PACIFIC BASIN EXCEPT  
ALASKA - BRITISH COLUMBIA - WASHINGTON - OREGON - CALIFORNIA.

... A TSUNAMI WARNING IS IN EFFECT ...

A TSUNAMI WARNING IS IN EFFECT FOR

RUSSIA

FOR ALL OTHER PACIFIC AREAS, THIS MESSAGE IS AN ADVISORY ONLY.

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS

ORIGIN TIME - 1804Z 25 FEB 2005  
COORDINATES - 52.3 NORTH 160.7 EAST  
LOCATION - OFF EAST COAST OF KAMCHATKA  
MAGNITUDE - 7.7

MEASUREMENTS OR REPORTS OF TSUNAMI WAVE ACTIVITY

GAUGE LOCATION	LAT	LON	TIME	AMPL	PER
NIKISKI	60.7N	151.4W	0057Z	0.52M	**MIN
SEVERO KURILSK	50.7N	156.1E	2042Z	0.12M	64MIN

TIME - TIME OF THE MEASUREMENT  
AMPL - AMPLITUDE IN METERS FROM MIDDLE TO CREST OR MIDDLE  
TO TROUGH OR HALF OF THE CREST TO TROUGH  
PER - PERIOD OF TIME FROM ONE WAVE CREST TO THE NEXT

EVALUATION

SEA LEVEL READINGS CONFIRM THAT A TSUNAMI WAS GENERATED. THIS  
TSUNAMI MAY HAVE BEEN DESTRUCTIVE ALONG COASTLINES OF THE REGION  
NEAR THE EARTHQUAKE EPICENTER. AUTHORITIES IN THE REGION SHOULD  
TAKE APPROPRIATE ACTION IN RESPONSE TO THIS POSSIBILITY. THIS  
CENTER WILL CONTINUE TO MONITOR SEA LEVEL GAUGES NEAREST THE  
REGION AND REPORT IF ANY ADDITIONAL TSUNAMI WAVE ACTIVITY. THE  
WARNING WILL NOT EXPAND TO OTHER AREAS OF THE PACIFIC UNLESS  
ADDITIONAL DATA ARE RECEIVED TO WARRANT SUCH AN EXPANSION.

FOR AFFECTED AREAS - WHEN NO MAJOR WAVES ARE OBSERVED FOR TWO  
HOURS AFTER THE ESTIMATED TIME OF ARRIVAL OR DAMAGING WAVES HAVE  
NOT OCCURRED FOR AT LEAST TWO HOURS THEN LOCAL AUTHORITIES CAN  
ASSUME THE THREAT IS PASSED. DANGER TO BOATS AND COASTAL  
STRUCTURES CAN CONTINUE FOR SEVERAL HOURS DUE TO RAPID CURRENTS.  
AS LOCAL CONDITIONS CAN CAUSE A WIDE VARIATION IN TSUNAMI WAVE  
ACTION THE ALL CLEAR DETERMINATION MUST BE MADE BY LOCAL  
AUTHORITIES.

ESTIMATED INITIAL TSUNAMI WAVE ARRIVAL TIMES. ACTUAL ARRIVAL TIMES  
MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. THE TIME  
BETWEEN SUCCESSIVE TSUNAMI WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION	COORDINATES	ARRIVAL TIME
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RUSSIA	PETROPAVLOVSK-K	52.9N 158.3E	1826Z 25 FEB
	UST KAMCHATSK	56.2N 162.5E	1843Z 25 FEB
	MEDNNY IS	54.6N 167.6E	1846Z 25 FEB
	SEVERO KURILSK	50.6N 156.3E	1900Z 25 FEB
	URUP IS	45.9N 150.2E	1931Z 25 FEB

BULLETINS WILL BE ISSUED HOURLY OR SOONER IF CONDITIONS WARRANT.  
THE TSUNAMI WARNING WILL REMAIN IN EFFECT UNTIL FURTHER NOTICE.

THE WEST COAST/ALASKA TSUNAMI WARNING CENTER WILL ISSUE BULLETINS  
FOR ALASKA - BRITISH COLUMBIA - WASHINGTON - OREGON - CALIFORNIA.

Communications Plan TWSP  
Page 22

TSUNAMI BULLETIN NUMBER 002  
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS  
ISSUED AT 0308Z 26 FEB 2005

THIS BULLETIN IS FOR ALL AREAS OF THE PACIFIC BASIN EXCEPT  
ALASKA - BRITISH COLUMBIA - WASHINGTON - OREGON - CALIFORNIA.

... TSUNAMI WARNING CANCELLATION ...

THE TSUNAMI WARNING IS CANCELLED FOR ALL COASTAL AREAS AND ISLANDS  
IN THE PACIFIC.

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS

ORIGIN TIME - 1804Z 25 FEB 2005  
COORDINATES - 52.3 NORTH 160.7 EAST  
LOCATION - OFF EAST COAST OF KAMCHATKA  
MAGNITUDE - 7.7

MEASUREMENTS OR REPORTS OF TSUNAMI WAVE ACTIVITY

GAUGE LOCATION	LAT	LOX	TIME	AMPL	PER
NIKISKI	60.7N	151.4W	0057Z	0.52M	**MIN
SEVERO KURILSK	50.7N	156.1E	2042Z	0.12M	64MIN

TIME - TIME OF THE MEASUREMENT  
AMPL - AMPLITUDE IN METERS FROM MIDDLE TO CREST OR MIDDLE  
TO TROUGH OR HALF OF THE CREST TO TROUGH  
PER - PERIOD OF TIME FROM ONE WAVE CREST TO THE NEXT

EVALUATION

SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED. IT MAY HAVE  
BEEN DESTRUCTIVE ALONG COASTS NEAR THE EARTHQUAKE EPICENTER. FOR  
THOSE AREAS - WHEN NO MAJOR WAVES ARE OBSERVED FOR TWO HOURS  
AFTER THE ESTIMATED TIME OF ARRIVAL OR DAMAGING WAVES HAVE NOT  
OCCURRED FOR AT LEAST TWO HOURS THEN LOCAL AUTHORITIES CAN ASSUME  
THE THREAT IS PASSED. DANGER TO BOATS AND COASTAL STRUCTURES CAN  
CONTINUE FOR SEVERAL HOURS DUE TO RAPID CURRENTS. AS LOCAL  
CONDITIONS CAN CAUSE A WIDE VARIATION IN TSUNAMI WAVE ACTION THE  
ALL CLEAR DETERMINATION MUST BE MADE BY LOCAL AUTHORITIES.

NO TSUNAMI THREAT EXISTS FOR OTHER COASTAL AREAS IN THE PACIFIC  
ALTHOUGH SOME OTHER AREAS MAY EXPERIENCE SMALL SEA LEVEL CHANGES.  
THE TSUNAMI WARNING IS CANCELLED.

THIS WILL BE THE FINAL BULLETIN ISSUED FOR THIS EVENT UNLESS  
ADDITIONAL INFORMATION BECOMES AVAILABLE.

THE WEST COAST/ALASKA TSUNAMI WARNING CENTER WILL ISSUE BULLETINS  
FOR ALASKA - BRITISH COLUMBIA - WASHINGTON - OREGON - CALIFORNIA.

TSUNAMI BULLETIN NUMBER 001  
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS  
ISSUED AT 0309Z 26 FEB 2005

THIS BULLETIN IS FOR ALL AREAS OF THE PACIFIC BASIN EXCEPT  
ALASKA - BRITISH COLUMBIA - WASHINGTON - OREGON - CALIFORNIA.

... A TSUNAMI WARNING AND WATCH ARE IN EFFECT ...

A TSUNAMI WARNING IS IN EFFECT FOR

RUSSIA / JAPAN / MARCUS IS. / MIDWAY IS. / WAKE IS. /  
N. MARIANAS / MARSHALL IS. / GUAM / HAWAII / JOHNSTON IS. /  
CHUUK / POHNPEI / TAIWAN / KOSRAE / YAP / PHILIPPINES / BELAU /  
NAURU / KIRIBATI / SAMOA / AMERICAN SAMOA / FIJI / MEXICO /  
HONG KONG / NEW CALEDONIA / COOK ISLANDS / FR. POLYNESIA

A TSUNAMI WATCH IS IN EFFECT FOR

NEW ZEALAND / EL SALVADOR / NICARAGUA

FOR ALL OTHER PACIFIC AREAS, THIS MESSAGE IS AN ADVISORY ONLY.

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS

ORIGIN TIME - 1804Z 25 FEB 2005  
COORDINATES - 52.3 NORTH 160.7 EAST  
LOCATION - OFF EAST COAST OF KAMCHATKA  
MAGNITUDE - 8.1

#### EVALUATION

IT IS NOT KNOWN THAT A TSUNAMI WAS GENERATED. THIS WARNING IS  
BASED ONLY ON THE EARTHQUAKE EVALUATION. AN EARTHQUAKE OF THIS  
SIZE HAS THE POTENTIAL TO GENERATE A DESTRUCTIVE TSUNAMI THAT CAN  
STRIKE COASTLINES NEAR THE EPICENTER WITHIN MINUTES AND MORE  
DISTANT COASTLINES WITHIN HOURS. AUTHORITIES SHOULD TAKE  
APPROPRIATE ACTION IN RESPONSE TO THIS POSSIBILITY. THIS CENTER  
WILL MONITOR SEA LEVEL DATA FROM GAUGES NEAR THE EARTHQUAKE TO  
DETERMINE IF A TSUNAMI WAS GENERATED AND ESTIMATE THE SEVERITY OF  
THE THREAT.

ESTIMATED INITIAL TSUNAMI WAVE ARRIVAL TIMES. ACTUAL ARRIVAL TIMES  
MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. THE TIME  
BETWEEN SUCCESSIVE TSUNAMI WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION		COORDINATES	ARRIVAL TIME
-----		-----	-----
RUSSIA	PETROPAVLOVSK-K	52.9N 158.3E	1826Z 25 FEB
	UST KAMCHATSK	56.2N 162.5E	1843Z 25 FEB
	MEDNNY IS	54.6N 167.6E	1846Z 25 FEB
	SEVERO KURILSK	50.6N 156.3E	1900Z 25 FEB
	URUP IS	45.9N 150.2E	1931Z 25 FEB
JAPAN	HACHINOHE	40.5N 142.0E	2032Z 25 FEB
	SHIMIZU	32.5N 133.0E	2221Z 25 FEB
	OKINAWA	26.2N 127.8E	2321Z 25 FEB
MARCUS IS.	MARCUS IS	24.3N 154.0E	2148Z 25 FEB
MIDWAY IS.	MIDWAY IS.	28.2N 177.4W	2200Z 25 FEB
WAKE IS.	WAKE IS.	19.3N 166.6E	2225Z 25 FEB
N. MARIANAS	SAIPAN	15.3N 145.8E	2315Z 25 FEB

Communications Plan TWSP  
Page 24

MARSHALL IS.	ENIWETOK	11.4N 162.3E	2330Z 25 FEB
	KWAJALEIN	8.7N 167.7E	2355Z 25 FEB
	MAJURO	7.1N 171.4E	0012Z 26 FEB
GUAM	GUAM	13.4N 144.7E	2336Z 25 FEB
HAWAII	NAWILIWILI	22.0N 159.4W	2344Z 25 FEB
	HONOLULU	21.3N 157.9W	2357Z 25 FEB
	HILO	20.0N 155.0W	0018Z 26 FEB
JOHNSTON IS.	JOHNSTON IS.	16.7N 169.5W	2353Z 25 FEB
CHUUK	CHUUK IS.	7.4N 151.8E	0005Z 26 FEB
POHNPEI	POHNPEI IS.	7.0N 158.2E	0006Z 26 FEB
TAIWAN	HUALIEN	24.0N 122.0E	0007Z 26 FEB
KOSRAE	KOSRAE IS.	5.5N 163.0E	0020Z 26 FEB
YAP	YAP IS.	9.5N 138.1E	0023Z 26 FEB
PHILIPPINES	LEGASPI	13.5N 124.0E	0045Z 26 FEB
BELAU	MALAKAL	7.3N 134.5E	0050Z 26 FEB
NAURU	NAURU	0.5S 166.9E	0113Z 26 FEB
KIRIBATI	CHRISTMAS IS.	2.0N 157.5W	0225Z 26 FEB
SAMOA	APIA	13.8S 171.8W	0331Z 26 FEB
AMERICAN SAMOA	PAGO PAGO	14.3S 170.7W	0338Z 26 FEB
FIJI	SUVA	18.5S 178.5E	0424Z 26 FEB
MEXICO	SOCORRO	18.8N 111.0W	0439Z 26 FEB
	MANZANILLO	19.1N 104.3W	0534Z 26 FEB
	ACAPULCO	16.5N 100.0W	0618Z 26 FEB
HONG KONG	HONG KONG	22.3N 114.2E	0440Z 26 FEB
NEW CALEDONIA	NOUMEA	22.3S 166.5E	0453Z 26 FEB
COOK ISLANDS	RAROTONGA	21.2S 159.8W	0501Z 26 FEB
FR. POLYNESIA	PAPEETE	17.5S 149.6W	0516Z 26 FEB
	RIKITEA	23.1S 135.0W	0707Z 26 FEB
NEW ZEALAND	NORTH CAPE	34.4S 173.3E	0645Z 26 FEB
	GISBORNE	37.5S 176.5E	0708Z 26 FEB
	NAPIER	39.5S 176.9E	0729Z 26 FEB
	EAST CAPE	36.2S 175.1E	0739Z 26 FEB
	AUCKLAND(W)	37.1S 174.2E	0744Z 26 FEB
	WELLINGTON	41.3S 174.8E	0747Z 26 FEB
	AUCKLAND(E)	36.7S 175.0E	0806Z 26 FEB
	NEW PLYMOUTH	39.1S 174.1E	0822Z 26 FEB
	LYTTTELTON	43.5S 173.0E	0830Z 26 FEB
	MILFORD SOUND	44.5S 167.5E	0833Z 26 FEB
	WESTPORT	41.5S 171.5E	0857Z 26 FEB
	DUNEDIN	45.9S 170.5E	0923Z 26 FEB
	BLUFF	46.5S 168.0E	0927Z 26 FEB
	NELSON	41.0S 173.5E	0933Z 26 FEB
EL SALVADOR	ACAJUTLA	13.6N 89.8W	0814Z 26 FEB
NICARAGUA	CORINTO	12.5N 87.5W	0841Z 26 FEB
	PUERTO SANDINO	12.2N 86.8W	0844Z 26 FEB
	SAN JUAN DL SUR	11.2N 85.9W	0854Z 26 FEB

BULLETINS WILL BE ISSUED HOURLY OR SOONER IF CONDITIONS WARRANT.  
THE TSUNAMI WARNING AND WATCH WILL REMAIN IN EFFECT UNTIL  
FURTHER NOTICE.

THE WEST COAST/ALASKA TSUNAMI WARNING CENTER WILL ISSUE BULLETINS  
FOR ALASKA - BRITISH COLUMBIA - WASHINGTON - OREGON - CALIFORNIA.



TSUNAMI BULLETIN NUMBER 002  
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS  
ISSUED AT 0309Z 26 FEB 2005

THIS BULLETIN IS FOR ALL AREAS OF THE PACIFIC BASIN EXCEPT  
ALASKA - BRITISH COLUMBIA - WASHINGTON - OREGON - CALIFORNIA.

... A TSUNAMI WARNING AND WATCH ARE IN EFFECT ...

A TSUNAMI WARNING IS IN EFFECT FOR

RUSSIA / JAPAN / MARCUS IS. / MIDWAY IS. / WAKE IS. /  
N. MARIANAS / MARSHALL IS. / GUAM / HAWAII / JOHNSTON IS. /  
CHUUK / POHNPEI / TAIWAN / KOSRAE / YAP / PHILIPPINES / BELAU /  
NAURU / KIRIBATI / SAMOA / AMERICAN SAMOA / FIJI / MEXICO /  
HONG KONG / NEW CALEDONIA / COOK ISLANDS / FR. POLYNESIA

A TSUNAMI WATCH IS IN EFFECT FOR

NEW ZEALAND / EL SALVADOR / NICARAGUA

FOR ALL OTHER PACIFIC AREAS, THIS MESSAGE IS AN ADVISORY ONLY.

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS

ORIGIN TIME - 1804Z 25 FEB 2005  
COORDINATES - 52.3 NORTH 160.7 EAST  
LOCATION - OFF EAST COAST OF KAMCHATKA  
MAGNITUDE - 8.1

MEASUREMENTS OR REPORTS OF TSUNAMI WAVE ACTIVITY

GAUGE LOCATION	LAT	LOX	TIME	AMPL	PER
NIKISKI	60.7N	151.4W	0057Z	0.52M	**MIN
SEVERO KURILSK	50.7N	156.1E	2042Z	0.12M	64MIN

TIME - TIME OF THE MEASUREMENT  
AMPL - AMPLITUDE IN METERS FROM MIDDLE TO CREST OR MIDDLE  
TO TROUGH OR HALF OF THE CREST TO TROUGH  
PER - PERIOD OF TIME FROM ONE WAVE CREST TO THE NEXT

EVALUATION

IT IS NOT KNOWN THAT A TSUNAMI WAS GENERATED. THIS WARNING IS  
BASED ONLY ON THE EARTHQUAKE EVALUATION. AN EARTHQUAKE OF THIS  
SIZE HAS THE POTENTIAL TO GENERATE A DESTRUCTIVE TSUNAMI THAT CAN  
STRIKE COASTLINES NEAR THE EPICENTER WITHIN MINUTES AND MORE  
DISTANT COASTLINES WITHIN HOURS. AUTHORITIES SHOULD TAKE  
APPROPRIATE ACTION IN RESPONSE TO THIS POSSIBILITY. THIS CENTER  
WILL CONTINUE TO MONITOR SEA LEVEL DATA FROM GAUGES NEAR THE  
EARTHQUAKE TO DETERMINE IF A TSUNAMI WAS GENERATED AND ESTIMATE  
THE SEVERITY OF THE THREAT.

ESTIMATED INITIAL TSUNAMI WAVE ARRIVAL TIMES. ACTUAL ARRIVAL TIMES  
MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. THE TIME  
BETWEEN SUCCESSIVE TSUNAMI WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION	COORDINATES	ARRIVAL TIME
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Communications Plan TWSP  
Page 26

RUSSIA	PETROPAVLOVSK-K	52.9N 158.3E	1826Z 25 FEB
	UST KAMCHATSK	56.2N 162.5E	1843Z 25 FEB
	MEDNNY IS	54.6N 167.6E	1846Z 25 FEB
	SEVERO KURILSK	50.6N 156.3E	1900Z 25 FEB
	URUP IS	45.9N 150.2E	1931Z 25 FEB
JAPAN	HACHINOHE	40.5N 142.0E	2032Z 25 FEB
	SHIMIZU	32.5N 133.0E	2221Z 25 FEB
	OKINAWA	26.2N 127.8E	2321Z 25 FEB
MARCUS IS.	MARCUS IS	24.3N 154.0E	2148Z 25 FEB
MIDWAY IS.	MIDWAY IS.	28.2N 177.4W	2200Z 25 FEB
WAKE IS.	WAKE IS.	19.3N 166.6E	2225Z 25 FEB
N. MARIANAS	SAIPAN	15.3N 145.8E	2315Z 25 FEB
MARSHALL IS.	ENIWETOK	11.4N 162.3E	2330Z 25 FEB
	KWAJALEIN	8.7N 167.7E	2355Z 25 FEB
	MAJURO	7.1N 171.4E	0012Z 26 FEB
GUAM	GUAM	13.4N 144.7E	2336Z 25 FEB
HAWAII	NAWILIWILI	22.0N 159.4W	2344Z 25 FEB
	HONOLULU	21.3N 157.9W	2357Z 25 FEB
	HILO	20.0N 155.0W	0018Z 26 FEB
JOHNSTON IS.	JOHNSTON IS.	16.7N 169.5W	2353Z 25 FEB
CHUUK	CHUUK IS.	7.4N 151.8E	0005Z 26 FEB
POHNPEI	POHNPEI IS.	7.0N 158.2E	0006Z 26 FEB
TAIWAN	HUALIEN	24.0N 122.0E	0007Z 26 FEB
KOSRAE	KOSRAE IS.	5.5N 163.0E	0020Z 26 FEB
YAP	YAP IS.	9.5N 138.1E	0023Z 26 FEB
PHILIPPINES	LEGASPI	13.5N 124.0E	0045Z 26 FEB
BELAU	MALAKAL	7.3N 134.5E	0050Z 26 FEB
NAURU	NAURU	0.5S 166.9E	0113Z 26 FEB
KIRIBATI	CHRISTMAS IS.	2.0N 157.5W	0225Z 26 FEB
SAMOA	APIA	13.8S 171.8W	0331Z 26 FEB
AMERICAN SAMOA	PAGO PAGO	14.3S 170.7W	0338Z 26 FEB
FIJI	SUVA	18.5S 178.5E	0424Z 26 FEB
MEXICO	SOCORRO	18.8N 111.0W	0439Z 26 FEB
	MANZANILLO	19.1N 104.3W	0534Z 26 FEB
	ACAPULCO	16.5N 100.0W	0618Z 26 FEB
HONG KONG	HONG KONG	22.3N 114.2E	0440Z 26 FEB
NEW CALEDONIA	NOUMEA	22.3S 166.5E	0453Z 26 FEB
COOK ISLANDS	RAROTONGA	21.2S 159.8W	0501Z 26 FEB
FR. POLYNESIA	PAPEETE	17.5S 149.6W	0516Z 26 FEB
	RIKITEA	23.1S 135.0W	0707Z 26 FEB
NEW ZEALAND	NORTH CAPE	34.4S 173.3E	0645Z 26 FEB
	GISBORNE	37.5S 176.5E	0708Z 26 FEB
	NAPIER	39.5S 176.9E	0729Z 26 FEB
	EAST CAPE	36.2S 175.1E	0739Z 26 FEB
	AUCKLAND(W)	37.1S 174.2E	0744Z 26 FEB
	WELLINGTON	41.3S 174.8E	0747Z 26 FEB
	AUCKLAND(E)	36.7S 175.0E	0806Z 26 FEB
	NEW PLYMOUTH	39.1S 174.1E	0822Z 26 FEB
	LYTTELTON	43.5S 173.0E	0830Z 26 FEB
	MILFORD SOUND	44.5S 167.5E	0833Z 26 FEB
	WESTPORT	41.5S 171.5E	0857Z 26 FEB
	DUNEDIN	45.9S 170.5E	0923Z 26 FEB
	BLUFF	46.5S 168.0E	0927Z 26 FEB
	NELSON	41.0S 173.5E	0933Z 26 FEB
EL SALVADOR	ACAJUTLA	13.6N 89.8W	0814Z 26 FEB
NICARAGUA	CORINTO	12.5N 87.5W	0841Z 26 FEB
	PUERTO SANDINO	12.2N 86.8W	0844Z 26 FEB
	SAN JUAN DL SUR	11.2N 85.9W	0854Z 26 FEB

BULLETINS WILL BE ISSUED HOURLY OR SOONER IF CONDITIONS WARRANT.

THE TSUNAMI WARNING AND WATCH WILL REMAIN IN EFFECT UNTIL  
FURTHER NOTICE.

THE WEST COAST/ALASKA TSUNAMI WARNING CENTER WILL ISSUE BULLETINS  
FOR ALASKA - BRITISH COLUMBIA - WASHINGTON - OREGON - CALIFORNIA.

Communications Plan TWSP  
Page 28

TSUNAMI BULLETIN NUMBER 002  
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS  
ISSUED AT 0311Z 26 FEB 2005

THIS BULLETIN IS FOR ALL AREAS OF THE PACIFIC BASIN EXCEPT  
ALASKA - BRITISH COLUMBIA - WASHINGTON - OREGON - CALIFORNIA.

... TSUNAMI WARNING AND WATCH CANCELLATION ...

THE TSUNAMI WARNING AND WATCH ARE CANCELLED FOR ALL COASTAL AREAS  
AND ISLANDS IN THE PACIFIC.

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS

ORIGIN TIME - 1804Z 25 FEB 2005  
COORDINATES - 52.3 NORTH 160.7 EAST  
LOCATION - OFF EAST COAST OF KAMCHATKA  
MAGNITUDE - 8.1

MEASUREMENTS OR REPORTS OF TSUNAMI WAVE ACTIVITY

GAUGE LOCATION	LAT	LON	TIME	AMPL	PER
NIKISKI	60.7N	151.4W	0057Z	0.52M	**MIN
SEVERO KURILSK	50.7N	156.1E	2042Z	0.12M	64MIN

TIME - TIME OF THE MEASUREMENT  
AMPL - AMPLITUDE IN METERS FROM MIDDLE TO CREST OR MIDDLE  
TO TROUGH OR HALF OF THE CREST TO TROUGH  
PER - PERIOD OF TIME FROM ONE WAVE CREST TO THE NEXT

EVALUATION

SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED. IT MAY HAVE  
BEEN DESTRUCTIVE ALONG COASTS NEAR THE EARTHQUAKE EPICENTER. FOR  
THOSE AREAS - WHEN NO MAJOR WAVES ARE OBSERVED FOR TWO HOURS  
AFTER THE ESTIMATED TIME OF ARRIVAL OR DAMAGING WAVES HAVE NOT  
OCCURRED FOR AT LEAST TWO HOURS THEN LOCAL AUTHORITIES CAN ASSUME  
THE THREAT IS PASSED. DANGER TO BOATS AND COASTAL STRUCTURES CAN  
CONTINUE FOR SEVERAL HOURS DUE TO RAPID CURRENTS. AS LOCAL  
CONDITIONS CAN CAUSE A WIDE VARIATION IN TSUNAMI WAVE ACTION THE  
ALL CLEAR DETERMINATION MUST BE MADE BY LOCAL AUTHORITIES.

NO TSUNAMI THREAT EXISTS FOR OTHER COASTAL AREAS IN THE PACIFIC  
ALTHOUGH SOME OTHER AREAS MAY EXPERIENCE SMALL SEA LEVEL CHANGES.  
FOR ALL AREAS THE TSUNAMI WARNING AND TSUNAMI WATCH ARE  
CANCELLED.

THIS WILL BE THE FINAL BULLETIN ISSUED FOR THIS EVENT UNLESS  
ADDITIONAL INFORMATION BECOMES AVAILABLE.

THE WEST COAST/ALASKA TSUNAMI WARNING CENTER WILL ISSUE BULLETINS  
FOR ALASKA - BRITISH COLUMBIA - WASHINGTON - OREGON - CALIFORNIA.

TSUNAMI BULLETIN NUMBER 002  
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS  
ISSUED AT 0312Z 26 FEB 2005

THIS BULLETIN IS FOR ALL AREAS OF THE PACIFIC BASIN EXCEPT  
ALASKA - BRITISH COLUMBIA - WASHINGTON - OREGON - CALIFORNIA.

... A PACIFIC-WIDE TSUNAMI WARNING IS IN EFFECT ...

THIS WARNING IS FOR ALL COASTAL AREAS AND ISLANDS IN THE PACIFIC.

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS

ORIGIN TIME - 1804Z 25 FEB 2005  
COORDINATES - 52.3 NORTH 160.7 EAST  
LOCATION - OFF EAST COAST OF KAMCHATKA  
MAGNITUDE - 8.8

MEASUREMENTS OR REPORTS OF TSUNAMI WAVE ACTIVITY

Gauge Location	LAT	Lon	Time	Ampl	Per
NIKISKI	60.7N	151.4W	0057Z	0.52M	**MIN
SEVERO KURILSK	50.7N	156.1E	2042Z	0.12M	64MIN

TIME - TIME OF THE MEASUREMENT  
AMPL - AMPLITUDE IN METERS FROM MIDDLE TO CREST OR MIDDLE  
TO TROUGH OR HALF OF THE CREST TO TROUGH  
PER - PERIOD OF TIME FROM ONE WAVE CREST TO THE NEXT

EVALUATION

SEA LEVEL READINGS CONFIRM THAT A TSUNAMI HAS BEEN GENERATED  
WHICH COULD CAUSE WIDESPREAD DAMAGE TO COASTS AND ISLANDS IN THE  
PACIFIC. AUTHORITIES SHOULD TAKE APPROPRIATE ACTION IN RESPONSE  
TO THIS THREAT. THIS CENTER WILL CONTINUE TO MONITOR SEA LEVEL  
DATA TO DETERMINE THE EXTENT AND SEVERITY OF THE THREAT.

A TSUNAMI IS A SERIES OF WAVES AND THE FIRST WAVE MAY NOT BE THE  
LARGEST. TSUNAMI WAVE HEIGHTS CANNOT BE PREDICTED AND CAN VARY  
SIGNIFICANTLY ALONG A COAST DUE TO LOCAL EFFECTS. THE TIME FROM  
ONE TSUNAMI WAVE TO THE NEXT CAN BE FIVE MINUTES TO AN HOUR, AND  
THE THREAT CAN CONTINUE FOR MANY HOURS AS MULTIPLE WAVES ARRIVE.

FOR ALL AREAS - WHEN NO MAJOR WAVES ARE OBSERVED FOR TWO HOURS  
AFTER THE ESTIMATED TIME OF ARRIVAL OR DAMAGING WAVES HAVE NOT  
OCCURRED FOR AT LEAST TWO HOURS THEN LOCAL AUTHORITIES CAN ASSUME  
THE THREAT IS PASSED. DANGER TO BOATS AND COASTAL STRUCTURES CAN  
CONTINUE FOR SEVERAL HOURS DUE TO RAPID CURRENTS. AS LOCAL  
CONDITIONS CAN CAUSE A WIDE VARIATION IN TSUNAMI WAVE ACTION THE  
ALL CLEAR DETERMINATION MUST BE MADE BY LOCAL AUTHORITIES.

BULLETINS WILL BE ISSUED HOURLY OR SOONER IF CONDITIONS WARRANT.  
THE TSUNAMI WARNING WILL REMAIN IN EFFECT UNTIL FURTHER NOTICE.

THE WEST COAST/ALASKA TSUNAMI WARNING CENTER WILL ISSUE BULLETINS  
FOR ALASKA - BRITISH COLUMBIA - WASHINGTON - OREGON - CALIFORNIA.  
TSUNAMI BULLETIN NUMBER 002  
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS  
ISSUED AT 0313Z 26 FEB 2005

Communications Plan TWSP  
Page 30

THIS BULLETIN IS FOR ALL AREAS OF THE PACIFIC BASIN EXCEPT  
ALASKA - BRITISH COLUMBIA - WASHINGTON - OREGON - CALIFORNIA.

... PACIFIC-WIDE TSUNAMI WARNING CANCELLATION ...

THE TSUNAMI WARNING IS CANCELLED FOR ALL COASTAL AREAS AND ISLANDS  
IN THE PACIFIC.

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS

ORIGIN TIME - 1804Z 25 FEB 2005  
COORDINATES - 52.3 NORTH 160.7 EAST  
LOCATION - OFF EAST COAST OF KAMCHATKA  
MAGNITUDE - 8.8

MEASUREMENTS OR REPORTS OF TSUNAMI WAVE ACTIVITY

Gauge Location	LAT	LON	TIME	AMPL	PER
NIKISKI	60.7N	151.4W	0057Z	0.52M	**MIN
SEVERO KURILSK	50.7N	156.1E	2042Z	0.12M	64MIN

TIME - TIME OF THE MEASUREMENT  
AMPL - AMPLITUDE IN METERS FROM MIDDLE TO CREST OR MIDDLE  
TO TROUGH OR HALF OF THE CREST TO TROUGH  
PER - PERIOD OF TIME FROM ONE WAVE CREST TO THE NEXT

EVALUATION

SEA LEVEL DATA INDICATE THAT A WIDESPREAD DESTRUCTIVE TSUNAMI HAS  
OCCURRED. HOWEVER - ADDITIONAL DESTRUCTIVE TSUNAMI IMPACTS ARE  
NOT EXPECTED FOR COASTAL AREAS NOT ALREADY AFFECTED. FOR THOSE  
AFFECTED AREAS - WHEN NO MAJOR WAVES ARE OBSERVED FOR TWO HOURS  
AFTER THE ESTIMATED TIME OF ARRIVAL OR DAMAGING WAVES HAVE NOT  
OCCURRED FOR AT LEAST TWO HOURS THEN LOCAL AUTHORITIES CAN ASSUME  
THE THREAT IS PASSED. DANGER TO BOATS AND COASTAL STRUCTURES CAN  
CONTINUE FOR SEVERAL HOURS DUE TO RAPID CURRENTS. AS LOCAL  
CONDITIONS CAN CAUSE A WIDE VARIATION IN TSUNAMI WAVE ACTION THE  
ALL CLEAR DETERMINATION MUST BE MADE BY LOCAL AUTHORITIES.

NO TSUNAMI THREAT EXISTS FOR OTHER COASTAL AREAS IN THE PACIFIC  
ALTHOUGH SOME OTHER AREAS MAY EXPERIENCE SMALL SEA LEVEL CHANGES.  
FOR ALL AREAS THE TSUNAMI WARNING IS CANCELLED.

THIS WILL BE THE FINAL BULLETIN ISSUED FOR THIS EVENT UNLESS  
ADDITIONAL INFORMATION BECOMES AVAILABLE.

THE WEST COAST/ALASKA TSUNAMI WARNING CENTER WILL ISSUE BULLETINS  
FOR ALASKA - BRITISH COLUMBIA - WASHINGTON - OREGON - CALIFORNIA.

## **SECTION 7: COMMUNICATION METHODS FOR SEISMOLOGICAL STATIONS, TIDAL STATIONS, AND DISSEMINATIONS AGENCIES**

### **7.1 GENERAL**

Appendix A details the communications information for the participating seismological observatories, tide stations, and dissemination agencies of the Tsunami Warning System. Each entry under the caption "Mail Address" is the official designation and mailing address of the agency indicated. The entry of telephone numbers is included to facilitate telephonic communication and should include those numbers whereby PTWC can contact responsible authorities on a 24 hour-a-day basis, either at their office or at their home residence. For each agency listed, the entry under the caption "Station Designator" is the term that may be used in each message to indicate the originator or addressee. This short descriptive title is intended to facilitate and expedite handling of messages by communication operating personnel.

The methods of communication listed in Section 4 and in Appendix A are those by which seismic and tide stations send reports to PTWC, or by which PTWC transmits tsunami watch and warning information to participating dissemination agencies, and are listed in order relative communication preference in the basis of presently available information. Changes in relative preference by any station as warranted by local conditions and previous experience should be communicated to PTWC. At a time of emergency, transmission of messages by telephone is encouraged in addition to teletype v

## APPENDIX A.

### COMMUNICATION POINTS

The PTWC maintains contact information for seismological and tide stations, and warning dissemination points for countries participating in the Tsunami Warning System in the Pacific. Presently, there are 123 communication points for the TWSP. For each communication point, the following information is available in a standardized format:

#### Locality Country-City (Physical Location)

Agency:

Agency Name

lat Lat lon Lon [id ID](#)

Parent Agency:

Parent Agency

Parent Agency contact

Parent agency phone

Parent agency email

Parent agency City/Country

**Postal** address:

Postal contact

Postal address 1

Postal address 2

Postal address 3

Postal city

Postal State

Postal code

Postal Country

Comments: Parent agency comment

Phone numbers:

Phone 1

Phone 2

Phone 3

FAX

Email:

Email 1

Email 2

Email 3

Other contact codes:

NADIN2 NADIN2

NMC NMC (FAA country code)

PLA Plain Language Address

Telex Telex

NWW NWW

EMWIN EMWIN



Each country is requested to update the current information on record at the PTWC using the following form:

**COMMUNICATIONS METHODS – <insert country name>**

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***For each Agency the receives information from, or sends data to the PTWC, please provide the following information:***

**Name of Country:**

**Postal Address:**      *Name of Person, Agency and Address*

**Telephone numbers:**

24 Hr Phone:

1<sup>st</sup> alternate:

2<sup>nd</sup> alternate:

Station Location:

Latitude: (minus=S)

Longitude: (minus=W)

**FAX:**

**E-mail address:**

Method – Primary:

Method – Alternate:

Warning Points Desired (Location name, Latitude, Longitude, Elevation)

Last Update:      *Date and Name of Person and Person's Title reporting update*

An example provided by the Republic of the Philippines is provided below:

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**COMMUNICATIONS METHODS – PHILIPPINES, REPUBLIC OF THE**

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**PHILIPPINES, REPUBLIC of the**

**Postal Address:**        **Philippine Institute of Volcanology and Seismology**

**PHIVOLCS** (QVP)  
Department of Science and Technology  
**PHIVOLCS** BLDG.  
Carlos P. Garcia Avenue  
U.P. Diliman, Quezon City  
Republic of the Philippines

**Telephone numbers:**

24 Hr. Phone:        011 632 426-1468 to 79  
1<sup>st</sup> alternate        011 632 929-9253 to 54

Station Location:

Latitude: (minus=S)

14.62

**FAX:**                    011 632 929-8366; 927-1087  
121.00

**E-mail address:**    **MIS\_team\_PHIVOLCS@yahoogroups.com**

Method – Primary:    Sends seismic phase picks by voice telephone or FAX direct to PTWC. Receives Tsumani bulletins **by FAX and** by FAX relay from PAGASA (RPMYMYX).

Method – Alternate:   If internal routing instructions are included, AUTODIN messages to the American Embassy in Manila can be forwarded to **PHIVOLCS**.  
FAX: 011-632-927-1342 or 926-3225

Last Update:            January 24, 2004 by Annie Encarnacion, PHIVOLCS Secretary

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Longitude: (minus=W) 120.97

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Communications Plan for the TWS

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Method – Primary:    Receives Tsunami Warning/Watch and Information messages by AFTN as a member of the AFTN Collective address NFZZCAXX. Also receives the same messages by GTS with WMO product header WEPA 40 PHEB.

Method – Alternate:

Last Update:            January 23, 2004 by Annie Encarnacion, PHIVOLCS Secretary

[END]