Develop state/NOAA coordination and technical support

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Abstract. The 5-year review will look at developments in the local interactions between the National Weather Service (NWS) Forecast Offices and county emergency managers, developments in the NOAA Weather Radio (NWR) program, the use of the Emergency Managers Weather Information Network (EMWIN), and the development and distribution of the Historical Tsunami Database for the U.S. West Coast, Hawaii, and Alaska, and the development of a "TsunamiReady" community program for Alaska.

1. The Plan

The original plan for the National Tsunami Hazard Mitigation Program as submitted to the Senate envisioned that this aspect of the Program would have two parts:

"The states will organize tsunami activities within their respective states through state-wide tsunami coordinators. These coordinators will serve as the focal point for tsunami-related activities during tsunami events by communicating with NOAA's Tsunami Warning Centers and other states, and by serving as a source of tsunami information and guidance for the state during tsunami events."

"NOAA will provide technical support for these coordinators through Warning Coordination Meteorologists in Alaska, California, Hawaii, Oregon and Washington, the Tsunami Warning Centers, and the International Tsunami Warning Center in Honolulu, Hawaii."

The Warning Coordination Meteorologist (WCM) serves as the principal interface between the National Weather Service (NWS) and the users of forecasts, watches, warnings, and other NOAA information. The WCMs plan and carry out public education programs designed to mitigate the impact of the natural disasters for which NOAA has forecast and warning responsibilities.

The plan provided no additional funding for this effort, anticipating that any necessary funding needed by the states or NOAA would come from existing sources.

2. Accomplishments

At the beginning of the implementation of the Plan, and for a number of years previous, Hawaii State Civil Defense had a tsunami advisor (it now has two), and this provided a pattern for the other states. As of this report these coordinators have been either formally or informally established.

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NOAA actively involved the WCMs at the NWS's coastal Weather Forecast Offices in the Tsunami Program. A WCM responsible for each coastal county emergency manager was identified and a county by county listing of WCMs/emergency manager pairs was established. (http://www.pmel.noaa.gov/ tsunami-hazard/wcms.html). The WCMs were given training related to this new responsibility and copies of the training materials were provided to the states. The WCMs were also included in the periodic internal NOAA reviews of the operation of the tsunami program.

NOAA, through the NWS, periodically meets with emergency management officials from the five states and British Columbia to advise the managers of recent accomplishments and planned improvements to the Tsunami Warning Program and to solicit their comments/suggestions for improvements. At the last meeting in Seattle in 1999 of the emergency managers there was an extended discussion on the format of the messages issued by the West Coast/Alaska Tsunami Warning Center (WC/ATWC). This resulted in a major restructuring of the messages along the lines suggested by the emergency managers.

3. Expanded State/NOAA Coordination and Technical Support

Early in the implementation of the program it was realized that there were many more areas where cooperation between the states and NOAA could significantly improve the ability of emergency managers to react to the threat of tsunamis. Activities that have been subsequently undertaken are described below.

3.1 Historical Tsunami Database for the U.S. Pacific Coast (HTDB/US)

There is a great amount of historic information on tsunamis for this area but it is contained in a variety of publications that are not readily available to emergency managers. As a result most emergency managers on the U.S. West Coast are not aware of the historical impact of tsunamis on their area or of what the potential impact on their area might be when they receive a watch or warning from the WC/ATWC. To overcome this deficiency the Pacific Region of the NWS funded the development of the HTDB/US by the Siberian Branch of the Russian Academy of Science. The HTDB/US, operating under Windows 95, 98, 2000, and NT 4.0, provides the emergency managers with user-friendly access to historical tsunami data for their area. The database contains 230,342 earthquakes dating back to 186 BC, 1305 of which (dating back to 47 BC) generated tsunamis and 6656 records of individual tsunami heights dating back to 476 AD. The program enables the emergency managers to query the database for the historical impacts of tsunamis in their areas and, by entering the coordinates of an earthquake contained in a watch/warning message, determine the impacts that past earthquakes of similar magnitude and location have had on their area. A

variety of analyses can also be accomplished. Attached to this report are several examples of the information that may be obtained from the program: Historic events associated with a current warning, tsunami heights generated by the historic events, tsunami heights in the vicinity of Hilo, Hawaii, height vs. time of Hilo tsunamis, and the probability of the 100-year occurrence of a 5-m tsunami.

3.2 Dissemination of earthquake information

The Program realized that while there was a mechanism for disseminating information on earthquakes that were potentially tsunamigenic there was no mechanism for disseminating information regarding earthquakes of lesser magnitude. A case in point was the Seattle earthquake of some years ago when it took about 3 hours for information on the location and magnitude of the event to reach the media. In an attempt to correct this problem a pilot project was established between the University of Washington and the NWS Forecast Office (WFO) in Seattle. The University of Washington would electronically provide information on the location and magnitude of the earthquake to the WFO who would enter it on NOAA Weather Wire Service (NWWS) and the Emergency Managers Weather Information Network (EMWIN). This would serve two purposes: The information would be automatically available to the media and emergency management community through AP and NWWS, and it would also be available on the Washington State ACCESS telecommunication system which is fed by the NWWS. An EMWIN receiver was provided to the emergency manager at Grays Harbor as a part of the project. Using this method a message sent by the University was delivered to the Grays Harbor EMWIN receiver in less than a minute. This system was converted to an operational system. Discussions are underway to possibly extend this method of dissemination to other west coast areas.

The value of using EMWIN to disseminate information to the emergency managers was clearly demonstrated during the 28 February 2001 Seattle earthquake. The emergency manager at Grays Harbor received the message from the WC/ATWC in about 2 minutes and was thus able to ensure an appropriate response to the event.

3.3 NOAA Weather Radio (NWR)

The Washington coastal coverage of NOAA Weather Radio (NWR) was completed with the installation of a new transmitter on Mt. Octopus so that the additional antenna elevation would give its broadcast greater range and coverage.

While discussions have been held about also using NWR to disseminate preliminary earthquake information, no formal plans are in place. NWR was used, however, by the Seattle WFO to disseminate information regarding the 28 February 2001 earthquake. This effort was well received and we can expect discussions on the use of this medium to continue.

3.4 TsunamiReady communities

The NWS Alaska Region has developed a version of the NWS national StormReady Program (http://www.nws.noaa.gov/stormready/) directed at promoting tsunami hazard preparedness among Alaskan coastal communities. The program is summarized in Appendix A and a full description may be found at http://www.wcatwc.gov/tsunamiready.htm.

4. Budget

In the original implementation plan no new federal funds were requested for this activity. NOAA has supported this activity through labor costs and travel expenses with about $100,000/year over the past 5 years for a total of $500,000.

5. Next Five Years

This portion of the program is really in more or less of a "steady state" at this point. Activities will be directed at continuing cooperation/coordination between the WCMs and the Forecast Offices and the Emergency Managers in their AOR, working to improve warning dissemination with the emphasis on EMWIN and NWR, periodic meetings with the representatives of the five states and British Columbia to brief on operations and discuss issues, and continuing the development and refinement of the databases which support the HTDB/US. Resources on the part of the NWS should continue at the $100,000/year level for in kind resources.

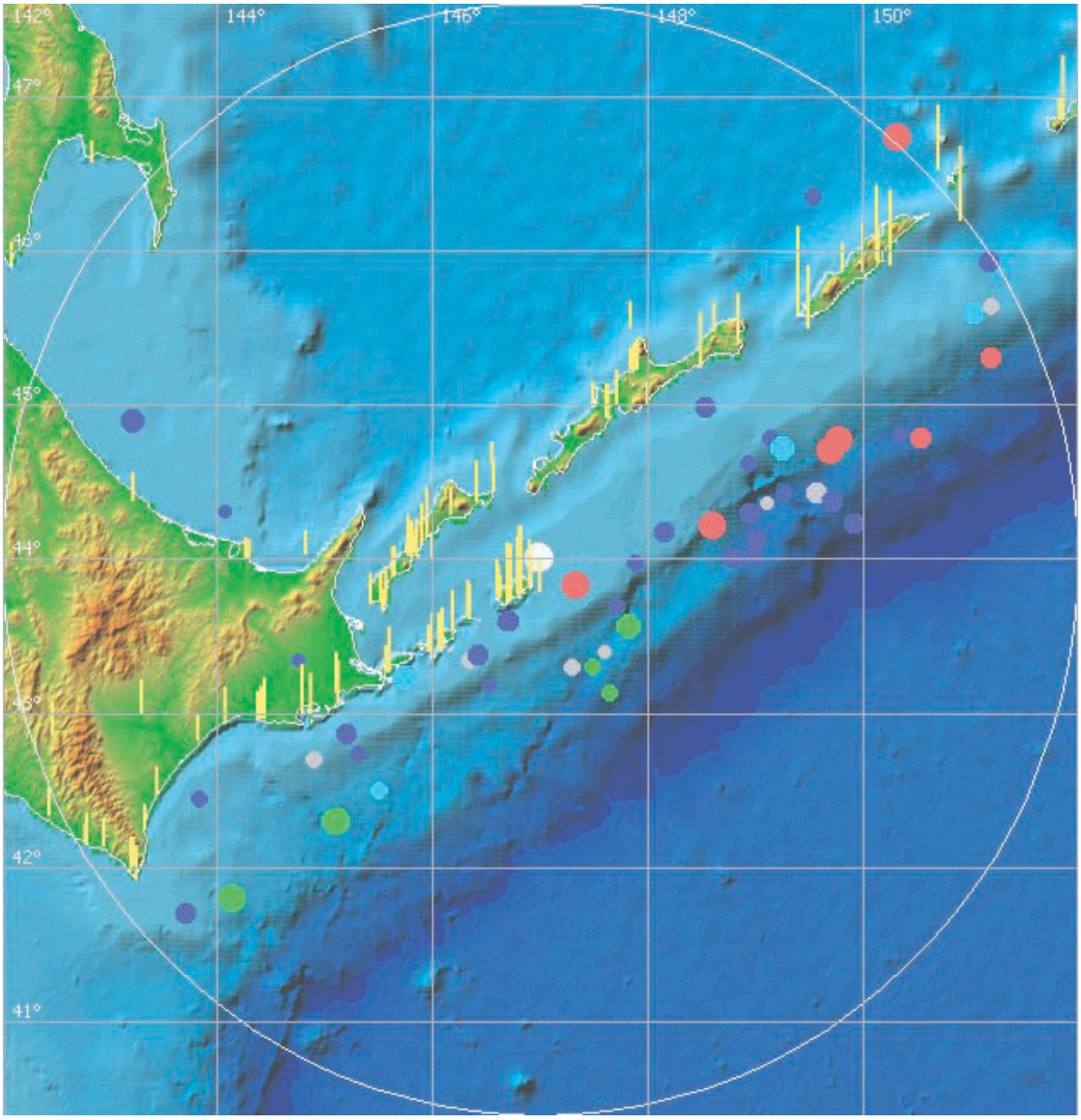

Figure 1: Earthquakes and tsunamigenic earthquakes historically associated with the 10/04/96 event.

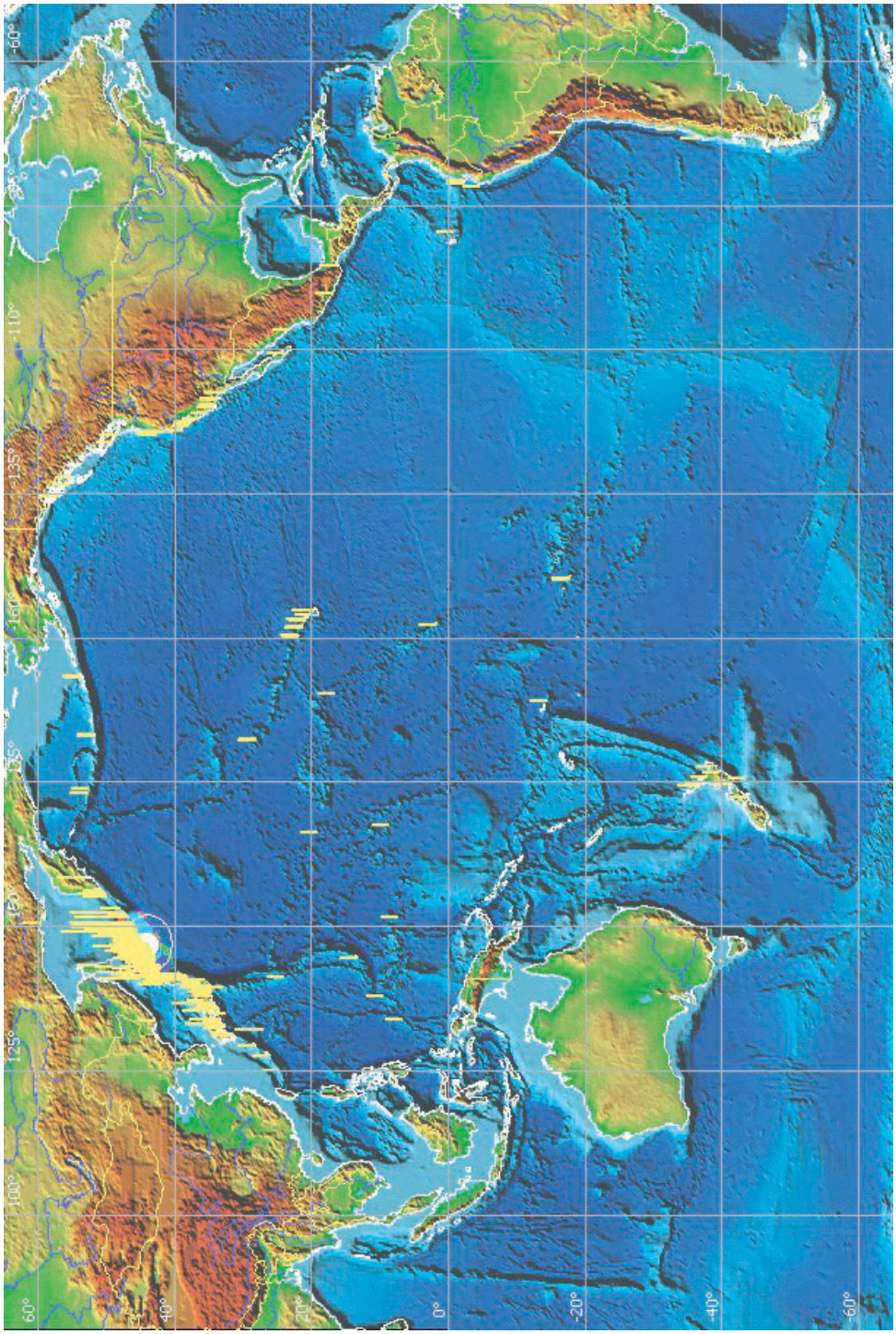

Figure 2: Pacific-wide tsunami heights related to the tsunamigenic earthquakes in Fig. 1.

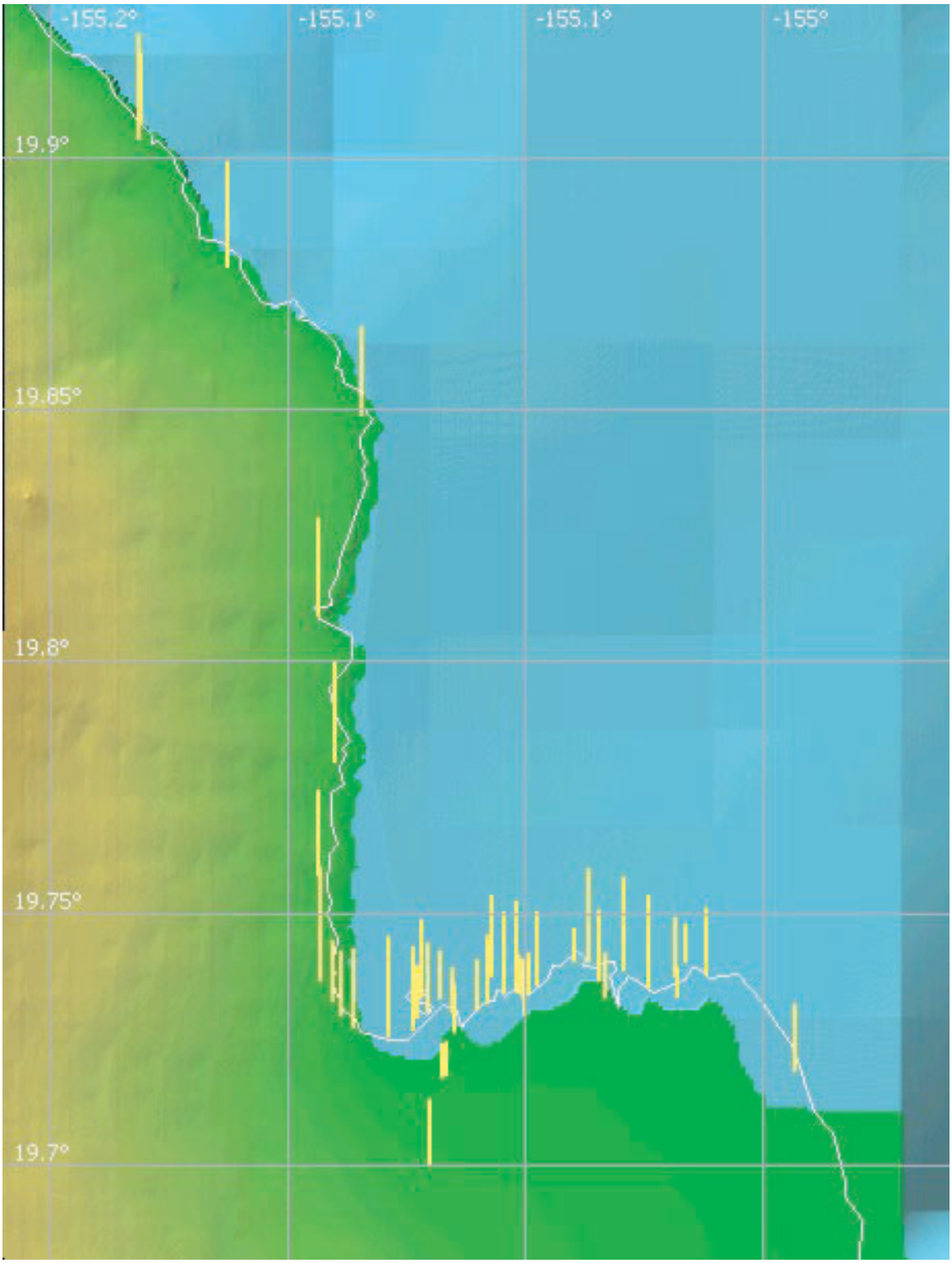

Figure 3: Historical tsunami heights for the Hilo, Hawaii area.

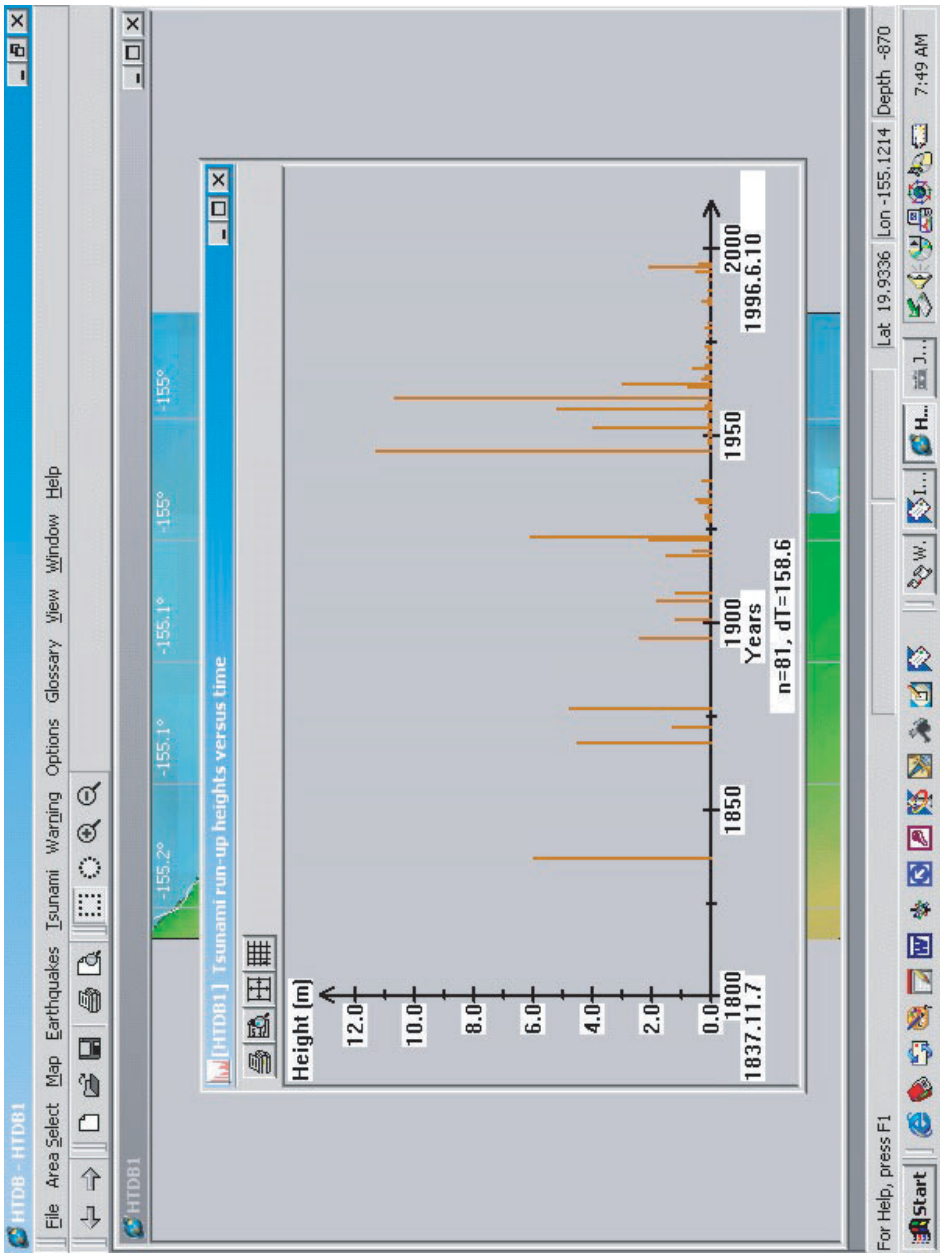

Figure 4: Graph showing distribution of tsunami heights by year.

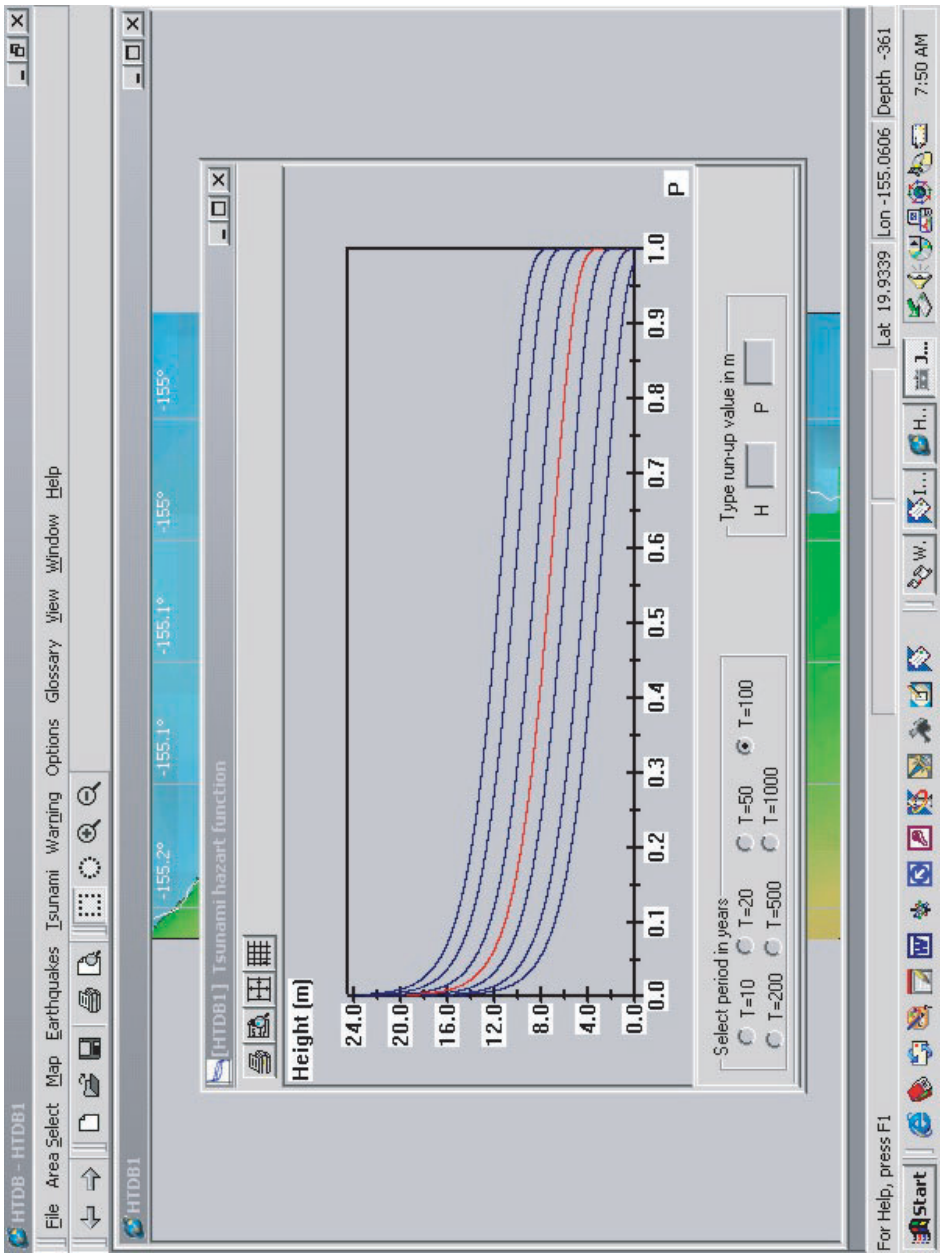

Figure 5: Graph illustrating the probability of Hilo experiencing a tsunami greater than 5 m in a 100-year period.

Appendix A: TsunamiReady Communities Summary

The Preparedness Challenge

Tsunami hazard planning along the U.S. West Coast and Alaska is widely neglected due to the comparative rarity of tsunamis. Because of that rarity, individuals and communities are not as "tsunami-aware" as they should be. Furthermore, the level of tsunami preparedness varies significantly from community to community. Avoidable casualties and property damage eventually will be significant unless communities at risk are prepared for tsunamis. Preparedness involves two key components: *awareness* and *mitigation*. *Awareness* involves educating key decision makers, emergency managers, and the public about the nature (physical processes) and threat (frequency of occurrence, impact) of a hazard. *Mitigation* involves taking steps before a hazardous event occurs to lessen the impact (loss of life and property) of that event when it does occur. As with earthquakes, there is no question tsunamis will occur. It's just a matter of when, and how bad it will be.

- The key to increased awareness of the hazard is education
- The key to effective mitigation is pre-event planning

The National Weather Service (NWS) TsunamiReady program meets both elements of a useful preparedness effort: it is designed to educate local emergency management officials and their public, and to promote a well-designed tsunami emergency response plan for each community.

Program Objectives

TsunamiReady promotes tsunami hazard preparedness as an active collaboration among Federal, state and local emergency management agencies, the public, and the NWS tsunami warning system. This collaboration supports better and more consistent tsunami awareness and mitigation efforts among communities at risk. The main goal is improvement of public safety during tsunami emergencies. To meet this goal, the following objectives need to be met:

- Create a minimum *standard criteria* for a community to follow for adequate tsunami preparedness
- Encourage consistency in educational materials and response among communities and states
- Recognize communities that have adopted TsunamiReady criteria
- Increase public awareness and understanding of the tsunami hazard
- Improve community pre-planning for tsunami disasters

Methodology

Processes and criteria used in TsunamiReady generally resemble those of the NWS StormReady program. TsunamiReady establishes minimum criteria for a community to be awarded the TsunamiReady recognition. Communities that accept the challenge to become tsunami ready and meet requirements set by the NWS TsunamiReady program are designated as TsunamiReady communities.

Table 1: Criteria to achieve TsunamiReady recognition. Four community categories (based upon population) are used to measure tsunami readiness.

	Population			
Criteria	<2500	2500–14,999	15,000–40,000	>40,000
Criterion 1: Communications and Coordination Center				
24-hr Warning Point (WP)	X	X	X	X
Emergency Operations Center		X	X	X
Criterion 2: Tsunami Warning Reception				
Number of ways EOC/WP can receive NWS tsunami messages. (NWR receiver with tone alert. NWR-SAME is preferred. Required for recognition only if within range of transmitter.)	3	4	4	4
Criterion 3: Warning Dissemination				
Number of ways EOC/WP can disseminate warnings to public	1	2	3	4
NWR-SAME receivers in public facilities.	X	X	X	X
For county/borough warning points, county/borough communication network that insures information flow among communities	X	X	X	X
Criterion 4: Awareness				
Number of annual tsunami awareness programs	1	2	3	4
Designate/establish tsunami shelter in safe zone	X	X	X	X
Designate tsunami evacuation areas and evacuation routes, and install evacuation route signs	X	X	X	X
Provide written, locality specific, tsunami hazard response material to public	X	X	X	X
Schools: establish tsunami hazard curriculum, practice evacuations, and train staff	X	X	X	X
Criterion 5: Administrative				
Develop formal tsunami hazard operations plan	X	X	X	X
Annual meeting/discussion between local emergency manager and NWS	X	X	X	X
Visits by NWS official to community at least every other year	X	X	X	X