Southeast Alaska Cloudburst Chronicle

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In This Issue

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Weather to Visit Southeast Alaska

—By Aimee Devaris

Most locals know when to invite their relatives and friends for a visit to Southeast Alaska... when the salmon are running! But in case your guests have more on the agenda than fishing, here's our weather-based assessment.

First of all, Southeast Alaska is a mid-latitude rain forest. For this latitude (58° North), temperatures are mild due to the moderating influence of the nearby Pacific Ocean. But, the ready availability of ocean source moisture and the lift provided by steep, complex terrain produces a high frequency of light precipitation. There can be up to 277 wet days per year.

The "dry season" is normally from April through June over most of the region, except in the southern panhandle where it is slightly later – May through July. During these months, you can expect a few warm, sunny periods lasting several days. Cloudy days and the probability of precipitation start to increase after the middle of July reaching nearly 70% every day during October, which is the peak of the "wet season." This late summer transition into the wet season also has an increasing frequency of foggy mornings.

The warmest months are June, July, and August when normal high temperatures are in the 60s. Mild temperatures, with highs near 60°, extend into the month of September. Normal low temperatures for June through August are in the mid- to upper-40s.

So, when should visitors plan their vacation in Southeast Alaska? The best chance for both warm temperatures and dry periods, is from April through July. Although mild temperatures with a few sunny days may continue well into September. Of course, you can enjoy Southeast Alaska's spectacular waterways, islands, mountains, glaciers, marine wildlife, and emerald green forests anytime of the year. '

Two New Zones for Glacier Bay and Hyder

—By Laura Furgione

The mission of the National Weather Service (NWS) is to provide weather, hydrologic, and climate forecasts and warnings. The NWS, Weather Forecast Office in Juneau, Alaska, is responsible for issuing these forecasts and warnings for Southeast Alaska from Cape Suckling to Dixon Entrance. Currently the forecast area is divided into seven zones.

Effective June 20, the new zones and their areas will be as follows:

****Zone 21**** - Glacier Bay Including Gustavus

Zone 22 - Cape Fairweather to Cape Suckling Coastal Area including Yakutat

Zone 23 - Cape Decision to Cape Fairweather Coastal Area including Pelican - Sitka - Port Alexander

Zone 24 - Northern Lynn Canal including Skagway and Haines

Zone 25 - Juneau Borough - Eastern Chichagof - Admiralty Island including Juneau - Hoonah - Angoon

Zone 26 - Inner Channels from Kupreanof Island to Etolin Island including Petersburg - Wrangell - Kake

Zone 27 - Southern Inner Channels including Ketchikan and Metlakatla

Zone 28 - Dixon Entrance to Cape Decision Coastal Area including Craig and Klawock

****Zone 29**** - Misty Fjords including Hyder

Please note: this changes the areas covered by zones 24 and 27.

At publication time, Glacier Bay is covered by zone 24 (Lynn Canal and Glacier Bay including Skagway and Haines) and Hyder is encompassed in zone 27 (Southern Southeast Alaska Ernest Sound to Dixon Entrance including Ketchikan, Metlakatla, and Hyder). Glacier Bay often has significantly different weather than Lynn Canal, and Hyder can have extremely different weather than Ketchikan.

To better forecast for these differences, we have worked with our customers and partners and created **two new zones, 21 and 29,** which will be added to the current suite beginning June 20, 2001. They will permit more specific broadcast forecasts while allowing forecasters the flexibility to add more precise details. Please see our website for a map showing the new zones.

A Ride on the *Ocean Mariner* Tugboat

May 16-18, 2001

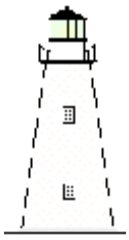
—By Edward Plumb

In an effort to improve marine forecasts and to strengthen the relationship with the marine community, the National Weather Service has encouraged forecasters to participate in familiarization (FAM) floats aboard marine vessels. Western Towboat Company, based in Seattle, generously offered to accommodate meteorologists from the Juneau forecast office interested in riding on one of their tugboats. When I was offered the opportunity to take a FAM float on the *Ocean Mariner* tugboat traveling through Southeast Alaska, I immediately jumped at the chance to gain first hand experience of the weather from the mariner's perspective.

As a meteorologist for the Weather Forecast Office in Juneau, I routinely write and update marine forecasts for

(See RIDE - page 5)

Seafarers' Spotlight



—By Aimee Devaris

Last summer on June 28th, a series of thunderstorms moved through the Juneau area producing heavy rain, gusty winds, and cloud-to-ground lightning. Fortunately this event occurred on a Wednesday, so fewer boats were out on the water than there were over the following busy holiday week-end. However, we have heard from mariners who were caught out on the water that afternoon and they all had the same question: "What can we do to protect ourselves from lightning when caught in a storm?"

The following article provides some important safety information that every mariner should be aware of. For more on lightning safety, check this web site: www.lightningsafety.noaa.gov .

To see this newsletter in COLOR please visit our website: http://www.alaska.net/~jnufo

Caught in a storm!

Thunderstorms in Southeast Alaska are infrequent and sometimes unpredictable. Even with the best weather reports, boaters can still be caught in open waters during a thunderstorm. Then, with or without a lightning protection system, it is critical to take additional safety precautions to protect the boat's occupants.

The most obvious, and hopefully instinctive, response is to seek safe harbor when weather conditions are threatening, and stay off the water until the weather improves. But if you find yourself caught in a storm while out on the water, you should take the following precautions:

Lightning Safety on the water:

- Stay in the center of the cabin if the boat is so designed. If no enclosure is available, stay low in the boat. Don't be a human lightning mast!
- Keep arms and legs in the boat. Do not dangle them in the water.
- Discontinue fishing, scuba diving, and other water activities when there is lightning or even when sky conditions look threatening. The first lightning strike can be a mile or more in front of an approaching thunderstorm cloud.
- Disconnect and do not use or touch the major electronic equipment, including the radio, throughout the duration of the storm.
- Lower, remove, or tie down the radio antenna and other protruding devices if they are not part of a lightning protection system.
- To the degree possible, avoid making contact with any portion of the boat connected to the lightning protection system (if present).
- Keep in mind it is always a good idea to have individuals aboard who are competent in cardiopulmonary resuscitation (CPR) and first aid. Many individuals struck by lightning or exposed to excessive electrical current can be saved with prompt and proper care. There is no danger in touching persons after they have been struck by lightning.
- If a boat has been, or is suspected of having been, struck by lightning, check out the electrical system and compasses before setting out again to ensure that no damage has occurred. '

*Why Was **Green-up** So Slow This Year?*

Plant Growth and Growing Degree Days

—By Carl Dierking

You might think that one type of degree-day is confusing enough without adding an assortment of them just to complicate things. The degree-day you are probably most familiar with is the one applied to home energy needs, called "Heating Degree Days." But, the degree-day approach has a variety of other applications in areas that are temperature dependent. For farmers, gardeners, horticulturists, and entomologists, the most important degree-day is the "Growing Degree Day."

In general terms, a degree-day is a departure of the daily mean temperature from a base value, one degree-day for each degree above (or below) the base. The value of the base, and whether the departure is above or below that base, depends on the temperature impact you are trying to track. In the case of Heating Degree Days, homes usually require an additional source of heat when the average temperature falls below 65°F. So the standard for Heating Degree Days is set at 65°, and the departures are only counted when the mean temperature is below 65°. In hot climates, the "Cooling Degree Day" is used to track air conditioning demands, so the base value is also 65°, but only departures above the base are counted.

The "Growing Degree Day," or GDD, is used to track and predict "phenological" events, which are events that are synchronized with the accumulated warmth of the growing season, such as bud swell, leaf emergence, fruiting, and insect growth cycles. In the northern United States, the temperature at which growth starts for woody plants is somewhere between 45° and 55°, so the most frequently used base value for GDD is 50°. However, because there are variations in the accumulated heat response of individual plants and insects, scientists may use base temperatures of 45° or 55° in other regions, or for specific purposes. In addition, day length and environmental factors can affect some events in a plant's life cycle, but the use of GDD may still be more accurate for tracking these events than simple calendar dates.

(See PLANT - page 9)

Annual Growing Degree Days for Southeast Alaska

Station	GDD 2000	Avg GDD	Highest/ Year	Lowest/ Year	No. Years
Yakutat	267	330	628/1997	73/1965	50
Skagway	631	813	1195/1993	469/1988	23
Haines	554	798	1178/1989	554/2000	31
Juneau (airport)	463	564	949/1997	214/1970	50
Downtown Juneau	488	738	1131/1957	357/1970	41
Lena Point (Juneau)	868	851	1114/1993	628/1988	14
Sitka	493	638	888/1979	393/1955	48
Petersburg	M	549	836/1993	344/1964	42
Wrangell	651	713	994/1997	651/2000	7

Weather Watchers Southeast's Spotter Network

—By Aimee Devaris

Breaking news! The Southeast Alaska Spotter Network has expanded into southern Southeast Alaska. We now have eleven certified storm spotters in Ketchikan and twelve in the Craig/Klawock area!

Even though the storm season is winding down, these volunteers have already begun providing NWS forecasters with critical information about the weather in their areas. On May 20th, a spotter in Craig notified forecasters of dangerous wind conditions that warranted a high-wind warning for exposed locations along the coast and a storm warning for the adjacent marine area. Computer model data and even the offshore buoys did not reveal the intensity of this storm, so the spotter report really made the difference. This is the kind of information that saves lives!

Becoming a spotter is easy! You can browse through the training information on the web, we can mail you a packet, or you can attend a short two-hour spotter course. Courses may be scheduled in any community where there is enough interest to satisfy a minimal level of attendance (usually at least 10 people).

If you are interested in becoming a spotter, please give us a call at (907) 790-6803. You will also find more information on the web at www.alaska.net/~jnufo/spotter/spot.htm.

MOST ACTIVE SPOTTER

We appreciate your time and dedication and recognize our most active spotters with special prizes and awards. This quarter, our most active spotter was **Craig Sempart** of Craig with 27 reports!

Congratulations, Craig! You will receive an "Alaska Cloud and Weather Field Guide" for your efforts!

(RIDE - Cont. from page 2)

Southeast Alaska and the eastern Gulf of Alaska coast. Since Southeast Alaska relies heavily on barge and tugboat operations for supplies, marine weather can have a large impact on the successful and timely delivery of goods and equipment. In order to gain insight into the variety of marine weather encountered within the Juneau forecast area, I requested a FAM float from Juneau to Yakutat. This trip would expose me to the protected waters of the inner channels as well as the exposed outer coastal waters in the northeastern Gulf of Alaska.

The crew of the Ocean Mariner informed me of the type of weather conditions that hamper operations. They are generally not concerned with strong winds while they are traveling through the inner channels. Strong head winds will slow their progress, but due to the smaller fetch of water for the wind to blow over, large sea conditions are seldom encountered within the inner channels. On the other hand, strong winds are dangerous and do bring operations to a halt when they are loading/unloading containers and equipment at a port. When winds of 35 knots or higher are forecast along the outer coast, they will delay crossing unprotected waters due to large sea conditions and the possibility of losing containers overboard.

Fortunately for my land-based body, the wind and seas were tranquil during my two-day journey aboard the Ocean Mariner tugboat. Although I didn't get to experience a raging storm and high seas, I do have a much better understanding of the impacts of weather on marine operations and a respect for the vulnerability of vessels to Mother Nature at sea.

Snow in August?

—By Jerry Painter

It's that time of year when we begin to think VACATION! Here in the north, a few of us think of the far north as an area to be seen. My millennial (2000) vacation consisted of driving both the Dalton Highway (500 miles, Fairbanks to Prudhoe Bay) and the Canadian Dempster Highway (472 miles, Dawson City, Yukon to Inuvik, Northwest Territory). The total trip was 5,300 miles in 17 days (2,200 miles of gravel!).

I will relay a few tips on both what to take and what to expect normally and (as was the case on my trip) what to expect FROM THE UNEXPECTED!

First, NORMAL summer weather conditions north of the Arctic Circle must be taken with a grain of salt! We should note the summer norms seem rather reasonable. For both the North Slope and Inuvik, summer highs will be upper 60s to about 70° for July, tapering off to the upper 50s for early June and late August. Overnight lows will be in the upper 40s to near 50°, tapering to 40° by Labor Day or Memorial Day. Beware September travel as temperatures in the teens have been known to occur as early as the 1st of the month north of the Arctic Circle!

Summer rain isn't much of a problem with both areas being dry. The Inuvik area receives just 4 inches of precipitation during the summer (69 inches of snow over winter!). The North Slope of Alaska averages about 2 inches of rain per summer month.

The weather encountered on my trip last year was a study in experiencing the unexpected. My "expedition" ran from August 17th through the 1st of September. On the Dalton Highway to Prudhoe Bay, I experienced rain on all four days and snow on two as I crossed the Brooks Range (4,800 ft. Atigun Pass) and moved across the Arctic Plain. It was 37° and snowing as I did the traditional "barefoot dip" in the Beaufort Sea (Arctic Ocean) at Prudhoe Bay, and highs were in the 40s with lows at or very near the freezing mark, nowhere near the NORMS of 60s and 40s.

On the Canadian side, the Dempster Highway gave me a much more mixed bag of weather. I noted rain, snow, thunder, bright sun, and both the coldest and warmest temperatures of the trip. Crossing Wright Pass (Richardson Mountains, Continental Divide 3,300 ft.), the border between

(See SNOW - page 7)

Tombstone Pk. And the Tombstone Mountains located within the Ogilvie Range at mile marker 46.

Wolf Creek in the Ogilvie Range, at the south end of the Dempster Highway at about mile marker 35.

IMETs: PROVIDING ONSITE FORECASTING SUPPORT FOR EMERGENCIES

—By Michael Richmond

One of the more exciting and challenging services meteorologists in the National Weather Service provide is responding to emergency situations in the field. A group of about 120 specially trained meteorologists nationwide, including two here in Juneau (myself and forecaster Michael Mitchell), are available for dispatch anywhere in the country our services are needed in the interest of public safety. What is it that we IMETS (Incident Meteorologists) do? We provide detailed forecasts onsite to emergency operations personnel, which could be at large wildfires, chemical or oil spills, or large rescue operations.

A good example of this is my experience last August providing support to those fighting wildfires in Montana. As you probably are aware, the summer fires of 2000 were the worst in many years over the western states due to drought conditions. I was dispatched from Juneau to the Valley Complex wildfire, 50 miles south of Missoula, Montana, last August 5th, arriving on the 6th. Barely one hour after my arrival at the Valley Complex wildfire, explosive fire growth occurred: 55,000 acres were lost in six hours along with 50 homes. This fire became the largest, most active one in the country at the time, with the greatest threats to life and property. It reached 225,000 acres before I left two weeks later.

Fortunately I was working with another IMET Steve Stoll of the Missoula, Montana, office. Steve and I both had several years of experience as forecasters in the Northern Rockies; I was a fire-weather meteorologist based in Missoula from 1990-94. Since this fire became so large and threatening so quickly, he stayed on and we worked together. We composed detailed fire weather forecasts covering the area of the fire as well as "spot" forecasts for specific points along the fire line. These forecasts were used as inputs to fire behavior models. Of course, our forecasts were also important for firefighter-

(See FIRE - page 8)

(SNOW - Cont. from page 6)

the Yukon and Northwest Territories, I was driving in four to ten inches of blowing and drifting snow. Thank goodness for 4-wheel drive on the 25th of August! As I woke up in Inuvik the tent seemed a bit cool. Turns out the mercury dipped to 23 "August" degrees in those early morning hours. I had rainy and cool, several days of sunny but cool to cold, and even a few days that were sunny and warm! I just thought of the weather as a challenge or adventure and ended up having a pretty good time.

Both of these trips are worthwhile. I enjoyed the Inuvik trip a bit more because I did have some really good weather. This trip includes world-famous Dawson City with its tourism and casinos along with its gold-rush history. At mile marker 50, North Fork Pass (4,003 ft.) is crossed. Notable here are the Tombstone Mountains and stunning 7,100 ft. Tombstone Peak. Be advised, no gasoline is available north of Dawson City until Eagle Plains Hotel at mile marker 231. Gas is also available at Ft. McPherson (mile 342) and Inuvik (mile 457). The Arctic Circle (66° 33' N) is crossed at mile marker 252.

Finally, a few traveling tips for these roads. They are gravel and are hard on tires. My tires had less than10,000 miles at the time. I had no flats on the Dalton Highway but two flats on the Dempster. Both were on the same stretch of road, one going north and one on the return south. This stretch is between the Arctic Circle and Rock Creek to the north with flint-like gravel on the roadbed. Travel at 40-50 miles per hour is easier on tires than 60 mph. I would recommend two mounted spares (six tires total) and/or a patch kit and 12V air compressor along with a spare five gallon can of gas. A CB radio or cell phone would also be a good idea due to the relative isolation.

(FIRE - Cont. from page 7)
and public-safety, and we were always available for specific questions about our forecasts.

The value of our services was demonstrated many times while I was at the Valley Complex fire. For example: On August 8th, the Missoula NWS office's daily fire weather forecast, which covers all of Northern Idaho and Western Montana, issued a red flag warning (these are issued when weather conditions are expected that can lead to extreme fire behavior). It was for strong west winds that afternoon caused by the passage of a dry cold front. We both knew from experience that the winds would not be as strong in the area around the fire, due to the topography. We were able to impress this upon the fire suppression team managers. They were very apprehensive at this point, because if the winds predicted by Missoula occurred, serious safety issues and fire behavior problems would arise. Instead of pulling the fire crews off the line, they kept working all day and made significant progress. The strong winds did not materialize and firecrew- and public-safety were not compromised.

The other most noteworthy incident was the dry thunderstorm outbreak of August 10th. High level moisture from Mexico often moves north in the summer, over the western states and the Northern Rockies especially, and causes thunderstorms to develop with bases at over 10,000 feet. Because the lower atmosphere is usually very dry in the West in the summer, rainfall from these storms often evaporates before hitting the ground, causing strong, gusty winds to develop. Of course, lightning strikes from these storms can then start more fires, which can be pushed by the strong winds. On this day we knew thunderstorms would form, and we issued a red flag warning. We had tracked the moisture moving north for a few days and had given notice of this previously.

Valley Complex Fire at night.

From the afternoon of Aug. 10th to the morning of Aug. 11th, 22,000 lightning strikes, with very little rain, occurred over Idaho and Montana! In our vicinity, lightning detection data showed hundreds of strikes during this time. We were able to issue weather warnings that afternoon to the fire-line personnel about the approach of the storms based on radar and lightning detection data that we had access to. A couple of nearby fires reported downburst winds over 50 mph with the storms, but very little rain. Fortunately our fire area was spared the strongest winds. All this time, the entire area in the southern Bitterroot Valley was shrouded in thick, heavy smoke due to fires burning in every direction except to the north. It was rather eerie seeing the lightning flashes and hearing the thunder, while unable to see more than a few thousand feet in any direction. At one point, strong electrical charges in the atmosphere caused our metal framed tent to begin sparking like a bug zapper for about a minute, but fortunately no strikes occurred in camp. Needless to say, firecrews were pulled off the fire-lines after our first warning of approaching storms was issued in the early afternoon.

These examples show how important onsite weather forecasting support can be in emergency management. The technology and data available to us continue to increase, and aid in our effectiveness as well. Although we usually don't have large wildfires in Southeast Alaska, our support could be used for a large oil-spill or shipwreck, for example. That is why most large NWS offices have one or two IMETs on station, ready to respond when the call arises.

(PLANT - Cont. from page 4)

In Southeast Alaska, where solar heat is in short supply during the growing season, GDD may be particularly useful. Gardeners may be able to determine why marginal plants have some years which are better than others, what thresholds these plants require, and how frequently these thresholds have been reached in the past. Fruit growers may find the GDD useful for tracking successful fruit production and comparing plant varieties. Insect emergence may be better predicted to minimize pesticide use.

You can track Growing Degree Days for many Southeast Alaska locations from the Juneau National Weather Service website at www.alaska.net/~jnufo/ .

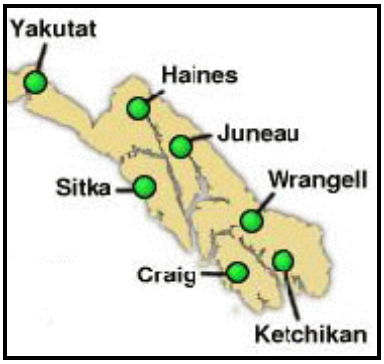
Select "Climatology" and then "Climate Database Page" to access GDD information. From this site, you can even do special searches for accumulated GDD over specific dates and years. So, in case you're wondering how last summer compared with other years: At the Juneau Airport, there were a total of 463 GDD in 2000 which is 101 below the 50-year average there of 564 GDD. '

U.S. Coast Guard Helps Improve NOAA Weather Radio Coverage

—By Laura Furgione

The U.S. Coast Guard and National Weather Service (NWS) are collaborating on an experimental weather broadcast transmitter located at the summit of Mt. Robert Barron. This radio, which broadcasts on Weather Channel 5 (162.450Mhz), is located on the Mansfield Peninsula of Admiralty Island at an elevation of 3,400 feet. The intended broadcast area encompasses southern Lynn Canal, northern Chatham Strait, northern Stephens Passage, western Icy Strait and the Mendenhall Valley.

The goal of this project is to provide the Alaska maritime community with accurate, timely, and comprehensive weather information. Currently the NWS has 16 VHF-FM broadcast sites from Ketchikan to Kodiak plus Nome and Fairbanks. These sites transmit continuously on 100 to 1,000 watt transmitters on Weather Channels 1 (162.550Mhz), 2 (162.400Mhz), and 3 (162.475Mhz). The products are up-dated continually. The average coverage area of the sea level transmitters has only a 40- nautical-mile radius. This small NOAA Weather Radio footprint, or coverage area, leaves many Alaska communities out of range.



NWR Transmitters

The U.S. Coast Guard currently transmits the NWS's products from three Coast Guard communication centers (Juneau, Valdez, and Kodiak). The transmissions are broadcast twice per day from all 28 of their VHF-FM high-level sites. These high sites are located from Dixon Entrance to Bristol Bay with an average elevation of 2,000 feet. Although the transmitters are only 30-50 watts, the average footprint has a radius of approximately 100 miles due to their elevation.

By combining the NWS's continuous broadcast with the U.S. Coast Guard's numerous high-level sites and large footprints, the Alaska maritime community and many Alaska residents will have better access to accurate, timely, and comprehensive weather information.

Public comment is appreciated to verify the actual coverage area of the Mt. Robert Barron transmitter. Anyone wishing to provide comments can contact the U.S. Coast Guard at (907)463-2343 or the National Weather Service at (907)790-6803. '

Tsunami

The Great Waves

—By Aimee Devaris

City of Kodiak after the 1964 tsunami.

Residents of Kodiak, Seward, Whittier and Valdez know of the dangers of tsunamis, and as infrequent as these events are, the hazard is understood and respected. In Southeast Alaska, the tsunami threat is not well identified by most, because our tsunami history is not as devastating. However, tsunamis are a threat to life and property to all coastal residents living near the ocean. Believing a deadly tsunami will not happen in your coastal town simply because it hasn't happened in recorded history may be a grave mistake.

Please take this opportunity to increase your awareness and knowledge of tsunamis. Then, share what you learn; knowing the right information may save your life and the lives of those you love.

A "tsunami" (soo-NAH-mee) is a series of ocean waves of very long length generated by disturbances associated primarily with earthquakes occurring below or near the ocean floor. Underwater volcanic eruptions and landslides can also generate tsunamis.

Not all earthquakes generate tsunamis. To generate tsunamis, earthquakes must create large movements in the sea floor. All oceanic regions of the world can experience tsunamis, but in the Pacific, destructive tsunamis are much more frequent. The deep ocean trenches off the coasts of Alaska, the Kuril Islands, Russia, and South America are known for their violent earthquakes as a source for Pacific-wide tsunamis.

In less than a day, these tsunamis can travel from one side of the Pacific to the other. However, people living near areas where large earthquakes occur may find that the tsunami waves will reach their shores within minutes of the earthquake. For these reasons, the tsunami threat to Alaska can be immediate (taking only a few minutes to reach coastal areas) or less urgent (taking from 3 to 22 hours to reach coastal areas).

In the open ocean a tsunami is less than a few feet high at the surface, but its wave height increases rapidly in shallow water. As the

(See TSUNAMI - page 11)

Tsunami Warning! What You Should Do...

- **Be aware** of tsunami facts. This knowledge could save your life!
- **If you are at school**, follow the advice of teachers and other school personnel.
- **If you are at home**, make sure your entire family is aware of the warning. Your family should evacuate your house if you live in a tsunami evacuation zone. Move to the evacuation site or any place outside the evacuation zone. Follow the advice of local authorities.
- **If you are at the beach** or near the ocean and you feel the earth shake, move immediately to high ground. DO NOT wait for a tsunami warning to be announced. A tsunami from a local earthquake could strike within minutes.
- **The upper floors of high,** multi-story, reinforced concrete hotels can provide a safe place should there be a tsunami warning and you cannot move quickly inland to higher ground. Homes and small buildings are not designed to withstand tsunami impacts. Do not stay in these structures if there is a tsunami warning.
- **If you are on a boat or a ship at sea**, do not return to port until you hear the "all clear" and verify that conditions are safe from the harbor authority.
- **If you are in port on a boat,** and there is time to move your boat or ship from port to deep water, then you may do so in an orderly manner, considering other vessels. Concurrent severe weather conditions (rough seas outside of safe harbor) could present an additional hazard to small boats, so physically moving yourself to higher ground may be the only option.

(TSUNAMI - Cont. from page 10)
tsunami attacks the coastline, the wave energy is compressed into a much shorter distance creating destructive, life-threatening waves.

When the tsunami moves inland, the water level can rise many feet. In extreme cases, water levels have risen to more than 50 feet for tsunamis of distant origin and over 100 feet for tsunami waves generated near the earthquake's epicenter. The flooding can extend inland by1,000 feet or more, covering large expanses of land with water and debris.

Warning Centers: As part of an international cooperative effort to save lives and protect property, the National Weather Service operates two tsunami warning centers. The West Coast/Alaska Tsunami Warn-ing Center in Palmer, Alaska, serves as the regional Tsunami Warning Center for Alaska, British Columbia, Washington, Oregon and California. The Pacific Tsunami Warning Center in Ewa Beach, Hawaii, serves as the regional Tsunami Warning Center for Hawaii and as an international warning center for tsunamis that pose a Pacific-wide threat. These organizations detect, locate and determine the magnitude of potentially tsunamigenic earthquakes. If the location and magnitude of an earthquake meet the known criteria for generation of a tsunami, a tsunami warning is issued.

The warning includes predicted tsunami arrival times at selected coastal communities within the geographic area defined by the maximum distance the tsunami could travel in a few hours. A tsunami watch with additional predicted arrival times is issued for a geographic area defined by the distance the tsunami could travel in a subsequent time period.

Tsunami watches, warnings, and information bulletins are disseminated to emergency officials and the public by a variety of communication methods:

- Bulletins are disseminated to local, state, national and international users as well as the media. These users, in turn, report the tsunami information to the public, generally over commercial radio and television channels.
- The NOAA Weather Radio system provides direct broadcast of tsunami information to the public.
- The Coast Guard broadcasts tsunami information to users equipped with medium frequency (MF) and very high frequency (VHF) marine radios.
- Local authorities and emergency managers are responsible for formulating and executing evacuation plans for areas under a tsunami warning.

As dangerous as tsunamis are, they do not happen very often. You should not let this natural hazard diminish your enjoyment of the beach and ocean. But, if you think a tsunami may be coming, the ground shakes under your feet or you hear there is a warning, tell your relatives and friends, and move quickly to higher ground.

Seward drydock after the 1964 tsunami

The Facts

- Tsunamis striking Pacific coastal locations are usually caused by earthquakes which may occur far away or near where you live.
- All low lying coastal areas can be struck by tsunamis.
- Tsunamis consist of a series of waves. Often the first wave may not be the largest. Danger from a tsunami can last for several hours after the first wave arrives.
- You cannot outrun a tsunami.
- Sometimes a tsunami causes the water near the shore to recede, exposing the ocean floor. This should be taken as a sign a tsunami is on its way.
- The force of a tsunami may be enormous. Boats and large debris may be moved inland hundreds of feet, killing or injuring people.