GUIDE TO NWS PRODUCTS AND SERVICES

For
Southeast Alaska

February 2014

NOAA's
NATIONAL WEATHER SERVICE
Juneau, Alaska

…Protecting Lives and Property from Weather Hazards…

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National Weather Service
Juneau, Alaska

…PROTECTING LIVES AND PROPERTY…

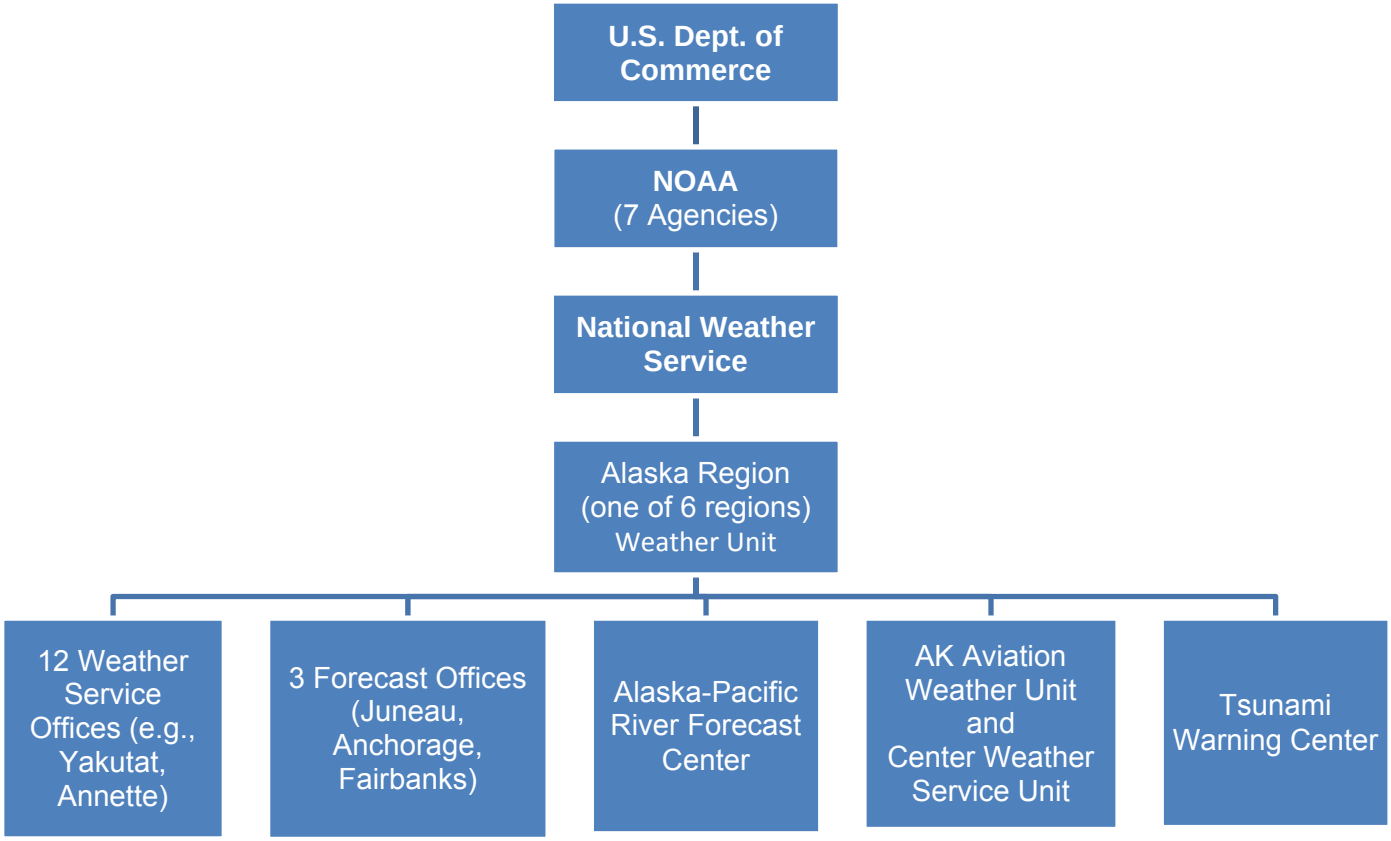
The National Weather Service (NWS) is a federal agency under the National Oceanic and Atmospheric Administration (NOAA), which is part of the Department of Commerce (DOC).

Our primary mission is to protect life and property from natural hazards, and to enhance the welfare and economy of the Nation. We fulfill this mission by observing, predicting, and monitoring weather and hydrologic conditions at sea and over land. We emphasize potentially damaging or life-threatening weather hazards through the use of specialized watches, warnings, and advisories to keep you informed and prepared for adverse conditions.

The NWS forecast office in Juneau, AK, is one of 122 NWS forecast offices across the United States from Maine to Guam and from Alaska to Puerto Rico.

The NWS is composed of six regions. Alaska is one region and consists of three Weather Forecast Offices (WFO) in Juneau, Anchorage, and Fairbanks; thirteen smaller Weather Service Offices; the Alaska-Pacific River Forecast Center; Tsunami Warning Center, and two offices devoted to aviation weather services.

The staff at the NWS office in Juneau maintains weather surveillance and has forecasting responsibility for approximately 155,000 square miles over Southeast Alaska and the eastern Gulf of Alaska. It has a full time staff of 23 employees and operates 24 hours a day, seven days a week.


U.S. Dept. of Commerce
NOAA
(7 Agencies)
National Weather Service
Alaska Region
(one of 6 regions)
Weather Unit
12 Weather Service Offices (e.g., Yakutat, Annette)
3 Forecast Offices (Juneau, Anchorage, Fairbanks)
Alaska-Pacific River Forecast Center
AK Aviation Weather Unit and Center Weather Service Unit
Tsunami Warning Center

About the NWS

National History

The weather has always been important in America. Weather records date back to the earliest settlers and became a prominent activity during the 1740-1770s. The National Weather Service was first organized through the Organic Act passed by Congress on February 2, 1870 and signed into law by President Ulysses S. Grant on February 9, 1870. The act authorized "the Secretary of War to take observations at military stations and to warn of storms on the Great Lakes and the Atlantic and Gulf coasts." We began as the Signal Service of the Army. The success of the agency through the years made this group of dedicated weather forecasters and observers one of the more popular and well-known federal agencies. In 1891 we moved to the Agriculture Department and changed our name to the Weather Bureau. In 1970, the National Oceanic and Atmospheric Administration was created and we changed our name to the National Weather Service.

Juneau Weather History

The U.S. Navy established Fort Rockwell in Juneau in May of 1881. The fort was situated on Chicken Ridge located near the site of the current State Office Building. Navy records are in the National Archives in Washington D.C. It is very likely sailors took the area's first routine weather observations. Records indicate that agents of the Northwest Trading Company became the observers in Juneau soon after the Navy departed in December 1881.

No official observations were recorded from October 1884 through July 1888. They continued in an inconsistent manner until December, 1898. This is the period of time for which the least information is available. Existing records are much more complete following December, 1898. At that time a cooperative observer, John McLaughlin, was commissioned by the U.S. Weather Bureau. His records, and those of subsequent cooperative observers, are contained in the Voluntary Observer's Meteorological Record currently held at NOAA's NWS Forecast Office in Juneau. It appears that the observing site was relocated to the waterfront area at this time.

On September 24, 1916, Melvin B. Summers, the first full-time Weather Bureau employee in Alaska, arrived in Juneau. Summers had quite a time getting established. The initial pages of his log book reveal he had to acquire a suitable building for himself, his family, an assistant, and the Weather Bureau Office (WBO). After doing this, Summers left for two months to visit cooperative observers around Alaska. On January 1, 1917, WBO Juneau officially opened, located at the Heid House (leased from Henrietta C. Heid), 224 4th Street. Summers was the Official-In-Charge (OIC), with James R. Craven as assistant.

On October 8, 1923, the Fairbanks News-Miner newspaper began receiving a Fairbanks weather forecast. This was the first indication in the notes of any forecast for towns outside of Juneau.

The field of aviation became increasingly important in the 1930's and the Weather Bureau supported the Alaska aviation industry from its beginnings. The first upper air observations in Alaska began July 29, 1931. The attack on Pearl Harbor led to increased staffing in Juneau that included up to ten observers, five forecasters, and five administrative personnel. Early in World War II, five new positions were established for people to encode

and decode military messages. On February 19, 1942, all of the administrative positions at the Weather Bureau Office in Juneau were moved to Anchorage. With this action, Anchorage replaced Juneau as center of the Weather Bureau in Alaska.

On July 1, 1943, the new Weather Bureau Airport Station (WBAS) opened at Juneau's International Airport. This is the benchmark date for official records for Alaska's capital city.

Federal budget restrictions in the early 1950's forced WBAS Juneau to accept major staffing reductions. The forecast section was closed in 1953 and much of its function was transferred to the Anchorage office.

In August 1972, shortly after the creation of NOAA, a staff of forecasters was reestablished in Juneau. The airport office was designated the Weather Service Office (WSO) Juneau. The revamped forecast group was named Weather Service Forecast Office (WSFO) Juneau. For just over one year both WSO and WSFO were co-located at the Airport. In December, 1973, the WSFO returned downtown to Room 433 of the Federal Building on 12th and Willoughby.

Necessary renovations at the Federal Building forced the WSFO staff to find temporary office space in the valley at Mendenhall Mall in the late 1980s. During the years at Mendenhall Mall, NWS went through a major modernization and restructuring of its infrastructure (offices, observing equipment, operational tools, etc) and staffing models. The restructuring of NWS led to a new weather forecast office (WFO) built in 1998 on property deeded from the US Forest Service at 8500 Back Loop Road. For the first time in its history, WFO Juneau was staffed and equipped similarly to the 121 other WFOs across the country. Today, WFO Juneau is responsible for informing citizens of impending weather conditions across the eastern Gulf of Alaska and the entire Southeast Alaska panhandle as well as disseminating tsunami information originating from the West Coast and Alaska Tsunami Warning Center in Palmer, Alaska.

NWS Statistics

The primary responsibility of the NWS is to issue warnings for hazardous weather and water conditions. To arrive at these forecasts, meteorologists and hydrologists analyze weather data gathered by satellites, Doppler radar, automated surface observations, and other means of remote sensing plus human observers. From present weather conditions, warnings and routine forecasts are prepared with the aid of computer and statistical models of the atmosphere. The forecast products are issued according to user groups; public (general weather), aviation, marine, fire weather, and hydrology. Weather products are used by the public and many industries and can be received via newspapers, radio and television, telephone recordings, NOAA Weather Radio, Internet, and special publications. The NWS operates 24 hours a day, 365 days a year with a total 122 forecast offices and specialized prediction center (e.g., Hurricanes and Tornadoes). Career fields with the NWS include not only Meteorologists and Meteorological Technicians but also Hydrologists, Physical Scientists, Information Technology/Computer Programmers, Electronics Technicians, and Geophysicists (at Tsunami Warning Centers). Preferred majors for entry-level positions include Atmospheric Sciences, Computer Sciences, Earth Sciences, Electronics, Geography, Hydrology, Mathematics, Meteorology, and Physics. Summer internship programs are occasionally available. Job applicants can obtain employment information from a local NWS office or through the US Government Office of Personnel Management.

WFO Juneau Staff

The staff of the National Weather Service in Juneau is here to serve and to protect the people of Southeast Alaska by keeping our citizens and visitors aware of our diverse weather conditions and the potential hazards that we face. Our goal is to be looked on as a community resource for information that will help people help themselves when the weather threatens our safety.

Office Administrators

Meteorologist in Charge	*Tom Ainsworth*
Warning Coordination Meteorologist	*Joel Curtis*
Science & Operations Officer	*Vacant*
Administrative Assistant	*Ursula Jones*
Senior Service Hydrologist	*Aaron Jacobs*
Electronics Systems Analyst	*Richard Martinez*
Information Technology Officer	*Vacant*

Lead Forecasters

Stephen Ahn *Brian Bezenek*

Rick Fritsch *Robert Tschantz*

Forecasters

Wes Adkins *Peter Boyd*

Nicole Ferrin *Jonathan Garner*

Edward Liske

Hydro-Meteorological Technicians

Geri Swanson *Kimberly Vaughan*

Meteorologist Interns

Richard Lam *Timothy Steffen*

Electronic Technicians

Art Puustinen

Our Service Programs

The NWS' approach to providing forecast services is one of addressing our customers' needs by programs. These programs have evolved over the years by the forecast requirements as addressed to activities.

The most prominent program through the broadcast media is our Public Forecast Program. These forecasts are designed to prepare the general public for dangerous and damaging weather while keeping our customers informed of the changes in routine weather. Public forecasts include sky conditions and/or weather, temperature, wind, and sometimes special hazardous conditions, such as headlines for flooding.

Aviation forecasts play a vital role in the lives of all residents of Southeast Alaska. This program provides pilots and airline dispatchers the precise flying conditions. These forecasts are required by regulation before any flight. The emphasis in these forecasts is on ceiling, visibility, weather, wind, turbulence and icing.

Marine forecasts are also essential to the day to day living here in Southeast. The mission of these forecasts is to provide warnings of hazardous marine conditions and the routine maritime weather for operating all types of vessels. The focus in marine forecasts is on the wind, seas, and vessel icing.

The Juneau Forecast Office also has hydrologic (river forecasting) and fire weather programs. We also provide some services in historical weather and climate. Our office also supports several regional and national programs which include: Tsunami Warning, NOAA Hazardous Materials, and state and local communications and alerts. We are eager to educate and make our customers aware of the climate, weather, and hazards.

Southeast Alaska Public Forecasts

Our highly trained staff of Meteorologists and Hydro-Meteorological Technicians are on duty 24 hours a day, seven days a week. As new information is received, our forecasts may be updated so that you can plan for the next few hours, the next day, or even your week.

The primary public product is called the Zone Weather Forecast. These are routinely generated and issued at least twice a day by 5 AM and 4 PM. The "zones" are areas that represent similar geographic and/or climatological regions. These contain warning headlines (if in effect), and sky, weather, temperature, and wind.

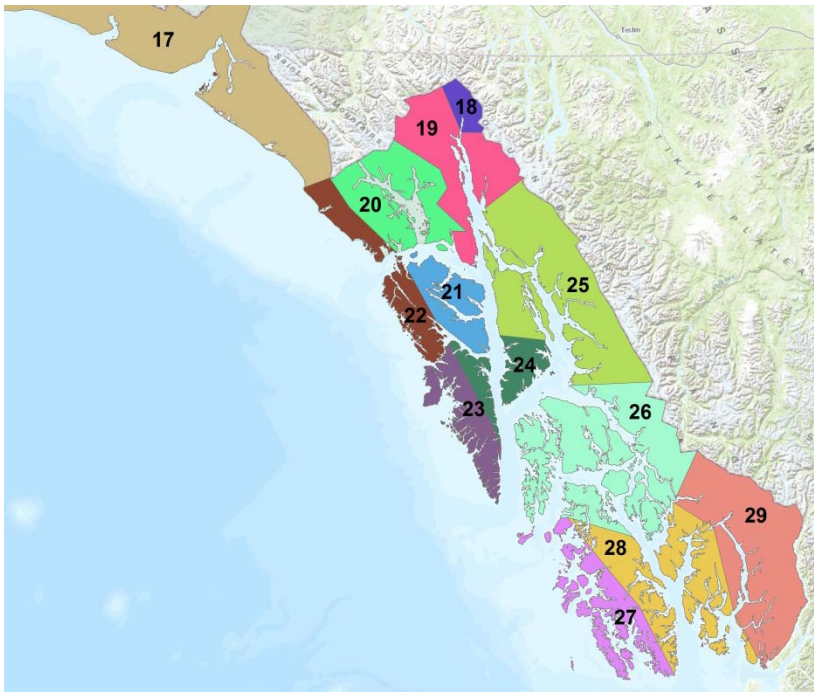
"Zones"

The Juneau office provides specific forecasts for 13 zones (areas) in Southeast Alaska between Cape Suckling and Dixon Entrance. They include:

ZONE NUMBER	ZONE NAME
017	Cape Fairweather to Cape Suckling Coastal Area
018	Taiya Inlet and Klondike Highway
019	Haines Borough and Lynn Canal
020	Glacier Bay
021	Eastern Chichagof Island
022	Salisbury Sound to Cape Fairweather coastal area
023	Cape Decision to Salisbury Sound Coastal Area
024	Eastern Baranof Island and Southern Admiralty Island
025	Juneau Borough and Northern Admiralty Island
026	Inner Channels from Kupreanof Island to Etolin Island
027	Dixon Entrance to Cape Decision Coastal Area
028	Southern Inner Channels
029	Misty Fjords

Zone Forecasts include detailed weather information out to 7 days for elevations sea level to 300 feet.

Public Weather Zone Forecast Map
WFO Juneau



AKZ017- CAPE FAIRWEATHER TO CAPE SUCKLING COASTAL AREA-
INCLUDING...YAKUTAT

AKZ018- TAIYA INLET AND KLONDIKE HIGHWAY-
INCLUDING...SKAGWAY

AKZ019- HAINES BOROUGH AND LYNN CANAL-
INCLUDING...HAINES

AKZ020- GLACIER BAY-
INCLUDING...GUSTAVUS

AKZ021- EASTERN CHICHAGOF ISLAND-
INCLUDING...HOONAH

AKZ022- SALISBURY SOUND TO CAPE FAIRWEATHER COASTAL AREA-
INCLUDING...ELFIN COVE...PELICAN

AKZ023- CAPE DECISION TO SALISBURY SOUND COASTAL AREA-
INCLUDING...SITKA...PORT ALEXANDER

AKZ024- EASTERN BARANOF ISLAND AND SOUTHERN ADMIRALTY ISLAND-
INCLUDING...ANGOON

AKZ025- JUNEAU BOROUGH AND NORTHERN ADMIRALTY ISLAND-
INCLUDING...JUNEAU

AKZ026- INNER CHANNELS FROM KUPREANOF ISLAND TO ETOLIN ISLAND-
INCLUDING...PETERSBURG...WRANGELL...KAKE

AKZ027- DIXON ENTRANCE TO CAPE DECISION COASTAL AREA-
INCLUDING...CRAIG...KLAWOCK

AKZ028- SOUTHERN INNER CHANNELS-
INCLUDING...KETCHIKAN...METLAKATLA

AKZ029- MISTY FJORDS-
INCLUDING...HYDER

Public "WARNINGS"

When severe weather approaches your area, we emphasize the hazard(s) with headlines called "Warnings". NWS Warnings are reserved for potentially life threatening or damaging events. When we issue a warning it means a certain weather phenomena is occurring or imminent.

During warnings, we issue special products that both announce the status of the warning and give a definition of the weather criteria for the type of warning. There may be additional

information in these products that describe the intensity of the hazard and additional action statements that promote safety during these events.

A Warning headline will appear at the top of a Zone Forecast. Here are the types of Warnings:

WARNINGS	CRITERIA
BLIZZARD WARNING	Sustained wind or frequent gusts ≥ 35 mph accompanied by falling and/or blowing snow, frequently reducing visibility to ≤ 1/4 mile for three hours or more.
FLASH FLOOD WARNING	Short duration (less than 6 hours), intense flooding resulting from torrential rain, dam breaks, or ice jams
FLOOD WARNING	Longer, more gradual flooding usually beginning after 6 hours of excessive rainfall or during spring snow runoff
FREEZE WARNING	Only during growing season: temperatures well below freezing across several zones, preceded by a much warmer pattern of duration greater than 10 days
FREEZING RAIN OR ICE STORM WARNING	Freezing rain event resulting in significant, widespread and possibly damaging accumulations of ice
HEAVY SNOW WARNING	Snowfall 6 inches (average) or more in 12 hours or 12 inches or more in 24 hours
HEAVY SNOW WARNING Zone 29, Misty Fjords, only	Snowfall 12 inches (average) in 24 hrs
HIGH WIND WARNING	Sustained wind speeds or frequent gusts to 60 mph
SEVERE THUNDERSTORM WARNING	Thunderstorm winds 58 mph and/or Hail ¾ inch are occurring or imminent
TORNADO WARNING	Tornado is occurring or imminent
WIND CHILL WARNING	Wind chill -55˚F with 15 mph sustained winds for 3 hours or more
WINTER STORM WARNING	A combination of winter weather elements (e.g. heavy snow and wind) causing life threatening conditions

Public "WATCHES"

The NWS issues "Watches" up to 48 hours in advance of potentially hazardous weather. This gives you plenty of time to plan ahead and protect yourself and your family. A Watch means conditions are favorable for certain weather phenomena to occur but it is not expected immediately. Go about your normal activities, but be aware of changing weather conditions and the potential for hazardous weather. A Watch headline will also appear at the top of a Zone Forecast.

WATCHES	CRITERIA
FLASH FLOOD WATCH	Potential for short duration, intense flooding resulting from torrential rain, dam breaks or ice jams
FLOOD WATCH	Conditions are favorable for flooding, but the occurrence is not certain
HIGH WIND WATCH	Conditions are favorable for development for development of high winds, but timing and location are not certain
SEVERE THUNDERSTORM WATCH	Conditions are favorable for the development of thunderstorm winds at least 58 mph and/or hail at or greater than ¾ inch
TORNADO WATCH	Conditions are favorable for tornadic development
WINTER STORM WATCH	Potential for a blizzard, heavy snowfall, ice storm and/or high winds

"ADVISORIES"

The NWS issues weather "Advisories" to inform you of events that can result in significant impact to you and your family, but are less intense than a warning. Like Warnings, the headlines will appear at the beginning of a Zone that is to be affected. A list of these appears below:

ADVISORIES	CRITERIA
BLOWING/DRIFTING SNOW ADVISORY	Blowing and/or drifting snow which reduces visibilities to ¼ mile or less
DENSE FOG ADVISORY	Widespread dense fog which reduces visibilities to less than ¼ mile for at least an hour

FREEZING RAIN/DRIZZLE ADVISORY	Freezing rain or drizzle resulting in light accumulations if ice making sidewalks and roadways slippery
SMOKE ADVISORY	Visibility reduced to ¼ mile or less due to smoke
SNOW ADVISORY	Snowfall 4 to 5 inches(average) in 12 hours
SNOW ADVISORY Zones 27-28 only	Snowfall 3 inches (average) in 12 hours
SNOW ADVISORY Zone 29 only	Snowfall 8 inches (average) in 24 hours
URBAN AND/OR SMALL STREAM FLOOD ADVISORY	Heavy rains causing locally deep standing water, or causing small streams to fill over their banks
VOLCANIC ASH ADVISORY	Whenever ash fall occurs
WINTER STORM ADVISORY	A combination of winter weather elements (snowfall, winds, and/or low windchill) occurring below warning thresholds

"OUTLOOKS"

The NWS issues "Outlooks" for weather that could occur three to seven (3 – 7) days in the future. An Outlook is issued for conditions or an event that could result in a hazard, but are still too far in the future for a watch, advisory, or warning to be issued. They are intended to increase public awareness of a potential hazard or explain a special weather phenomenon that could affect your life. The text message for Outlooks is a Special Weather Statement.

OUTLOOKS	EXAMPLES
FLOOD POTENTIAL OUTLOOK	Heavy precipitation and/or snow melt could produce flooding
HAZARDOUS WEATHER OUTLOOK	Daily product to highlight hazardous weather (if any) within the next seven days
NON-PRECIPITATION OUTLOOK	Some Examples: High Wind, Blowing Dust, Dense Fog, Heat, Cold, Volcanic Ash, Smoke
WINTER WEATHER OUTLOOK	Some Examples: Winter Storm, Freezing Rain

The "NOWCAST"

Weather conditions vary significantly over short distances in Southeast Alaska. This is due to our spectacular mountain topography, abundant maritime influences, and channeled wind flows. To describe the variations and more detailed weather in local areas, we issue Short Term Forecasts that serve to keep you informed of weather conditions in your area over the next two to six hours. These are commonly referred to as "NOWCASTs". These are your best choice for detailed weather for the next few hours. NOWCASTs will also have headlines for any warning that is currently in effect.

Understanding NWS Forecasts

Sky, precipitation, wind, and temperature conditions are the core elements of the public zone forecast. Public zone forecasts go out seven days into the future. Marine Weather and Fire Weather forecasts go out five days into the future. Weather watches, warnings, and advisories are unscheduled predictions of potentially hazardous conditions. These forecasts typically cover 48 hours or less into the future.

Listed below are descriptions of regularly used weather terms to aid you in better understanding of their meaning. It is important to keep in mind public forecasts describe the weather over the whole zone, not just at a single location. In Southeast Alaska, zones roughly equate to a whole borough or large areas of land, such as one or more islands.

FORECAST TIME PERIODS

NWS weather forecasts are broken down into 12 hour day time and night time periods. The day time period is considered to be between 6 a.m. and 6 p.m. The night time period is considered to be between 6 p.m. and 6 a.m. Time periods with similar predicted weather may be combined (e.g., TUESDAY NIGHT THROUGH THURSDAY…) especially in the later forecast periods.

SKY CONDITIONS

These terms are used to describe the predominant condition of the sky condition based upon tenths of the sky covered by opaque (not transparent) clouds.

Sky Condition	Cloud Coverage
Cloudy	88 to 100%
Mostly Cloudy, or Considerable Cloudiness	70 to 87%
Partly Cloudy or Mostly Cloudy	51 to 69%
Partly Cloudy or Mostly Sunny	26 to 50%
Sunny or Mostly Clear	6 to 25%
Clear or Sunny	5% or less

WIND

Used to describe the prevailing direction *from which* the wind is blowing, with speeds given in miles per hour. (The term "winds" are used when referring to multiple directions).

Sustained Wind Speed	Descriptive Term
0 – 5 mph	Light, or light and variable winds
5 – 15 mph	None used
15 – 25 mph	Breezy (mild weather), Brisk or Blustery (cold weather)
20 – 30 mph	Windy
30 – 40 mph	Very Windy
40 – 73 mph	Strong, dangerous, damaging, High Wind
74 mph or greater	Hurricane Force

TEMPERATURES

Used to describe the forecast maximum and minimum temperatures, or in some cases, the temperature expected at a specific time.

Description Examples	Range
Near 40	Approaching 40 or a range from 38 to 42
Around 85	Range of temperatures from 83 to 87
Lower 50's	Temperatures of 50 through 53
Middle 70's	Temperatures of 74 through 76
Upper 30's	Temperatures of 37 through 39
60's	Temperatures of 60 through 69

PRECIPITATION PROBABILITIES

Following are precipitation probabilities used in National Weather Service forecasts and a brief explanation of each. Technically, the Probability of Precipitation (PoP) is defined as the likelihood of occurrence (expressed as a percent) of a measurable amount of liquid precipitation (or the water equivalent of frozen precipitation) falling during a specified period of time at any given point in the zone forecast area. "Measurable" precipitation is defined as equal to or greater than 0.01 inch or 0.2 millimeters (mm). The period of time is 12 hours, unless specified otherwise. The forecast area, or zone, is generally considered to be an area of similar weather characteristics and/or climatology. In some geographically unique areas, like mountains, the forecast area/zone may consist of all or a portion of a Borough. At times, some NWS forecasters will use "occasional" or "periods of" to describe a precipitation event that has a high probability of occurrence, i.e., they expect any given location in a forecast zone area to most likely have precipitation, but it will be of an "on and off" nature.

PoP Percent	Expressions of Uncertainty	Equivalent Areal Qualifiers
10 – 20 %	Slight chance	Isolated
30 – 40 – 50 %	Chance	Scattered
60 – 70 %	Likely	Likely
80 – 90 – 100 %	None used	None used (categorical)

Wind Chill Table

The wind chill table shows the cooling effect of wind on humans and animals. Winds of more than 45 mph add little to the chilling. Wind chills should be calculated with sustained wind speeds. Dangerous wind chills begin at -20°F.

Temperature (°F) vs. Wind (mph)

	35°	30°	25°	20°	15°	10°	5°	0°	-5°	-10°	-15°	-20°	-25°	-30°	-35°
Wind Chill Factor – Apparent Temperature															
5	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52
10	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59
15	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64
20	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68
25	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71
30	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73
35	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76
40	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78
45	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79

Forecast Discussion

The Area Forecast Discussion can be found in the Forecast Text section on the right hand side of our homepage. This discussion is issued by the day and midnight shifts, and is a narrative of our forecast reasoning. The discussion will contain some technical terms, and is primarily used as a coordination tool between WFO Juneau and the surrounding weather offices. The discussion is composed in free form, but includes sections on the synopsis, short term, and long term reasoning. The synopsis is a diagnosis of the current state of weather features that are affecting or will affect Southeast Alaska. The short term section is concerning with the next 24 to 36 hours, while the long term section discusses the reasoning for the forecasts from 36 hours out to seven days.

Aviation Forecasts and Observations

The Juneau forecasters produce aviation forecasts for general aviation purposes and flight planning. The Terminal Aerodrome Forecast (TAF) provides a concise 24-hour forecast for specific weather conditions within a five statute mile radius of an airport. TAFs are prepared for the following eight locations:

TAFs
Yakutat
Gustavus
Skagway
Haines

TAFs continued.
Juneau
Sitka
Petersburg
Wrangell
Ketchikan

Aviators not only rely on forecasts, they use Meteorological Aviation Reports (METAR) to find out specific weather information at an airport for their operations. An Automated Surface Observation System (ASOS) or trained weather observers report observations at least once an hour (more frequently during rapidly changing weather). A standard aviation weather observation includes the following elements:

METAR Observation Elements	
Wind Velocity (speed and direction)	Air Temperature
Visibility (in miles)	Dew Point Temperature
Precipitation and Obscurations	Altimeter (atmospheric pressure)
Cloud Cover (amount and height above ground level)	Precipitation

Southeast Alaska METAR reporting stations

The Alaska Aviation Weather Unit (AAWU) provides the Southeast Alaska aviation community with additional services: Area Forecasts, AIRMETs, SIGMETs, and aviation graphical products. The products are used to forecast aviation hazards such as icing and turbulence, while also forecasting the routine flying weather the occurs between WFO Juneau's TAFs. Their products are used extensively in preflight pilot weather briefings given by the Federal Aviation Administration. All of their products are available on their website:

http:/aawu.arh.noaa.gov/

and through links from our WFO website. (Note - one stop flight folders are available from the left-hand column on the AAWU home page: Area Fax Sheets)

Marine Forecasts

WFO Juneau is responsible for all marine weather forecasts and warnings for Southeast Alaska between Cape Suckling and Dixon Entrance including the inner channels, the Gulf coast out 100 nm, and the open offshore waters of the Gulf of Alaska east of 144 degrees west longitude. Our Marine Weather forecasts serve a very wide variety of customers ranging from crews of the largest ocean-going vessels, commercial and recreational fishers, and families in skiffs.

Marine weather forecasts include predominant wind direction and speed, significant wave height, and inclement weather. The sea conditions occasionally include mention of swell direction. Marine weather forecasts are issued two times daily at 4:00 am/pm. Wind is expressed in knots (KT), which are nautical miles per hour. (1 nautical mile = 1.2 statute miles)

Marine weather advisories and warnings are issued when wind and wave conditions exceed certain thresholds. The advisories and warning criteria are listed below.

ADVISORIES	CRITERIA
SMALL CRAFT ADVISORY	• Sustained wind speed or frequent gusts between 23 – 33 knots, • Seas 8 feet or greater
WARNINGS	**CRITERIA**
GALE WARNING	Sustained wind speed or frequent gusts of 34 – 47 knots (39 – 54 mph) expected within 24 hours

STORM WARNING	Sustained wind speed or frequent gusts of 48 – 63 knots (55 – 73 mph) expected within 24 hours
HURRICANE FORCE WARNING	Sustained wind speed or frequent gusts, of 64 knots (74 mph) or greater, expected within 24 hours
SPECIAL MARINE WARNING	Thunderstorms causing sustained wind or frequent gusts of 34 knots or greater and/or ¾ inch diameter hail and/or a waterspout lasting less than two hours

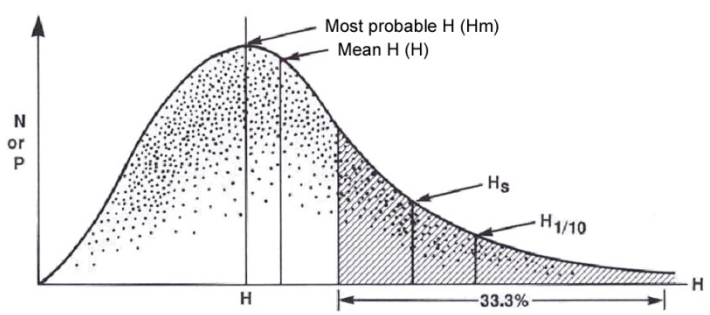
Waves

Our maritime customers need to understand what waves we are forecasting and measuring. The value of "SEAS" given in our forecasts is defined as the "combined significant wave" measured in feet (FT). Combined seas mean that this height, crest to trough, is a combination of the swell and the wind wave which does NOT distinguish between the two components. Wind waves are the waves generated by the direct forcing of the wind. Swell(s) are the wind waves that have left a generation area (fetch).

Significant Wave Height

A wave spectrum is an extremely complex fluid phenomenon. The spectrum is literally made up of waves on top of waves (on top of waves!). It is extremely important for mariners to understand how this spectrum of wave heights is conveyed in marine weather information. The wave height value in a forecast and reported by ships and buoys is called the *significant wave height*. Significant wave height (Hs) is defined as the average height of the highest one-third waves in a wave spectrum. This happens to correlate very well with the wave height a skilled observer perceives in a wave spectrum.

What do we mean by "highest one-third waves"? Remember, a wavy water surface is comprised of thousands of interacting waves that originated in different places and traveled in different directions at different speeds. If a person could filter out and plot on a graph all of the waves that make up a spectrum, the distribution of waves with different heights would result in a "bell curve" graph similar to the one in the figure shown on the following page. Each dot represents the number of waves (N) in the spectrum with a height of H. The graph shows there are a relatively low number of small waves (left side of graph) and a low number of very large waves (right side of graph). The greatest number of waves (N) in this spectrum fall in the mid range of heights (centered under Hm). The highest one-third (33.3%) number of waves in this spectrum is shaded on the graph. The average height of waves in this shaded group is the significant wave height, Hs.



Also shown are the mean wave height (H), most probable wave height (Hm), and the height of the highest 10% of waves (H1/10). The mean wave height H is approximately equals to 2/3rds (0.64) the value of Hs and H1/10 is approximately equal to 1.27 times the value of Hs. In addition, the height of the highest 1% of waves (H1/100) is approximately equal to 1.67 times Hs, and a theoretical maximum wave height (Hmax) is approximately equal to *two times Hs*.

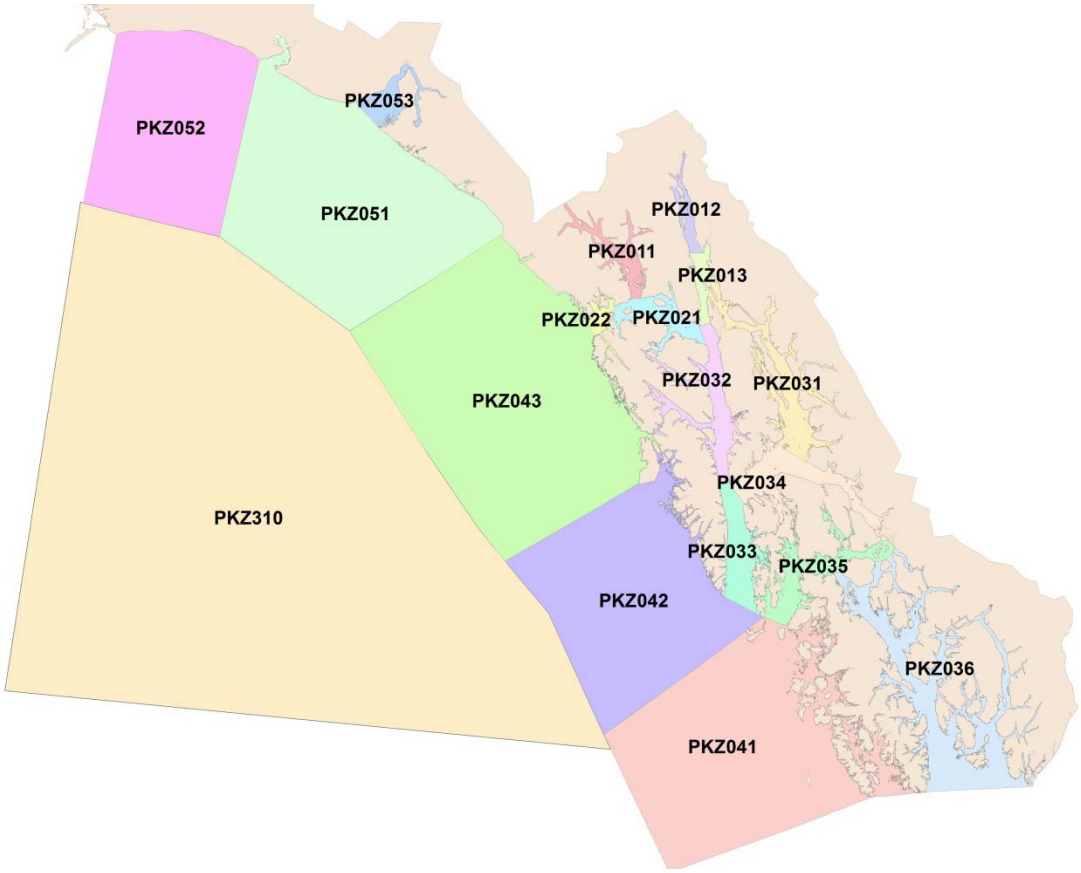
Coastal Flooding / Tidal Overflow

A somewhat rare, but important hazardous marine situation is that of a Coastal Flood. This is caused in low elevations very near sea level near the Gulf of Alaska. This hazard is a combination of high tide, low atmospheric pressure, onshore wind, and waves surging onto the beach. This phenomena is also known as storm surge and is potentially damaging, particularly to fish camps and boats not secured on the beach. Coastal flood warnings, or in a lesser case, minor tidal overflow, will be mentioned in both marine and Zone forecasts.

COASTAL FLOOD WATCH / WARNING	A combination of very high surf and high water, with waves traveling beyond the beach, producing damaging results

Marine Weather Zone Forecast Map

Marine Forecast Zones and Designators



PKZ098- SYNOPSIS FOR SOUTHEAST ALASKA INNER CHANNELS COASTAL WATERS...
PKZ099- SYNOPSIS FOR OUTSIDE WATERS...
PKZ398- SYNOPSIS FOR THE GULF OF ALASKA...
PKZ011- GLACIER BAY-
PKZ012- NORTHERN LYNN CANAL-
PKZ013- SOUTHERN LYNN CANAL-
PKZ021- ICY STRAIT-
PKZ022- CROSS SOUND-
PKZ031- STEPHENS PASSAGE-
PKZ032- NORTHERN CHATHAM STRAIT-
PKZ033- SOUTHERN CHATHAM STRAIT-
PKZ034- FREDERICK SOUND-
PKZ035- SUMNER STRAIT-
PKZ036- CLARENCE STRAIT-
PKZ041- DIXON ENTRANCE TO CAPE DECISION-
PKZ042- CAPE DECISION TO CAPE EDGECUMBE-
PKZ043- CAPE EDGECUMBE TO CAPE FAIRWEATHER-
PKZ051- CAPE FAIRWEATHER TO ICY CAPE-
PKZ052- ICY CAPE TO CAPE SUCKLING-
PKZ053- YAKUTAT BAY-
PKZ310- GULF OF ALASKA NORTH OF 55 DEGREES NORTH AND EAST OF 144 DEGREES WEST-

Fire Weather

WFO Juneau produces fire weather forecasts, Fire Weather Watches, and Red Flag Warnings for Southeast Alaska typically between April and August. The Fire Weather Forecast zones are identical to the Public Forecast Zones (see maps on pages 7 and 18). WFO Juneau also provides fire weather “spot forecasts” upon request for a site-specific management purposes (e.g., prescribed burns ignited on Federal Lands, for wildfires on Federal Lands, or a non-Federal Land prescribed burn that is declared a wildfire, hazardous materials release).

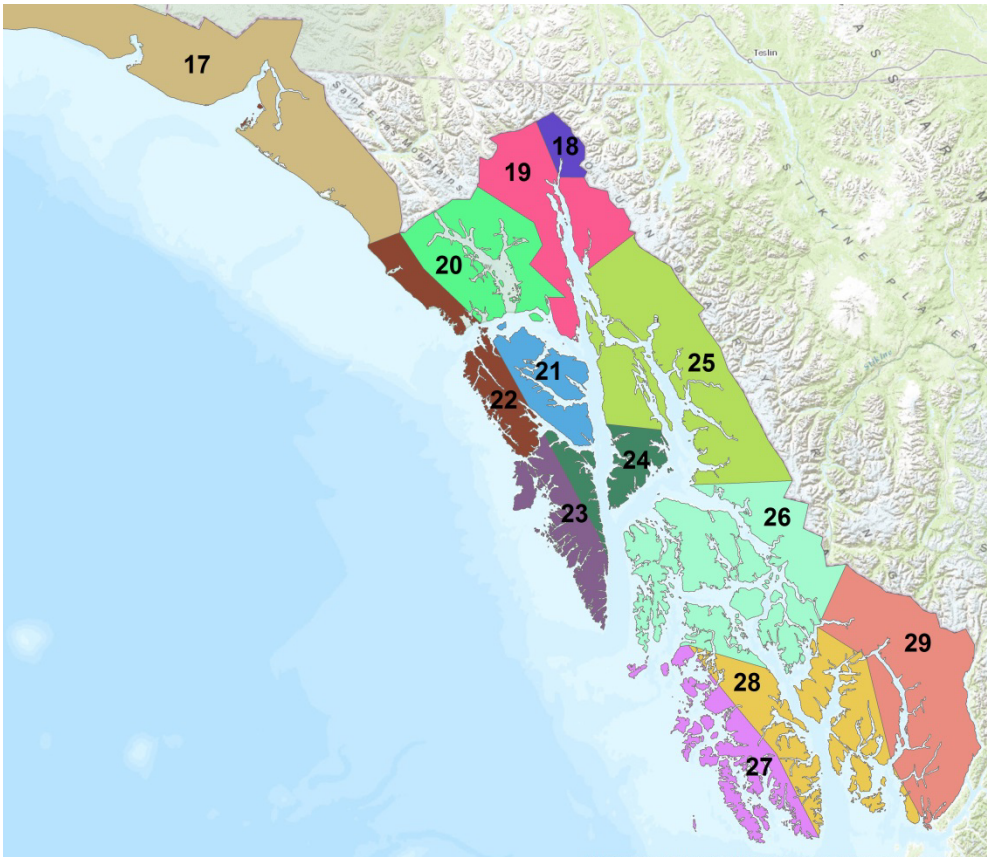
During fire season special forecasts are prepared daily for users like the US Forest Service (USFS), Bureau of Land Management (BLM), Bureau of Indian Affairs, and Alaska State Land to provide meteorological information that is critical to fire behavior and where fire starts may potentially occur. Some specific items we forecast for include relative humidity changes, temperature changes, drainage and general winds, and lightning activity.

In Southeast Alaska, fire weather conditions are typically most severe in April and May. Dry and windy conditions are not uncommon and fine grassy fuels have not greened up yet and are very combustible. Special Fire Weather Watches and Red Flag Warning criteria for high fire danger are listed below, along with zone specific conditions.

PRODUCT	TIME PERIOD
FIRE WEATHER WATCH	Criteria below is forecasted to occur within 24 – 72 hours
RED FLAG WARNING	Criteria below is forecasted to occur within 0 – 24 hours

ZONE	WIND AND HUMIDITY CONDITION
ZONES 17-29 (Same as Public Weather Zones)	(1) Strong Wind: Wind* ≥ 25 mph &RH is ≤ 30% (2) Low Humidity: RH ≤ 15% (3) Strong Wind *and* Low Humidity: Wind* ≥ 25 mph & RH ≤ 15% (4) Dry Thunderstorms: Dry thunderstorms with a scattered coverage (25% areal) and < 0.10" rainfall. *Wind is defined as frequent gusts or sustained for one-hour duration or more.

WFO Juneau Fire Weather Zone Forecast Map



AKZ017- CAPE FAIRWEATHER TO CAPE SUCKLING COASTAL AREA-
INCLUDING...YAKUTAT
AKZ018- TAIYA INLET AND KLONDIKE HIGHWAY-
INCLUDING...SKAGWAY
AKZ019- HAINES BOROUGH AND LYNN CANAL-
INCLUDING...HAINES
AKZ020- GLACIER BAY-
INCLUDING...GUSTAVUS
AKZ021- EASTERN CHICHAGOF ISLAND-
INCLUDING...HOONAH
AKZ022- SALISBURY SOUND TO CAPE FAIRWEATHER COASTAL AREA-
INCLUDING...ELFIN COVE...PELICAN
AKZ023- CAPE DECISION TO SALISBURY SOUND COASTAL AREA-
INCLUDING...SITKA...PORT ALEXANDER
AKZ024- EASTERN BARANOF ISLAND AND SOUTHERN ADMIRALTY ISLAND-
INCLUDING...ANGOON
AKZ025- JUNEAU BOROUGH AND NORTHERN ADMIRALTY ISLAND-
INCLUDING...JUNEAU
AKZ026- INNER CHANNELS FROM KUPREANOF ISLAND TO ETOLIN ISLAND-
INCLUDING...PETERSBURG...WRANGELL...KAKE
AKZ027- DIXON ENTRANCE TO CAPE DECISION COASTAL AREA-
INCLUDING...CRAIG...KLAWOCK
AKZ028- SOUTHERN INNER CHANNELS-
INCLUDING...KETCHIKAN...METLAKATLA
AKZ029- MISTY FJORDS-
INCLUDING...HYDER

Hydrology

Water is an important factor in our lives here in Southeast Alaska. Some weather reporting stations in the panhandle receive, on average, over 200 inches of liquid precipitation each year. The NWS provides the official word for hydrologic warnings, watches and other pertinent information on water flow, flood potential, and water supply on our area's waterways and land areas. We provide water level and stream flow forecasts for certain locations on several rivers.

The hydrologic forecast process starts at the NWS River Forecast Center located in Anchorage, AK. Hydrologists collect data from various sources including precipitation gauges, SNOTEL gauges, river level gauges, and various weather observations. Hydrologists quality control these data, then use these data (along with other data from agencies like the US Army Corp of Engineers, US Bureau of Reclamation, US Geological Survey, and Natural Resource Conservation Service) in sophisticated computer programs to model snow accumulation and melt, runoff, and stream flow. Hydrologists review the computer model output and refine the forecasts before making them available for use.

The staff at the WFO Juneau interprets river forecasts and issues appropriate warnings, watches and statements when necessary. During the Southeast Alaska flood season (September through November), WFO Juneau prepares special statements and forecasts for selected points on rivers in our area. During other times of the year, storms may cause quick bursts of rainfall which cause flash flooding. Our forecasters issue watches, warnings

and statements during these events as well. We also issue appropriate statements in the unlikely event of a dam failure.

List of Hydrological Products

River Statement (FGAK87 and RVSAJK)
Used to alert for changing river conditions in a non-warning or non-watch mode.

Flood Advisory (WGAK87 and FLSAJK)
Used when rainfall or snow melt causes water to pond on roadways, yards and/or small creeks and streams are near or at minor flood stage (nuisance urban and rural flooding).

Flood Watch and Flash Flood Watch (WGAK67 and FFAAJK)
Used when flooding is possible, but not occurring at the present time.

Flood Warning (WGAK47 and FLWAJK)
Used when flooding is imminent or occurring. The criteria is based on established "moderate flooding" levels for specific rivers, but the warning is an areal forecast.

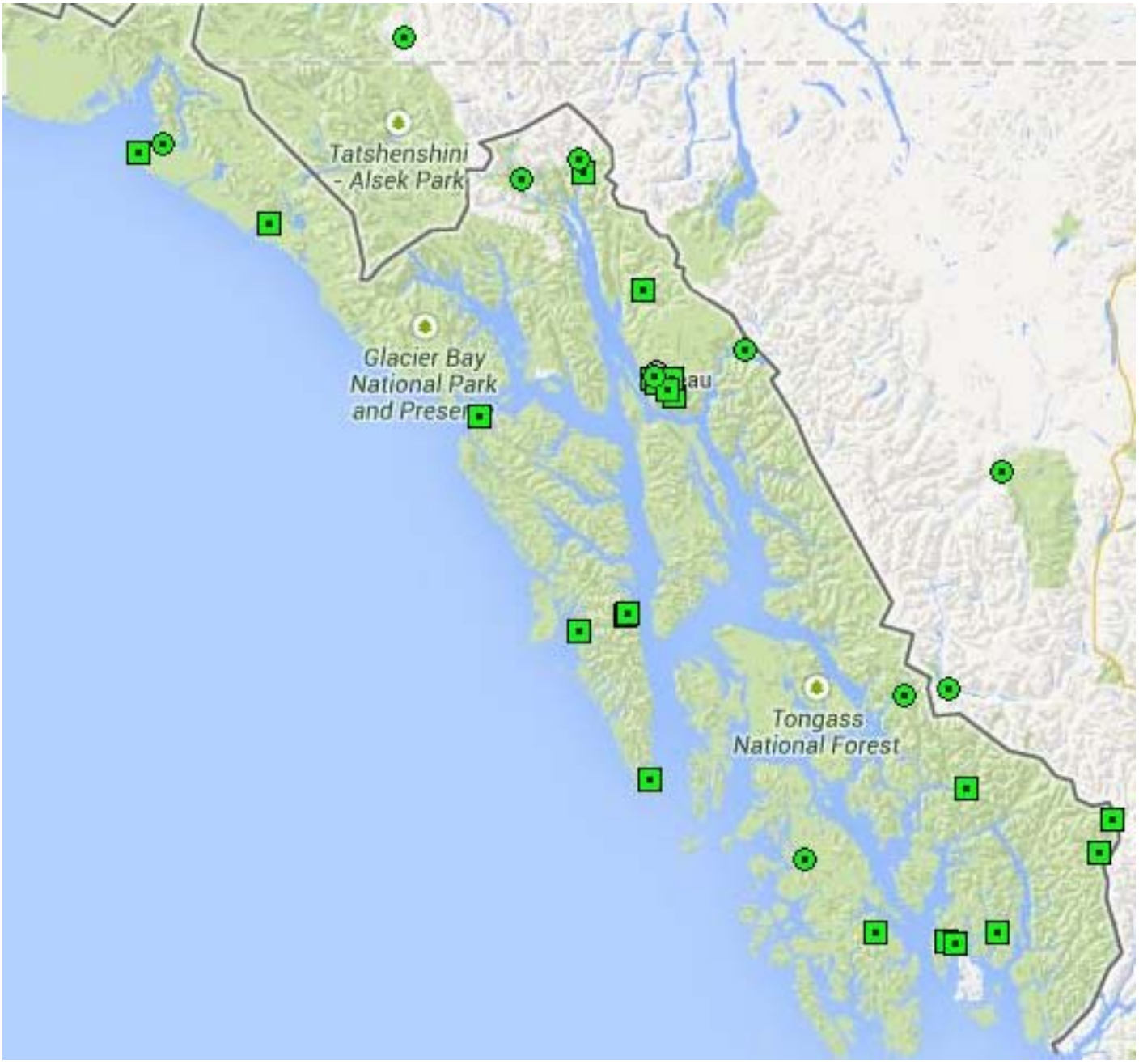
Flood Statement (WGAK87 and FLSAJK)
This is used to update or cancel a flood warning or flood advisory..

Flash Flood Warning (WGAK57 and FFWAJK)
Used when a flash flood is imminent or occurring, such as when 2 to 6 hour rainfall totals reach amounts that will cause a rapid rise in streams and rivers.

Flash Flood Statement (WGAK77 and FFSAJK) Used to update or cancel a Flash Flood Warning.

Flash Flood Warning for Dam Break (WGAK57 and FFWAJK)
Used to warn during dam failures.

Southeast Alaska River/Tide Observations



Monitored River Gages in SE Alaska

River and Location	Flood Stage (ft)
Alsek River	NA
Antler River	33.5
Auke Lake	NA
Chilkat River	21.5
Fish Creek	4.3
Government Creek	NA
Jordan Creek	9.7
Lemon Creek	NA
Mendenhall Lake	9.0
Mendenhall River	11.5
Montana Creek	15.5
Old Tom Creek	NA
Salmon River near Hyder	NA
Salmon River near Juneau	NA
Situk River	71.5
Skagway River	26.5
Soule River	NA
Staney Creek	16.5
Stikine River	27
Taiya River	16.5
Takatz Creek	NA
Taku River	43

NWS Forecast Formats and the National Digital Forecast Database

NWS forecasts are issued in a variety of formats including text, tabular, graphical and at detailed, evenly spaced "grid points". Text forecasts are the traditional format of public zone forecasts, marine zone forecasts, watches, warnings, and advisories. Tabular formats are more commonly used to convey site-specific information such as hydrologic river levels and selected city temperature forecasts. Graphical forecasts (maps and charts) are available on NWS web pages and marine facsimile receivers show spatial variations of weather parameters.

Advances in digital technology combined with scientific breakthroughs allow NWS to present weather forecasts and warnings with much more specificity. NWS offices in Alaska are working to implement a digital gridded database of weather elements. Gridded forecasts can be thought of assigning specific values of temperature, wind speed, precipitation, etc., for each corner of the squares that make up a checker board. The sides of each checker board square ranges from 3 kilometers (km) to 5 kilometers in length. A kilometer is approximately 0.6 miles long. Once each corner of the square, or grid, has a numeric value, patterns and coverage areas emerge. National Digital Forecast Database (NDFD) is comprised of high resolution digital forecasts from each NWS field offices which is blended together with forecasts from neighboring offices to create a seamless mosaic of forecast weather parameters across Alaska and the Lower-48.

The real power of a digital database is that it opens the door for providing much more forecast information and in more useful forms. The NDFD will contain much more data than the NWS was previously able to provide, at time scales as small as hourly and space scales of a few kilometers.

Powerful computers generate a set of NWS forecasts from a single gridded forecast database which brings a high level of consistency between forecasts for different applications (e.g., wind predictions in marine weather forecasts are related to wind predictions in fire weather forecasts). Ultimately, this database is made available to all customers and partners, including private sector meteorologists and university researchers, so they can create a wide range of text, tabular, graphic, and digital products of their own.

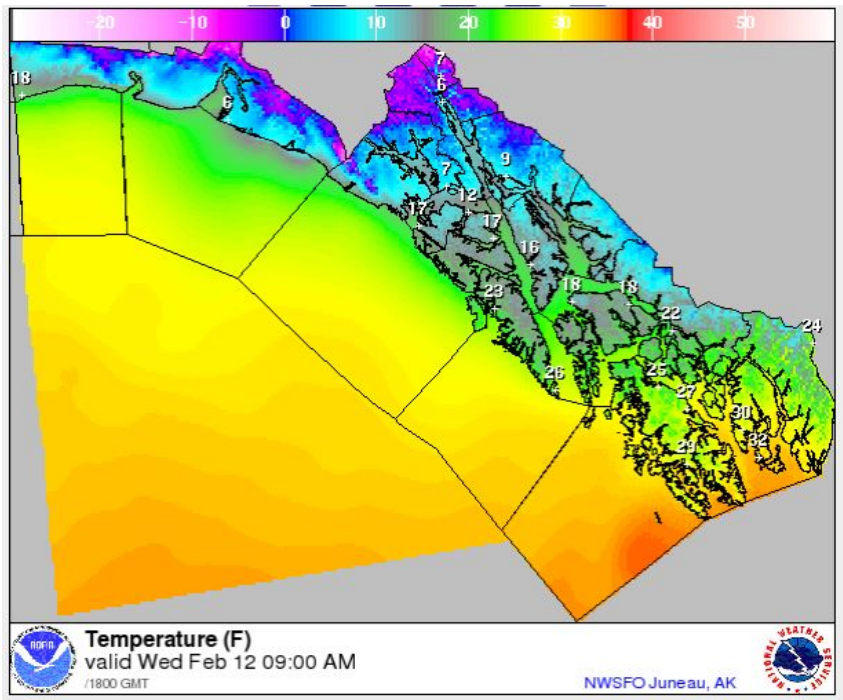
Commercial weather services will be able to produce many different applications and products, either general information for radio and television broadcast, or tailored products for specific customers. For example:

- Decision support systems that fit the forecasts to the problem
- Individualized weather information along a path – forecasts for a drive across a state or a sailing across the gulf matched to a user-defined itinerary
- Text forecasts generated in more than one language
- Forecasts for vehicles and hand-held devices with Global Positioning Systems (GPS)
- Controls for smart appliances (e.g., heating, cooling, irrigation)
- Graphics for mass media.

Teaming the NDFD with GIS systems will provide very powerful capabilities. The NDFD will give the customers what they want when they need it.

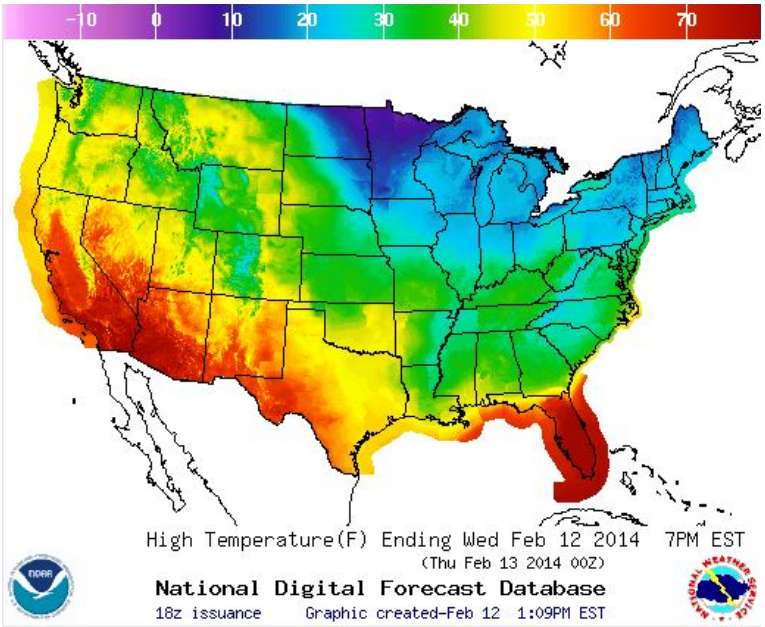
Commercial products available today that provide point forecasts or large scale graphics sometimes rely on direct model output, or the algorithmic interpretation of model output, with no human contributions. NDFD will be the source of site-specific weather forecasts prepared by local forecasters familiar with localized weather phenomenon in their area of responsibility.

Any individual with a computer and access to the Internet can download information from the NDFD to suit his or her needs. No longer will this customer have to wait for the timed broadcast of weather information, but can time the receipt of the specific information needed to his or her schedule.



Example of Southeast Alaska gridded/graphical temperature forecast

Example of CONUS temperature mosaic from NDFD



Historical Weather Data and Climatology

Recorded weather observations are received from a variety of sources ranging from sophisticated Automated Surface Observing Systems (ASOS), precipitation gauges, river gages, and volunteer "Cooperative Observers". Trained NWS specialists called Hydro-Meteorology Technicians (HMT) collect weather data from across Southeast Alaska (and the rest of the nation) from a network of observers. HMTs quality control data from a Local Climate Data (LCD) summary is produced each month for hundreds of specific sites across the United States. The LCD contains climatological elements such as daily temperatures records, percent of cloud cover, daily rainfall amounts and snowfall, and wind information. Major airports and some coastal observing stations are examples of the almost 40 weather reporting stations in Southeast Alaska.

Cooperative Observers (Coops) are volunteer weather observers who take daily records of temperature maximum/minimums and/or rainfall amounts. Our HMTs visit each Coop at least once each year to maintain and calibrate their weather instruments. HMTs forward data collected from the Coops to the national repository for historical weather records at the National Climatic Data Center (NCDC) in Asheville, North Carolina.

NCDC stores many forms of weather data such as radar and satellite images, forecasts, and observations from airports and upper air balloons releases. Any type of weather information can be obtained by calling them and ordering the information. Please see the special phone and address page (pg. 29) for ordering information.

Climate information may be obtained via the Internet from these sites:

National Climatic Data Center (NCDC) *http://www.ncdc.noaa.gov*

Western Regional Climate Center *http://www.wrcc.dri.edu/*

Southeast Weather Records

It has been said that, “Records are meant to be broken”, and that “Normals are just the average of extremes.” These statements are true but they minimize the value in understanding the climatology of Southeast Alaska. Climatological averages and extremes provide us with valuable information and permit citizens to better prepare themselves (i.e., protected against) against what Mother Nature might throw at us in the future. The following information summarizes the range of weather we can be subject to in Southeast Alaska (valid June 2005).

WEATHER ELEMENT	JUNEAU		SKAGWAY		SITKA		KETCHIKAN	
Annual Average High Temperature	47.3°F		48.7°F		49.6°F		52.0°F	
Record High Temperature/Year	90°F	1975	94°F	1900	89°F	2004	96°F	1913
Annual Average Low Temperature	34.6°F		34.4°F		39.5°F		38.9°F	
Record Low Temperature/Year	-22°F	1972 & 1968	-24°F	1947	-4°F	1917	-8°F	1916
Average Total Annual Rainfall	57.54”		24.80”		86.70”		155.24”	
Record Highest Annual Rainfall/Year	85.15”	1991	39.93”	1923	122.96”	1961	190.46”	1917
Record Lowest Annual Rainfall/Year	37.8”	1951	15.23”	1905	51.66”	1950	99.2”	1989
Average Annual Snowfall	97.8”		37.1”		39.6”		35.3”	

NOAA Weather Radio

Information from the NWS is highly useful for day-to-day planning and is intended to keep citizens out of harm’s way. A vital component of our mission is ensuring the information is thoroughly disseminated in a timely fashion in ways citizens can receive it. NWS relies on commercial radio and television stations to help us share the information. In addition, NOAA has its own network of VHF radio transmitters. NOAA Weather Radio (NWR) is a nationwide network of over 900 radio stations broadcasting continuous weather information direct from a nearby NWS office. NWR broadcasts NWS warnings, watches, forecasts, and other hazard information 24 hours a day.

Working with the Federal Communication’s Commission (FCC) Emergency Alert System, NWR is an "all hazards" radio network, making it your single source for comprehensive weather and emergency information. When necessary, NWR also broadcasts warning and safety information during all types of hazards--both natural (such as earthquakes, tsunamis, and volcano activity) and environmental (such as chemical releases or oil spills).

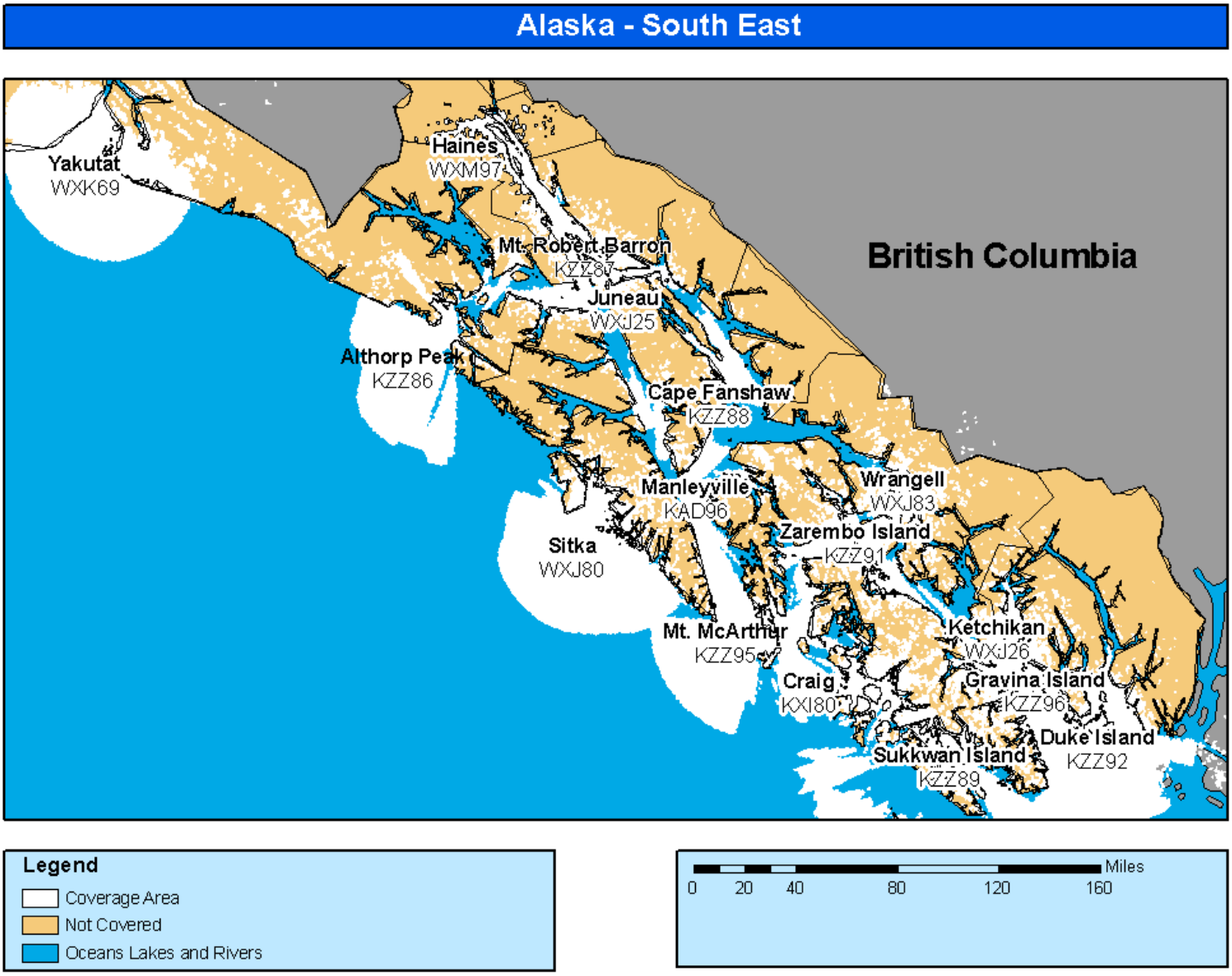
The Juneau NWS office programs and maintains six NWR transmitters from Haines to Ketchikan. Specially designed radios can be purchased from commercial vendors so you can listen to NWR. Some of these radios have special features that alarm when the NWS issues a warning. A simple scanner can also access these frequencies. Recently, some car manufacturers have included these special frequencies on their radios.

An important NWR program that is unique to Alaska is the "Weather Blanket" program developed in partnership with the US Coast Guard 17th District. The Coast Guard operates and maintains a number of low power transmitters at "high sites" (i.e., mountain tops) along the Alaska coast and Inside Passage to assist radio communications for vessels traveling these waters. Unless the high sites are actively transmitting urgent distress messages, they transmit NWR broadcasts. These additional transmitters have greatly expanded the range and coverage patterns of NWR. In some locales, high site broadcasts are the only source for up to date weather information.

Locations of NOAA Weather Radios and High Sites that service Southeast Alaska include:

LOCATION	CALL LETTERS	FREQUENCY
Yakutat	WXK69	162.400 MHz
Haines	WXM97	162.400 MHz
Juneau	WXJ25	162.550 MHz
*Mt. Robert Baron	KZZ87	162.450 MHz
* Althorp Peak	KZZ86	162.425 MHz
*Cape Fanshaw	KZZ88	162.425 MHz
Sitka	WXJ80	162.550 MHz
*Manleyville	KAD96	162.500 MHz
Wrangell	WXJ83	162.400 MHz
*Mt. Zarembo	KZZ91	162.450 MHz
*Mt. McArthur	KZZ95	162.525 MHz
Ketchikan	WXJ26	162.550 MHz
*Gravina Island	KZZ96	162.525 MHz
*Duke Island	KZZ92	162.450 MHz
Craig	KXI80	162.475 MHz
*Sukkwan Island	KZZ89	162.425 MHz
*Indicates a High Site transmitter operated by Juneau USCG D17		

NOAA Weather Radio Coverage In Southeast Alaska



EMERGENCY ALERT SYSTEM (EAS)

The Emergency Alert System (EAS) is used to alert the local community about emergency information and warnings through local broadcast and cable media. Certain messages can be generated by local, state, and federal offices and transmitted on radio, television, and cable networks. These messages alert the community about such hazards as power outages, tornadoes, flash floods, severe thunderstorms, blizzards, dam failures, nuclear accidents, toxic leaks or any occurrence that poses a danger to life or property.

The EAS system can be activated by several methods. We at the NWS can activate the system via our NOAA Weather Radio. Usually we activate the system when life threatening weather or potential damage to property may occur. The main weather elements we activate the system for are tornadoes, flash floods, severe thunderstorms, tsunamis, and rapidly developing blizzards. We can, at the request of specified officials, activate the system for items like dam failures or messages from county emergency management directors who need to alert their community to hazards like toxic spills.

When the system is activated, certain tones are heard on radio and television that interrupt the audio portion of the programming. Each television station may choose whether to use a crawler or have an audio portion discuss what the alert is for. Radio stations use only audio messages. Once the message is relayed, the television and radio stations return to normal programming. Testing of the EAS is carried out weekly on NWR.

Other Communication Links

NWS forecast and warning information can also be found on the Internet. Weather observations from ocean buoys can be emailed to you. Forecasts and observations from across the country and around the world can be obtained. Views from web cams, satellite imagery, and Doppler radars, as well as historical climate records and hurricane tracking charts, are also available. You are just a few clicks away. Explore the following web pages and turn your computer into a weather station.

Juneau's homepage:	***http://pajk.arh.noaa.gov/***
Annette Island homepage:	***http://pant.arh.noaa.gov/***
Yakutat homepage:	***http://paya.arh.noaa.gov/***
Alaska Aviation Weather Unit:	***http://aawu.arh.noaa.gov/***
Alaska Region homepage:	***http://www.arh.noaa.gov***
NWS Headquarters homepage:	***http://weather.gov***
NOAA homepage**:**	***http://www.noaa.gov***

There are many commercial weather services that provide a wide variety of weather products and graphics for a fee. Newspapers, radio stations, and television stations often hire the services of commercial weather service providers for graphic or animated displays that help people see the weather in different ways. Commercial weather vendors provide a source of information for U.S. businesses and individuals seeking more specialized meteorological products and services than those available from the National Weather Service. This list is available online at: **http://www.nws.noaa.gov/im/more.htm**. This list is

purely intended as informational with no implied endorsement. For further information on these companies, you will need to contact them directly.

In the State of Alaska, certain public agencies like Alaska Department of Homeland Security and Emergency Management, sheriff departments and fire stations receive NWS text products through the state's "First Class" system.

NWS Weather Spotters

The National Weather Service office in Juneau maintains a network of over 100 volunteer "Weather Spotters". Spotters report (by phone or email) occurrences of significant weather. We're always looking for interested members from our community to assist in the detection and reporting of potentially hazardous weather. The spotter network is an important source of live field reports and real-time local weather data. All reports and data received from our spotters are used as 'ground truth' verification for the purpose of enhancing our warning and forecasting programs. This information might also be specifically mentioned in our forecast products.

There are certain elements that can help us determine a storm's severity. These may include items like wind speed, hail size, snowfall amounts, damage from winds, heavy rains and flooding. A list of suggested items for spotters to report is shown below:

SUGGESTED WEATHER ELEMENTS		
Tornadoes and Waterspouts	Damaging Winds	Low Visibility (blowing snow or dust)
Dense Fog (less than ¼ mile visibility)	Weather Related Damage	Extreme Road Hazards from Weather
Frequent Cloud to Ground Lightning	Heavy Snow (1" or more per hour or storm total accumulations)	Freezing Rain
Rainfall Amounts (over 1" in an hour)	Flooding (location & type)	Hail
Heavy surf or unusually high tide that are causing beach erosions	Volcanic activity or earthquakes	

If you would like more information on how you can take part in protecting lives and property in your community, or know of individuals in any location who would like to assist us, provide the requested information on the Spotter Sign-up form on page 36 and Fax to the NWS office in Juneau at 907-790-6827.

Damage Assessments

The NWS collects data related to weather that has caused major property damage, injuries, deaths, or hazardous conditions that affect the community. This information is tabulated from every NWS office and placed in a monthly publication called "*Storm Data and Unusual Weather Phenomena.*" The storm data can be accessed through the National Climatic Data Center or by using their homepage in PDF format at:

http://www5.ncdc.noaa.gov/pubs/publications.html#SD

The Juneau WFO relies on various sources for inclusion into this document. Sources include: city and borough emergency management officials, fire and law enforcement agencies, television meteorologists, television/radio journalists, newspapers, Alaska Department of Homeland Security and Emergency Management, Alaska Department of Transportation, spotter reports, amateur radio groups and the general public just to name a few.

We conduct formal Storm Damage Surveys after notable weather events and determine what weather phenomena may have caused the damage and/or injuries/deaths. Certain weather elements we look at include wind, hail, tornadoes and floods in order to assess the strength of the weather event (e.g. wind speeds) and give tornado ratings (Enhanced Fujita Scale EF0 through EF5).

NWS Equipment

The NWS operates and uses many varied types of instruments to measure weather elements like moisture, wind, clouds, pressure, and precipitation. A partial list of these instruments appears below:

EQUPMENT	USES
ACARS	Commercial Airplanes measure temperature, moisture, winds
Advanced Weather Interactive Processing System (AWIPS)	Display system for hydro-meteorological operations
Automated Surface Observation System (ASOS)	Wind, temperature, moisture, cloud bases, weather & obscurations, pressure
Co-Operative Observation Networks	Temperatures & precipitation
Doppler Weather Radar	Precipitation intensity and amounts, winds, severe weather patterns
Hydrologic Observing Systems	Temperature, precipitation, river stage/flow
Marine Buoys	Wave heights, wind, pressure
Mesonets	Temperatures, winds, precipitation
Mobile Weather Units	Taken on-sight at HAZMAT concerns or large fires to provide weather observations and forecasts
National Lightning Data Network	Lightning strikes, intensities and trends
NOAA Weather Radio	Official warning and forecast voice of the NWS
Personal Computers	Localized forecast models & text generation

River Gages	River stage, water temperature
Satellite	Clouds – tops, temperatures, moisture content, large scale winds, sea surface temperatures
Ship Observing Networks	Temperatures, moisture, wind, pressure
Special Communications	National Warning Alert System, amateur radio
Spotter Networks	Weather reports and observations
Super Computers	Global & regional forecast models
Tide gages	Ocean Level
Tsunami Warning Center	Issues Tsunami warnings for undersea earthquakes
Upper Air Balloon Soundings	Winds, temperatures, moisture
Wind Profilers	Wind patterns

Frequently use telephone numbers, addresses, and web addresses

National Weather Service
8500 Mendenhall Loop Road
Juneau, AK 99801

http://pajk.arh.noaa.gov/

Media Line (unlisted): *907-790-6824*
Administrative Line (7:00 am - 4:00 pm): *907-790-6802*
Spotter Line (unlisted): *877-807-8943*
Alaska Weather Information Line (Recorded Forecasts): *907-790-6850 or 1-800-472-0391*
FAX: 907-790-6827

National Climatic Data Center
Federal Building
151 Patton Ave.
Asheville, NC 28801-5001

www.ncdc.noaa.gov
828-271-4800
FAX: 828-271-4876

Western Regional Climatic Center
PO Box 60220
Reno, NV 89506

www.wrcc.dri.edu
775-674-7010
FAX: 775-674-7016

Weather Related Websites

National Weather Service Juneau, AK	*http://pajk.arh.noaa.gov/*
NWS Alaska Region Headquarters	*http://www.arh.noaa.gov*
West Coast/Alaska Tsunami Warning Center	*http://wcatwc.arh.noaa.gov*
Alaska Aviation Weather Unit (AAWU)	*http://aawu.arh.noaa.gov/*
National Weather Service Headquarters	*http://www.nws.noaa.gov*
NWS Forecast Offices Nationwide	*http://www.weather.gov/organization.php*
National Centers for Environmental Prediction	*http://www.ncep.noaa.gov*
Climate Prediction Center	*http://www.cpc.ncep.noaa.gov*
Storm Prediction Center	*http://www.spc.noaa.gov*
National Climatic Data Center	*http://www.ncdc.noaa.gov*
Western Regional Climate Center	*http://www.wrcc.dri.edu/*
National Severe Storms Laboratory	*http://www.nssl.noaa.gov*
NWS Digital Forecast Database	*http://www.nws.noaa.gov/ndfd*
University Center for Atmospheric Research	*http://www2.ucar.edu/*
American Red Cross	*http://www.redcross.org*

SPOTTER RECRUITMENT FORM

National Weather Service ~ Juneau, Alaska

Your Location	
Nearest Town (to where you report from)	
Affiliation (Fire Dept., Police, general public, etc.)	
Title or Position	
Name	
Mailing Address	
City, State & Zip Code	
Home Phone (area code and number)	
Hours we may call you	
Work Phone – optional (area code and number)	
Remarks - (anything that might be important, times not to call, extensions, etc.)	
Pager Number – optional	
Cell Phone – optional	
Email Address	
Video Equipment (camcorder, digital camera, etc.)	
Observing Equipment - (snow stake, rain gage, thermometer, wind equipment, etc.)	
Amateur Radio Call ID	
Last date of Training - (type of training: severe weather, snow, etc.)	

To Report Severe Weather:

Call Juneau
National Weather Service
1-877-807-8943

Please report the following if you observe them:

- Damaging Winds (see below)
- Heavy Snow (1" or more per hour / storm accumulations)
- Freezing Rain
- Rainfall Amounts (over one inch in an hour)
- Flooding (location and type)
- Low Visibility (blowing dust / snow)
- Dense Fog (less than ¼ mile visibility)
- Weather Related Damage
- Extreme Road Hazards from Weather
- Frequent Cloud to Ground Lightning
- Tornadoes (location & movement), Waterspouts, Funnel Clouds
- Hail (see below)
- Heavy surf or unusually high tides that are causing beach erosions
- Volcanic activity or earthquakes

Estimating Wind Speed:

25-30 mph	Large branches moving
30-40 mph	Whole trees moving
40-45 mph	Twigs break & impedes walking
45-55 mph	Slight structural damage
55-65 mph	Moderate structural damage
> 65 mph	Heavy structural & tree damage

Hail Sizes:

Pea	¼ inch
Dime	½ inch
Penny	¾ inch
Quarter	1 inch
Golf Ball	1 ¾ inches
Tennis Ball	2 ¾ inches

Suggested reporting style:

Identify yourself:	"This is [name], a spotter from [location]. My Spotter # is: [optional]
What you have seen:	"I'm calling to report damage caused by strong winds. Four 50-foot spruce trees were knocked over. One home had roof shingles blown off."
Where you saw it:	"It was between Craig and Klawock"
When you saw it:	"Winds were estimated to be are gusting over 60 mph the past two hours."
What it is doing now:	"Winds have decreased to around 30 mph and the worst seems to be over."

National Weather Service
8500 Mendenhall Loop Road
Juneau, Alaska 99801

http://pajk.arh.noaa.gov/
907-790-6824

Inquiries about the NWS Weather Spotter Program may be directed to the Warning Coordination Meteorologist at WFO Juneau.

Appendix A
Safety Rules

Following are safety rules for different weather conditions. During times of threatening or severe weather, WFO Juneau asks that the media occasionally broadcast these safety rules to listeners.

FLOOD / FLASH FLOOD SAFETY RULES

When a flash flood warning is issued for your area, or the moment you first realize that a flash flood is imminent, act quickly to save yourself. You may only have seconds.

1. Get out of areas subject to flooding. This includes dips, low spots in canyons, washes, etc.
2. Avoid already flooded and high velocity flow areas. Do not attempt to cross a flowing stream on foot where the water is above your knees.
3. If driving, know the depth of water in a dip before crossing. The road bed may not be intact under the water. *Turn Around - Don't Drown*!
4. If the vehicle stalls, abandon it immediately; seek higher ground – rapid rising water may engulf the vehicle and its occupants and sweep them away.
5. Be especially cautious at night when it is hard to recognize flood danger.
6. Do not camp or park your vehicle along streams and washes, particularly during threatening conditions.

WINTER STORM SAFETY RULES

Keep ahead of winter storms by preparing ahead:

1. Check battery powered equipment before the storm arrives. A portable radio or television set may be your only contact with the world outside.
2. Check your food stock and extra supplies. Your supply should include food that requires no cooking or refrigeration in case of power failure.
3. Stay indoors during storms unless you are in peak physical condition. If you must go out, avoid overexertion.
4. Do not overexert yourself shoveling snow. It is extremely hard work for anyone in less than prime physical condition, and can bring on a heart attack, which is a major cause of death during and after winter storms.

WINTER TRAVEL SAFETY RULES

1. If the storm exceeds or even tests your limitation, seek available refuge immediately.
2. Plan your travel and select primary and alternate routes.
3. Know before you go! Check the latest weather information before leaving.
4. Try not to travel alone; two or three persons are preferable.
5. Always fill your gasoline tank before entering open country, even for short distances.
6. Suggested winter storm car kit includes: blankets or sleeping bags, matches and candles, empty 3-pound coffee can with plastic lid (for melting snow to provide drinking water), facial tissue, paper towels, clothing, high-calorie, nonperishable food, compass, shovel, flashlight or signal light, windshield scraper, booster cables, tire chain tow chains, fire extinguisher, catalytic heater and an axe.

7. If snow is obscuring the roadway, pull your vehicle off the pavement as far as possible, stop, turn off lights, set the emergency brake, and take your foot off the brake pedal to insure that tail lights are not illuminated.
8. Do not enter the snow storm area if you can avoid it.
9. If you cannot pull off the roadway, proceed at a speed suitable for visibility; turn on lights and sound horn occasionally. Use the painted lines to guide you. Look for a safe place to pull off the roadway.
10. Never stop on the traveled portion of the roadway.

IF A BLIZZARD TRAPS YOU IN YOUR AUTOMOBILE

1. Avoid overexertion and exposure. Attempting to push your car, shovel heavy drifts, and perform other difficult chores during a blizzard may induce a heart attack even for someone in apparently good physical condition.
2. Stay in our vehicle. Do not attempt to walk out of a blizzard. Disorientation comes quickly in blowing and drifting snow. You are more likely found when sheltered in your car.
3. Keep fresh air in your car. Freezing wet snow and wind driven snow can completely seal the passenger compartment.
4. Beware the gentle killers: Carbon monoxide and oxygen starvation. Run the motor and heater sparingly, and only with the downwind window open for ventilation. Periodically check to make sure the exhaust pipe is not obstructed by drifting snow.
5. Exercise by clapping hands and moving arms, legs, and toes vigorously from time to time, and do not stay in one position for long.
6. Turn on dome light at night. It can make your vehicle visible to rescue workers.

TSUNAMI SAFETY RULES

1. A strong earthquake felt in a low-lying coastal area is a natural warning of possible immediate danger. Keep calm and quickly move to higher ground, away from the coast. Stay out of danger until competent authority issues an “all clear”.
2. All large earthquakes do not cause tsunamis, but many do. If the quake is near or directly under the ocean, the probability of a tsunami increases. When you hear that an earthquake has occurred in the ocean or near the coastline regions, prepare for a tsunami emergency.
3. A small tsunami at one beach can cause severe inundation only a few miles away. Do not let the modest size of one make you lose respect for all.
4. A tsunami is not one wave, but a series of waves. Waves are preceded by an “emptying of the bay”, water receding much farther out than usual. Never go down to the beach to watch for a tsunami. When you can see the wave you are too close to escape.

FOG DRIVING SAFETY TIPS

1. Drive with lights on low beam. High beams will only be reflected back off the fog and actually impair visibility even more.
2. Slow down… Slow down… Slow down. Follow the “fog line” painted on the shoulder of the road.
3. Listen for traffic you cannot see.
4. Use wipers and defrosters as necessary for maximum visibility.

5. Be patient. Do not pass lines of traffic.
6. Do not stop on a freeway or heavily traveled road. If your car stalls or becomes disabled, move away from the vehicle to avoid personal injury.
7. Consider postponing your trip until the fog clears. Usually by late morning and during the afternoon visibilities are much better.

LIGHTNING SAFETY RULES

When thunderstorms develop or thunder is heard:

1. Get inside a home, a large building, or an all metal (not convertible) automobile.
2. Boats are high risk lightning targets, especially metal boats or ship with tall metal masts.
3. Do not use the telephone except for emergencies.
4. Avoid being the tallest object, for example by standing on a hilltop.
5. Do not stand underneath tall objects, such as a tree, to “get out” of the rain. These are natural lightning rods.
6. In a forest, seek shelter in a low area under a thick growth of small trees. In open areas, go to a low place such as a ravine or valley.
7. Get away from open water, tractors and other metal farm equipment, or small metal vehicles such as motorcycles, bicycles, or golf carts.
8. Stay away from wire fences, clotheslines, metal pipes and rails; put down golf clubs.
9. Finally, if you are caught out in a level field or in the open, away from shelter, and you feel your hair stand on end, lightning may be about to strike. Get low and avoid contact with the ground. Squat down on the balls of your feet like a baseball catcher. Keep your hands on your knees. Do not lie flat on the ground.

TORNADO AND WATER SPOUT SAFETY RULES

When a tornado or water spout is observed, immediate action can save your life.

1. Blowing debris is the major cause of injury. Stay away from windows, doors and outside walls, and protect your head.
2. In homes and small buildings, go to an interior part of the lowest level – closets, bathrooms, or interior halls. Get under something sturdy.
3. In schools, nursing homes, hospitals, factories, and shopping centers, go to pre-designated shelter areas. Interior hallways on the lowest floor are usually the best.
4. In high-rise buildings, go to interior small rooms or hallways.
5. Leave mobile homes or vehicles, and go to a substantial shelter. If there is no shelter nearby, lie flat to avoid blowing debris and shield your head. Be alert to rapidly rising waters in the ditch.

HEAT WAVE SAFETY RULES

1. Slow down. Strenuous activities should be reduced, eliminated, or re-scheduled to the coolest time of the day. Individuals at risk should stay in the coolest available place, not necessarily indoors.
2. Dress for summer. Lightweight, light-colored clothing reflects heat and sunlight, and helps your body maintain normal temperatures.
3. Put less fuel on your inner fire. Foods (like proteins) that increase metabolic heat production also increase water loss.

4. Drink plenty of water or other non-alcoholic fluids. Your body needs water to keep cool. Drink plenty of fluids even if you don't feel thirsty (unless your physician has directed otherwise).
5. Do not drink alcoholic beverages. This is the same advice given for extremely cold weather. Alcoholic beverages will constrict the blood vessels, which prevent adequate blood circulation to remove excess heat.
6. Do not take salt tablets unless specified by a physician.
7. Spend more time in air-conditioned places. Air conditioning in homes and other buildings markedly reduces danger from the heat. If you cannot afford an air conditioner, spending some time each day (during hot weather) in an air-conditioned environment affords some protection.
8. Don't get too much sun. Sunburn makes the job of heat dissipation that much more difficult.

APPENDIX B
Weather Terminology

ADVECTION

The horizontal movement of an air mass that causes changes in the physical properties of the air such as temperature and moisture.

AIRMASS

A large body of air that has nearly uniform conditions of temperature and humidity.

BLOWING SNOW

Wind-driven snow that significantly reduces surface visibility to less than seven miles.

CIRRUS CLOUD

A wispy, cloud that is composed of ice crystals and is formed at altitudes of 20,000 to 40,000 feet above the ground.

COASTAL WATERS

The waters of the ocean extending from the coast out to 60 nautical miles.

COMBINED SEAS

Used to describe the combination or intersection of wind waves and swell in which the separate components are not distinguished.

CUMULONIMBUS CLOUD

A cumulus cloud that is vertically developed and often has an anvil shaped top. Generally associated with lightning, thunder, heavy showers, and occasionally hail and strong winds.

CUMULUS CLOUD

A cloud that has a flat base with an upper portion that is billowy or heaping.

CYCLONE

An area of low atmospheric pressure that has a closed circulation. Cyclones (or more commonly called 'low pressure systems' or 'lows') usually bring about marked changes in the weather.

DEGREE-DAY (Heating/Cooling)

Gauges the amount of heating or cooling needed for a building using 65 degrees as a baseline. To compute heating/cooling degree-days, the average temperature is taken and referenced to a base line of 65 degrees. An average temperature of 50 yields 15 heating degree-days while an average of 75 would yield 10 cooling degree-days. Electrical, natural gas, power, heating, and air conditioning industries utilize heating and cooling degree information to calculate their needs.

DEW

Water droplets that form upon surfaces on or near the ground when air is cooled toward its dew point.

DEW POINT

The temperature to which air must be cooled, at constant pressure and moisture content, in order for saturation to occur. The higher the dew point, the greater the amount of water vapor in that vicinity. Dew points and higher in the 70's generally make people feel uncomfortable.

DOMINANT PERIOD

The period of ocean waves with the maximum wave energy.

DOPPLER WEATHER RADAR

A Weather Surveillance Radar (WSR-88D) system developed in 1988. About 121 systems have been installed at Weather Forecast Offices, with an additional 24 systems at Department of Defense (Air Force Bases) sites. This powerful and sensitive Doppler system generates many useful products for meteorologists, among them: standard reflectivity 'echoes', wind 'velocity' or atmospheric air motion pictures, and areal 1-hour, 3-hour, or storm-total precipitation images.

DOWNBURST

A strong downdraft, initiated by a thunderstorm, which includes an outburst of damaging winds on or near the ground. Downbursts are extremely rare in Southeast Alaska.

DOWNSLOPE / UPSLOPE FLOW

Downslope flow: Air that descends down a mountain chain or over sloping terrain (pressurized air moving from high pressure to low pressure), resulting in subsequent drying, and in some cases, dramatic warming of air that can quickly melt a snow cover. Local names for downslope winds, or "foehn" winds in the western USA are Chinook Wind, East Winds, North Winds, and Mono Winds. Usually associated with little or no clouds. Upslope flow: Representative of air being lifted by rising terrain and is normally associated with extensive clouds and/or precipitation.

DRIZZLE

Water drops that are very small and fine. For the most part, drizzle falls from stratus clouds and is usually accompanied by low visibility and fog.

EL NIÑO

Significant warming of the waters in the eastern Pacific Ocean, usually off the coast of South America, which results in shifts of world-wide weather patterns. This pattern usually indicates a warmer than average winter for Southeast Alaska.

FATHOM

A unit of length equal to six feet used to measure the depth of water.

FETCH

An area from which waves are generated by a wind that is nearly constant in direction and speed.

FLASH FLOOD

A dangerous and sudden flood that threatens lives and property and usually occurs after heavy rain. May also occur after an ice jam breaks up or after a dam fails.

FOG BOW

A nebulous arc or circle of white or yellowish light sometimes seen in fog.

FLURRIES

Light snowfall that generally does not produce measurable accumulation.

FREEZING DRIZZLE or RAIN

Describes the effect of drizzle or rain freezing upon impact on objects that have a temperature of 32°F or below.

FREEZING LEVEL

The point in the atmosphere where temperatures are at 32°F.

FRONT

The boundary between two different air masses, i.e. cold front, warm front, stationary front. The name implies which air is moving in the direction of the front. A warm front means that warm air is replacing cold air at the surface. Similarly, a cold front means that cold air is replacing warm air at the surface.

FROST

A covering of small ice crystals that forms on or near the ground when temperatures approach or drop below 32°F. The moisture that is condensing on the surface directly forms ice crystals.

FUNNEL CLOUD

A rotating, visible extension of cloud, pendant to a cumulus or cumulonimbus with circulation not reaching the ground. Essentially these are tornadoes or waterspouts that have not reached the surface from aloft.

GROUND FOG

Fog of little vertical extent, usually 20 feet or less.

HAIL

Precipitation in the form of balls or lumps usually consisting of concentric layers of ice. A thunderstorm is classified as severe when it produces hail 3/4 of an inch or larger in diameter.

HALOS

Rings or arcs that encircle the sun or moon which are caused by refraction of light through ice crystals that make up cirrus clouds.

HAZE

Fine particles of dust, smoke or water droplets suspended in the air that reduces visibility.

HEAT INDEX

The apparent temperature that describes the combined effect of moderate to high temperatures and high levels of humidity.

HEAVY SNOW

In Southeast Alaska zones 17 - 28, defined as snowfall accumulations of 6 inches in 12 hours or 12 inches in 24 hours. For zone 29, it is defined as snowfall accumulation of 12 inches in 24 hours.

HUMIDITY

Amount of water vapor in the atmosphere.

HURRICANE

A dangerous tropical cyclone with winds speeds of 64 knots (74 mph), or higher. (typhoon in western Pacific)

ICE PELLETS

A type of precipitation consisting of transparent or translucent pellets of ice. Can be referred to as small hail (translucent) or sleet (usually transparent). Common in Southeast Alaska.

ICE STORM

A freezing rain event that produces damaging ice accumulations of 1/4 inch or greater.

INVERSION

A situation where the temperature increases with height instead of decreasing, which is usually the case in the troposphere.

INSTABILITY (UNSTABLE AIR)

A state of atmosphere in which the vertical distribution of temperature allows warm rising air to continue to rise and accelerate. This kind of motion is conducive for thunderstorm development.

ISOBARS

Lines of equal barometric pressure as shown on a weather map.

JET STREAK

A concentrated region within the jet stream where the wind speeds are the strongest. The jet streak sets up unique wind currents in its vicinity, which either enhance or diminish the likelihood of clouds and precipitation. The jet streak will propagate downstream along the jet stream axis.

JET STREAM

A narrow band of strong winds in the atmosphere that controls the movement of high and low pressure systems and associated fronts. Jet streams meander from time to time. Wind speeds can reach 200 mph or higher in certain cases. It is usually found at 30,000 to 40,000 feet above the earth's surface. The jet stream owes its existence to the large temperature contrast between the polar and equatorial regions.

JÖKULHLAUP

An Icelandic term pronounced *YO-kul-hloip*, refers to a flood resulting from the breaching of a glacier-dammed lake (*jökull* meaning "glacier," *hlau*p meaning "flood burst"). There are at least two locations in Southeast Alaska where these events are known to occur with regularity: the Tulsequah Glacier near Juneau and the Salmon Glacier near Hyder.

KNOT(s)

Unit of speed used in aviation and marine activities, which is equal to about 1.15 statute miles an hour. Abbreviation: KT.

LA NIÑA

Significant cooling of the waters in the eastern Pacific Ocean, usually off the coast of South America, which results in shifts of world-wide weather patterns. This pattern usually indicates a cooler than average winter for Southeast Alaska.

LAKE-EFFECT SNOW SQUALL (LAKE SNOW)

A local intense, narrow band of moderate to heavy snow typically caused by very cold dry air moving over the warmer body of water. It can extend long distances inland, persist for many hours, and may be accompanied by strong gusty surface winds. Similar phenomena occurs in Southeast Alaska for the inner channels.

LEEWARD / WINDWARD

Leeward: The side of an object away from the direction in which the wind is blowing. Windward: The side of an object facing into the wind. Usually used to describe sides of mountain ranges.

LIGHTNING

A sudden visible flash of energy and light caused by electrical discharges from thunderstorms.

MILLIBAR

Unit of atmospheric pressure.

NAUTICAL MILE

A unit of distance used in marine navigation and forecasts, equal to 1.15 statute miles.

NEXRAD

An acronym that stands for NEXt generation of weather RADar.

OCEAN/LAND BREEZE

An ocean breeze occurs when prevailing winds blow off the water, while a land breeze indicates winds blowing from land over the water. Both are caused by the difference in surface temperature (heating) of the land and water. As a result, an ocean breeze occurs during the day while a land breeze happens at night.

OFFSHORE / ONSHORE FLOW

Offshore flow occurs when air moves from land to sea, while onshore flow is when air over the water advances across land. Offshore flow is usually associated with dry weather, while onshore flow indicates an increase in moisture and resultant higher precipitation probabilities.

OFFSHORE WATERS

The waters of the ocean extending from 60 out to 250 nautical miles from the coastline. Further than 250 nautical miles is considered High Seas.

OROGRAPHIC UPLIFT (UPSLOPE FLOW)

Occurs when air is forced to rise and cool due to terrain features such as hills or mountains. If the cooling is sufficient, water vapor condenses into clouds. Additional cooling results in rain or snow. It can cause extensive cloudiness and increased amounts of precipitation in higher terrain.

OZONE

A nearly colorless (but faintly blue) gaseous form of oxygen, with a characteristic odor like that of weak chlorine. Its formula is O_3. It is usually found in trace amounts in the atmosphere, but is primarily found at 30,000 to 150,000 feet above the ground. Its production results from a photochemical process involving ultraviolet radiation. Because it absorbs harmful ultraviolet radiation at those heights, it is a beneficial gas. However, photochemical processes involving industrial/vehicle emissions can produce ozone near the ground, in which case it can be harmful to people with respiratory or heart problems.

PERIOD

Time, in seconds, between the passage of consecutive wave crests past a fixed location. (Abbreviation: T).

PROBABILITY OF PRECIPITATION (POP)

The average probability (likelihood) that any given point in the forecast area will observe 0.01 inches of precipitation (water) for a given forecast period (usually twelve hours unless otherwise expressed). This is expressed in percent, 0% meaning dry, and 100% meaning certain precipitation (see page 9).

RADIATIONAL COOLING

The cooling of the earth's surface. At night, the earth suffers a net heat loss to space due to terrestrial cooling.

RAIN

Indicates a nearly steady and uniform fall of liquid precipitation (rain) over an area for several hours, as opposed to the term "showers", which implies intermittent and scattered precipitation of a more unstable, convective nature.

RAINBOW

An arc that exhibits in concentric bands the colors of the spectrum and is formed opposite the sun by refraction and reflection of the sun's rays in raindrops.

RELATIVE HUMIDITY

The ratio of the amount of moisture in the air to the amount that the air could hold at the same temperature and pressure if it were saturated; usually expressed in percent.

RIDGE

An elongated area of high pressure in the atmosphere; the opposite of trough.

ROLL CLOUD

A turbulent cloud formation that resembles a roller. This cloud can be found in the lee of some mountains. The air in the cloud rotates around an axis parallel to range of mountains. It is also sometimes found along the leading edge of a thunderstorm cloud; formed by rolling action in the wind shear region between cool downdrafts and warm updrafts. The motions of air within the cloud are extremely hazardous to aircraft.

SEICHE

A standing wave oscillation in any enclosed lake that continues after the forcing mechanism has ceased. Seismic waves from the Alaska earthquake of 28 March, 1964, were so powerful that they caused water bodies to oscillate at many places in North America. Seiches were recorded at hundreds of surface-water gaging stations - although they had rarely been reported following previous earthquakes. Indeed, four seiches were observed in Australia.

Some of the 1964 seiches were very large. Waves as high as 1.8 meters were reported on the Gulf Coast - probably because they were generated in resonance with the seismic surface waves.

SEVERE THUNDERSTORM

A thunderstorm that produces either of the following: damaging winds of 58 miles an hour or greater, hail 3/4 of an inch in diameter or larger, or a tornado. Severe thunderstorms can result in the loss of life and property.

SHOWERS

Intermittent and localized (cellular) areas of precipitation, often moderate or heavy. (see **RAIN**). These are most often associated with cumulus type clouds.

SIGNIFICANT WAVE HEIGHT

The average height (trough to crest) of the one-third highest waves.

SLEET

Describes precipitation in the form of solid grains of ice. It is formed by the freezing of raindrops or the refreezing of largely melted snowflakes.

SNOW

A steady fall of snowflakes for several hours over the same area.

SNOW GRAINS

A precipitation type of white opaque snow pellets often called soft hail.

SNOWPACK

The combined layers of snow and ice on the ground at any one time. Also called the "snow cover".

SNOW SHOWERS

Snow that starts and stops suddenly and is characterized by rapid changes in both intensity and visibility. There is normally measurable accumulation. These are also most often associated with cumulus clouds.

SQUALL LINE

A broken or solid line of thunderstorms that may extend across several hundred miles, ahead or along an advancing cold front. These are most often observed over the Gulf of Alaska in the fall, winter, and early spring.

STRATUS

Low clouds, which are flat and gray, usually covering most of the sky.

SUSTAINED WIND

Wind speed determined by averaging observed values over a 1-minute period.

SWELL

Wind-generated ocean waves that have traveled out of their generating area. Swell characteristically exhibits smoother, more regular and uniform crests and a longer period than wind waves.

THERMAL

A relatively small-scale, rising air current produced when the earth's surface is heated. Thermals are a common source of low level turbulence for aircraft.

TORNADO

A violently rotating column of air, usually pendant to a cumulonimbus, with circulation reaching the ground. The visible condensation (cloud) may not reach the ground, but if the lower circulation, marked by dust, dirt, and/or debris, reaches the ground, it is classified as a tornado. It nearly always starts off as a funnel cloud and may be accompanied by a loud roaring noise.

TROPICAL or SUBTROPICAL DEPRESSION

Cyclones that have maximum sustained winds of 33 knots (38 mph) or less. These are referred to as low pressure systems in public advisories and statements.

TROPICAL STORM

Tropical cyclone that has maximum sustained winds from 34 to 63 knots (39 to 73 mph) inclusive.

TROUGH

An elongated area of low pressure in the atmosphere; the opposite of a ridge.

UPPER-LEVEL DISTURBANCE

A disturbance of the flow pattern in the upper atmosphere, which is usually associated with clouds and precipitation. This disturbance is characterized by distinct cyclonic flow, a pocket of cold air, and sometimes, a jet streak. These features make the air aloft more unstable and conducive to clouds and precipitation.

VIRGA

Wisps or streaks of rain or snow falling out of a cloud, but evaporating before reaching the ground.

WARNING

Indicates that a hazardous weather element is imminent, has a very high probability of occurrence, or has already begun.

WATCH

Alerts the public to the possibility of severe weather, or some other hazardous weather element. It is intended to provide enough lead-time so those who need to set their plans in motion can do so.

WATERSPOUT

A violently rotating column of air, usually pendant to a cumulus or cumulonimbus cloud, over a body of water, with circulation reaching the water.

WET BULB TEMPERATURE

The temperature an air parcel would have if cooled to saturation at a constant pressure by evaporation of water into it.

WIND WAVES

Waves generated from the action of local wind on a water surface, as opposed to swell.

WIND CHILL

An apparent temperature that describes the combined effect of wind and low air temperatures on exposed skin.