Southeast Alaska

Cloudburst Chronicle

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Cape Decision Lighthouse
Built in 1932 and manned with personnel until 1974 when a generator was installed as a replacement. In 1996 the generator was replaced with solar-power. The National Weather Service receives temperature, wind speed and direction through a remote sensor on the island.

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A Short History of Weather and Technology - Part II

By Paul Shannon

In the last *Cloudburst Chronicle* we traced the evolution of meteorology from it's early beginnings in Aristotle's ancient Greece through the first thermometers, barometers and hygrometers invented during the Renaissance period of the 17th and early 18th centuries. The invention of these early weather instruments led to the advancement of our understanding of weather and forecasting. In this issue we will continue our look at how rapidly technology advanced during the late 18th century through the 19th century and continued that march toward our present day understanding of weather forecasting.

18th and 19th Centuries

With new instruments from the Renaissance in place to measure pressure, temperature, and humidity, it became possible to accurately measure the weather. In 1765 French chemist Antoine-Laurent Lavoisier began taking daily measurements of atmospheric pressure, moisture and the velocity and direction of winds. He realized observations from different locations were needed, so he created a network of correspondents in Europe with barometers and wind gauges. "With all this information," he wrote in his *Oeuvres, Volume III*, "it is almost always possible to predict one or two days in advance, within a rather broad range of probability, what the weather is going to be; it is even thought that it will not be impossible to publish daily forecasts which would be very useful to society."

It soon became obvious, though, that since the atmosphere was a three dimensional volume, observations from different altitudes were necessary. Surface observations from different elevations were not enough. Some way was needed to get instruments off the ground.

Upper Air Observations

Upper air observations, the measurement of wind and temperature parameters high above the ground, began as early as 1749 when a kite was used to carry aloft a thermometer. In June of 1752, Ben Franklin conducted his very famous (and dangerous!)

Ben Franklin during his kite experiment

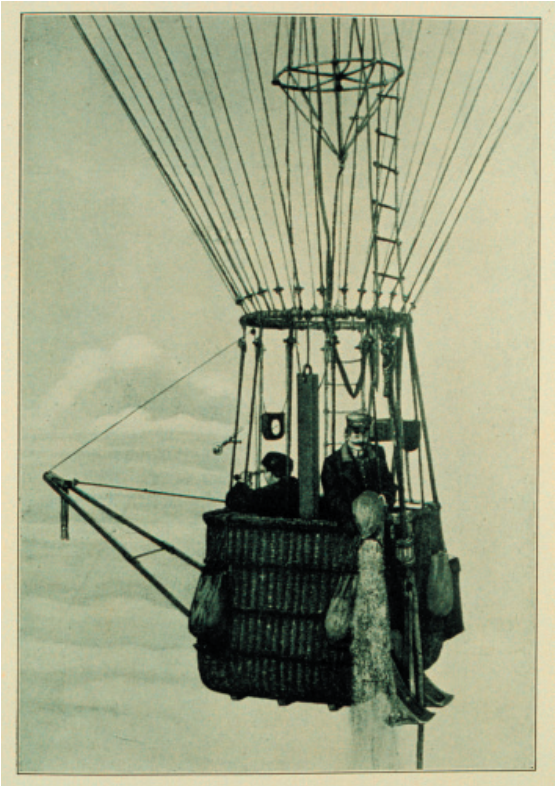
experiment by flying a kite near a thunderstorm to demonstrate the electrical nature of lightning. The use of kites to gather information about the weather continued to about 1925 when kites were gradually replaced by airplanes.

Kites obviously had a limited range of altitudes, being tethered to the ground. Balloons started being used toward the end of the 18th century and provided a great leap forward in weather observation, supplementing the kite. Balloon observations remain a vital observing tool to this day.

The hot-air balloon was invented by the Montgolfier brothers, Joseph and Jacques, after watching clouds floating in the sky. On November 21, 1783, Jean-François Pilâtre de Rozier and François Laurent, became the first human hot air balloon pilots on an untethered flight. Their flight lasted 25 minutes, reached a height of nearly 3,000 feet, and landed over 6 miles away. In 1783 the French physicist Jacques Charles realized hydrogen was lighter than air and made the first balloon using hydrogen gas. On August 27, 1783, he ascended to a height of nearly 3,000 feet. Upon landing outside of Paris, the balloon was destroyed by terrified peasants. The first meteorological ascent was made by Charles on December 1, 1783 in a hydrogen filled balloon equipped with a barometer and thermometer. During this flight, Charles recorded how temperature decreased with height and became the first to determine an atmospheric lapse rate value.

The shortcomings of these manned balloon flights included a limit to the altitude possible due to a lack of oxygen, flights were only feasible in fair weather, they had limited areal coverage and it was necessary to wait until the balloon landed to see the observations. Free balloons that dropped their sensors during flight and tethered balloons addressed some of these issues, although it was not until the late 19th century that free balloons carrying recording instruments came into regular use.

The invention of radio in the late 19th century led to the invention of the radiosonde, an instrument that transmits the weather data via radio signals

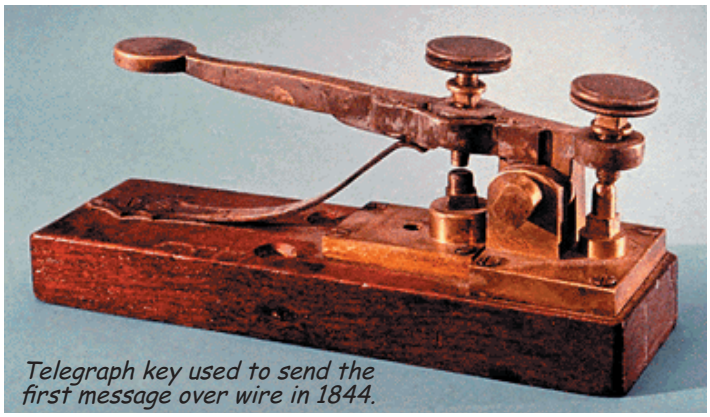


Balloon equipped for meteorological observations

to a receiver on the ground. In January 1930, Russian meteorologist Pavel A. Molchanov achieved the first official flight of a radio meteorograph attaching a telemetered instrument package that recorded temperature and pressure to a balloon. This is essentially the same system in use today with twice daily launches from about 1,100 locations around the globe, both on land and at sea, synchronized to 0000 and 1200 Universal Time (4 a.m. and 4 p.m. ADT). The data from these flights are compiled and distributed worldwide for use in plotting upper air charts and are crucial input data to weather analysis and forecasting models.

Communications

In 1839, John Ruskin, best known for his work as an art critic and social critic, but is remembered as an author, poet, artist, social revolutionary and conservationist, wrote: "The meteorologist is impotent if alone; his observations are useless; for they are made upon a point, while the speculations to be derived from them must be on space. It is of no avail that he changes his position, ignorant of what is passing behind him or before; he desires to estimate the movement of space, and can only observe the dancing of atoms; he would calculate the currents of the atmosphere of the world, while he only knows the direction of a breeze."

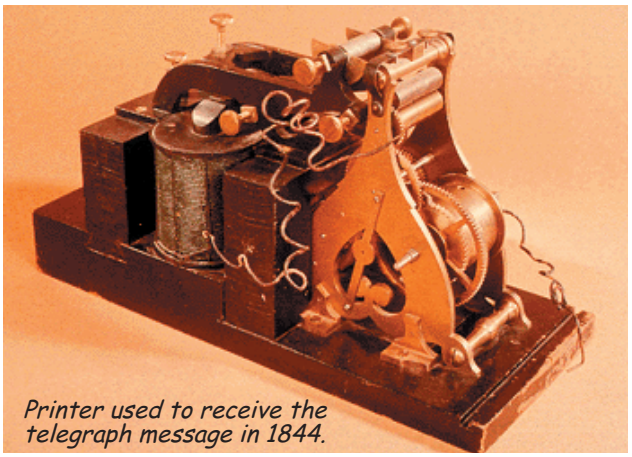


Telegraph key used to send the first message over wire in 1844.

Ruskin realized that it is impossible to understand or forecast the weather on the basis of data from a single observer. Synoptic meteorology, roughly translated as "seen at the same time", is the study of weather data obtained simultaneously over a wide area. Knowing the "big picture" is necessary to understand the atmosphere and forecast weather. Before the new science of synoptic meteorology could take off, advances in communication technology were needed.

In the mid-19th century there was still no quick way of transferring weather data from one location to the next. When communication was limited to ship, horse or rail, often the weather that was being warned about would arrive before the data did. That all changed with the invention of the telegraph.

Samuel F. B. Morse constructed an experimental version of an electromagnetic telegraph in 1835 based on a simple patterns of "dots" and "dashes" (Morse Code) transmitted over a wire. The first practical system came in 1844, when he built a line from Baltimore, Maryland to Washington, D.C. Within ten years after the first telegraph line opened, 23,000 miles of wire crisscrossed the United States.



Printer used to receive the telegraph message in 1844.

In 1849, the Smithsonian Institution began to supply weather instruments to telegraph companies. By the end of 1849, 150 volunteers throughout the United States were reporting weather observations to the Smithsonian regularly. By 1860, the network had grown to 500 stations. These stations would take observations of temperature, wind speed and direction, and pressure. This data was then sent to Washington, D.C., where it was analyzed by hand. In 1871, the first U.S. weather map was published by the U.S. Army Signal Service which later became the Weather Bureau and is now known as the National Weather Service.

The invention of radio, mentioned above, allowed this fledgling observation network to expand into a truly global network. With radio, it was possible to collect data from ships at sea and other places not accessible by telegraph wire. Today, radio (now often via satellite) allows the collection of data from aircraft, data buoys, and other remote sensors.

The Modern Era

With the beginnings of a worldwide communications and observations network, the science of meteorology was ready for the explosion of technological advances to come. Our final article in the next *Cloudburst Chronicle* will bring us up to date with the two biggest technology leaps in our historical journey – computers and the move off the planet into outer space. ■

You won't want to miss the final installment of Weather History in our next *Cloudburst Chronicle*!

Chris Maier Bids Farewell to Alaska

By Ursula Jones

WFO Juneau's WCM, Chris Maier, recently accepted a new job moving him to Maryland. Taking a new job is always difficult if you enjoy your current job and the people you work with. Moving close to 3,000 miles across the country can be daunting to say the least. When asked why he accepted the position, he said his decision was based mainly on being able to be closer to family, something that has become increasingly more important now that he and his wife have two daughters, one new arrival and the other is two years old.

Chris exiting WFO Juneau for the last time

Although his new job takes him closer to family, he is saddened by the fact that he will miss working closely with the weather spotters and staff at WFO Juneau. Chris will also miss the one-on-one relationships he has been able to establish with constituents throughout Southeast Alaska. In his new job as National Warning Coordination Meteorologist at NOAA's National Weather Service Headquarters in Silver Spring, Maryland, Chris will be evaluating NWS products and services nationwide and will be leading NWS preparedness and education outreach programs.

With that in mind, he bids a fond farewell to everyone he has had the pleasure of meeting and working with during his four years in Juneau and hopes to come back to visit some day. ■

Taking Chris' place is Joel Curtis, who comes to Juneau from WFO Anchorage where he was a Lead Forecaster the past 12 years. Prior to that he was the Deputy MIC at WFO Juneau in the early 90s. ***Welcome Joel!***

FORECASTER SPOTLIGHT

Who Forecasted That?

By Brian Bezenek

The featured forecaster this issue is Carl Dierking, the Science and Operations Officer at WFO Juneau.

Carl preparing to go cross country skiing

Brian - Where are you from?
Carl - I grew up in Aurora, Indiana, which is a small town on the Ohio River that is now becoming part of the expanding metropolis of Cincinnati, Ohio.

Brian - Have you always been interested in weather?
Carl - Pretty much. I remember checking out library books on weather when I was in grade school and building my own weather instruments.

Brian - Where did you get your meteorological training?
Carl - Purdue University. Go Boilermakers!

Brian - Where else have you worked?
Carl - At the National Hurricane Center in Miami and the NWS forecast office in Jackson, Mississippi. If you want to go way back to summer jobs, I was an inspector for the Indiana State Highway Department and a Lifeguard.

Brian - What do you like best about being a forecaster?
Carl - It's challenging and interesting work. Like solving a new puzzle every day. Plus, it's fascinating to witness all those textbook scientific relationships actually being demonstrated in the atmosphere every day. There's actually some order in the universe.

Brian - So, as the Science and Operations Officer, what do you do?
Carl - There are three aspects to the job: implementing new technologies, training, and research. The training aspect is really inter-woven throughout the process. It all boils down to finding, evaluating, and implementing new tools or procedures to improve our forecasts and warnings.

Brian - How long have you been forecasting the weather?
Carl - I started with NWS in June of 1973 (Hmmmmm... is that almost 33 years? There must have been a mistake somewhere!) I've been in Juneau for 26 ½ of those years.

Brian - Why did you choose to accept a job in Alaska?
Carl - After visiting a friend in Fairbanks, backpacking around Denali National Park, and looking at all the Juneau "sunny day" pictures of a co-worker in Miami who had worked here, I was ready to pack my bags and head north.

Carl, thank you for taking time out of your busy schedule to answer my questions.

Tune in to the next issue to see who's the lastest person to end up in the Forecaster Spotlight!

William Strehler, Nathan Teal, Lauren Thompson, and Tracey Ress

The 14th Annual Southeast Alaska Regional Science Fair was held on March 17th and 18th at the Juneau-Douglas High School. The community really comes together each year to make this happen. 114 volunteers mentored students and another 138 helped judge the projects and give out awards. Six mentors and two judges from the National Weather Service office in Juneau participated in this year's fair.

It is very impressive what the local high school students are doing in science these days. Their projects reflect how advanced today's students are in many areas of science. We have come a long way away from the old papier-mâché volcano projects that used baking soda and vinegar! The help of computers, professional mentors, and the environment of Southeast Alaska alone lend themselves to a vast number of scientific studies for the local students. This year's fair featured 128 projects covering a variety of topics with eight projects relating directly to weather and climate in Southeast Alaska. The students who took on the task of researching local weather are listed below along with their project title.

Morgan Fisher, "The Effects of Average Cloud Cover and Cloud Height on Temperature Range"
Jake Johnson, "How Wind Direction Affects Precipitation at Fritz Cove"
Samin Peirovi, "How the Difference in Air Pressure Affects the Wind Velocity in a Channel"
Drake Skaggs, "The Correlation Between Change in Tides and Wind Speed"
William Strehler, "The Effects of Wind Direction on Precipitation"
Nathan Teal, "How Does the Front Type/Direction Affect the Amount of Precipitation in Juneau, Alaska?"
Lauren Thompson, "How the Mendenhall Glacier Affects the Microclimates of the Mendenhall Valley"
Dylan Wenzlau, "How Location on a Mountain Affects Rainfall"

All the students did a fantastic job with their projects given the short amount of time in which they had to collect weather data and are commended for their effort. The National Weather Service in Juneau gave out awards for the Best Weather Project and Best Weather Project Runner-up. These students received a plaque and a NOAA Weather Radio. This year's Best Weather Project went to Lauren Thompson for her project on "How the Mendenhall Glacier Affects the Microclimates of the Mendenhall Valley." The runner-up was Nathan Teal for his project on "How Does the Front Type/Direction Affect the Amount of Precipitation in Juneau, Alaska?" The American Meteorological Society (AMS) also provided two Outstanding Achievement Awards which were presented by WFO Juneau. Lauren Thompson received one of the AMS awards for her project, "How the Mendenhall Glacier Affects the Microclimates of the Mendenhall Valley." William Strehler won the second AMS award for his project on "The Effects of Wind Direction on Precipitation."

Congratulations to all 128 participants in this year's Fair. We hope they will continue to be fascinated with the fields of science. NOAA and NWS supports science fairs around the country and encourages students to consider careers in physical sciences. ■

By Tracey Ress

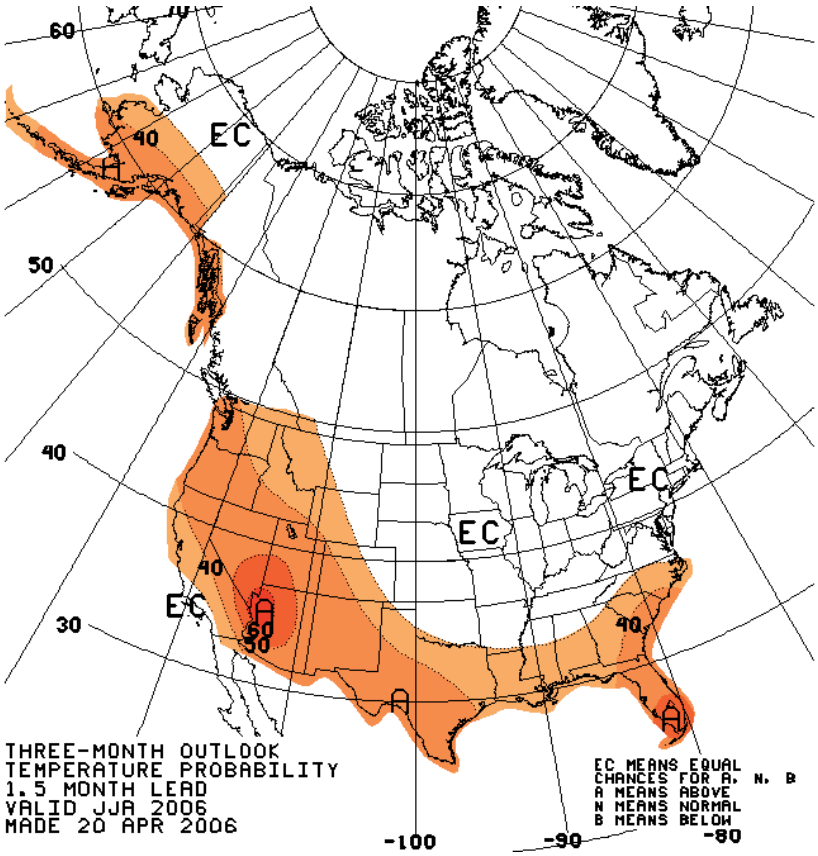
Summer Outlook for Southeast Alaska

By Brian Tassia

NOAA's Climate Prediction Center (CPC) has issued its summer season outlook for June, July, and August. The outlook for Southeast Alaska indicates temperatures will average slightly above normal for the three-month period. There are currently no strong indicators regarding precipitation, so the outlook calls for "equal chances" of being above normal, below normal, or near normal this summer in terms of total rainfall. "Normal" refers to the average temperature and rainfall amounts during the summer months over the past 30 years (1971-2000).

The previous *Cloudburst Chronicle* (December 2005) explained what goes into making a Seasonal Outlook at CPC, so I won't repeat those details here. Recall, however, the outlooks are based on statistical (computer models) and physical (ambient ocean and atmospheric observations) inputs. Among the many parameters considered is the current status and trend of the El Niño/Southern Oscillation (ENSO) parameters of sea surface water temperatures and atmospheric pressures across the Pacific Ocean. A review of Southeast Alaska climate records by staff at the NWS Forecast Office in Juneau revealed that ENSO conditions in the summer have a greater impact on temperatures while ENSO conditions in winter have more of an effect on precipitation.

CPC describes the current state of ENSO as a waning weak La Niña. La Niña conditions have often been associated with cooler, cloudier summers in Southeast Alaska. CPC's assessment that the current La Niña is weak and is fading leads forecasters there to believe our summer season temperatures will end up being at or slightly warmer than normal. For comparison, El Niño conditions have ruled the past four summers which all finished warmer than average. Therefore, while we don't expect this summer to be a repeat of the record warmth in 2004, temperatures are predicted to rebound from the cool spring weather and by the end of summer end up being at or slightly warmer than normal. Because June, July, and August are the three driest months of the year in Southeast, even slight differences in monthly precipitation amounts compared to normal can sway the outcome of the summer being wetter or drier than normal.



Taken from the Climate Predition Center Three Month Outlook page at http://www.cpc.ncep.noaa.gov/products/predictions/long_range/lead02/off_index.html.

Climate Prediction Center's products are operational predictions of climate variability, real-time monitoring of climate and the required databases, and assessments of the origins of major climate anomalies. The products cover time scales from a week to seasons, extending into the future as far as technically feasible, and cover the land, the ocean, and the atmosphere, extending into the stratosphere.

Southeast Alaska Climate Summary

Fall 2005 and Winter 2006
By Mike Mitchell

Fall 2005 was considerably wetter and a little warmer than normal across Southeast Alaska. Although temperatures and precipitation were close to normal in September and October, an active jet stream moved into the region during November and brought frequent, strong Pacific Storms into the Alaska Panhandle. For the season, rainfall amounts ranged from a low of 97 percent of normal at Yakutat to 167 percent of normal at Juneau. Most stations ended the three-month period with 120 to 130 percent of normal rainfall. Little Port Walter, overall the wettest location, received 100.56 inches during the three-month period while Skagway, the driest location overall, received 16.58 inches. Temperatures averaged between 0.4 and 1.6 degrees above normal for the season with the exception of Ketchikan, which ended the fall 0.5 degrees below normal.

Southeast Alaska Temperature and Precipitation Summary September through November 2005

	Temperature (F)	Temperature Above Normal (F)	Precipitation (inches)	% of Normal Precipitation	Snow (inches)	Snow departure from normal (inches)
Skagway	43	1.1	16.58	130	n/a	n/a
Juneau	42.7	1.6	32.42	167	8.3	-37.7
Sitka	47	1	41.47	127	n/a	n/a
Annette	47.6	0.9	42.62	131	3.4	-0.4
Yakutat	40.9	0.4	58.4	97	56.8	31

In September, no Southeast Alaska station reported more than five dry days with monthly totals ranging from 3.70 inches at Skagway to a soggy 32.67 inches at the Snettisham power generating station 35 miles southeast of Juneau. On the 6th, heavy rains moved across the Juneau area and dropped up to 2.0 inches of rain in 12 hours resulting in minor flooding of roadside ditches and low-lying areas.

October was an unusually quiet weather month for Southeast Alaska. Precipitation was evenly distributed during the month except for a 5-day period between the 21st and 25th when as much as 10 inches of rain fell across the Southern Panhandle at Ketchikan. Little Port Walter, located on the southeastern face of Baranof Island, was the overall wettest location with 31.13 inches for the month while Skagway was the driest receiving 4.49 inches in October.

November 2005 was one of the wettest months in Southeast Alaska history with numerous daily, monthly, and all time rainfall records set. Between the 16th and 24th, a relentless series of strong Pacific storms slammed into the Alaskan Panhandle and dumped 1 to 8 inches of rain, daily. Pelican was the hardest hit with 29.77 inches falling during the 9-day period with more than one inch falling on eight of the nine days. Pelican established an all time daily rainfall record of 8.41 inches on the 19th. Both Sitka and Juneau had their wettest 7-day period on record with 12.58 and 10.33 inches, respectively, falling during this week. The 3.34 inches that fell in Haines on the 22nd was the wettest day on record for the airport.

Of course, with frequent heavy rains, flooding and mud slides were a problem for much of northern and central Southeast Alaska. On the 22nd, flooding in Sitka destroyed a building and flooded Sawmill Plaza to a depth of 2 feet, while mud slides knocked out the power for several hours. Tenakee Springs, Pelican, Hoonah, Gustavus, and Skagway also had minor flood or mud slide damage. In Juneau, mud slides significantly damaged a residence near downtown and closed Glacier Highway near Fred Meyer until the next day. There were numerous reports of clogged storm drains and flooded basements. Haines also experienced moderate small stream flooding on the 22nd and 23rd that produced substantial road damage across the borough. A mud slide along Mud Bay Road covered a home with 4 feet of mud while a second mud slide buried a car to a depth of 3 feet along the Haines Highway near mile 23 that prompted a public rescue.

In contrast, the winter of 2005-2006 was drier and much warmer than normal. Total precipitation for the three-month period December through February ranged from 59 percent of normal in Skagway to 102 percent of normal at Ketchikan. Little Port Walter was the wettest reporting location with 66.70 inches of rain and melted snow while Skagway was the driest with just 4.11 inches for the three-month period. Temperatures were well above normal, averaging 2 to 5 degrees warmer than a normal winter. Because of the warm temperatures and drier than normal conditions, snowfall was also well below normal for the winter of 2005-2006 except for the Coast Mountains from Taku Inlet to Petersburg to Hyder.

Southeast Alaska Temperature and Precipitation Summary December through February 2006

	Temperature (F)	Temperature Above Normal (F)	Precipitation (inches)	% of Normal Precipitation	Snow (inches)	Snow departure from normal (inches)
Skagway	29.5	4.6	4.11	59	n/a	n/a
Juneau	30.6	4.1	11.74	96	38.6	-26.8
Sitka	37.5	2.3	20.83	93	n/a	n/a
Annette	38.7	2.5	26	89	7.1	-22
Yakutat	30.7	3.1	31.11	78	67.4	-43.4

December precipitation was near or above normal across the region with no significant rain or snow events noted. Little Port Walter remained the wet spot with 34.16 inches for the month while Skagway only managed 1.79 inches for December. Temperatures averaged 3 to 5 degrees above normal area wide and were as much as 7 degrees above normal in Northern Lynn Canal. Juneau and the central Panhandle had one of its least snowiest Decembers on record; however, the Coast Mountains ended the month closer to normal. Hyder was the snowiest location in December with 49.9 inches followed by 37.7 inches at Haines Customs.

Precipitation was generally below normal in January, ranging from well below normal in the far north to a sliver above normal through the Southern Inner Channels from Ketchikan to Petersburg. The 0.22 inches that fell in Skagway was only 8 percent of normal while the 1.81 inches in Haines was 35 percent of normal. For Central and Coastal Southeast Alaska, precipitation was between 40 and 80 percent of normal with the 2.93 inches falling in Juneau being 61 percent of normal. Rainfall amounts increased to between 6 and 22 inches along the coast where 10 to 30 inches in January is not uncommon. Precipitation was above normal along the Southern Coast Mountains where Petersburg picked up almost 11 inches for the month while Ketchikan measured more than 15 inches. Little Port Walter was the wet spot with 21.07 inches and Skagway was the driest location with 0.22 inches. Temperatures were above normal area wide averaging 2.5 degrees above normal. No big Arctic Outbreaks occurred.

In spite of the warm temperatures, snowfall was near normal to above normal for the Coast Mountains from Taku Inlet to Hyder. Here, snowfall ranged from 55 to 110 inches. Annex Creek took top honors in January with 109.9 inches followed by Hyder with 60.5 inches for the month. Petersburg was also unusually snowy with 55.1 inches compared to the normal 28. Although the 30.8 inches of snow that fell at the Juneau Airport was only 1.9 inches above normal, the 17 consecutive days of measurable snow at the Juneau Airport that began on the 17th (and ended on February 3rd) set a new record for consecutive snowy days. Eaglecrest was forced to postpone their opening until January 26th due to the lack of snow on the lower slopes. As of this writing, Eaglecrest closed after a 58 day season.

February was a quiet weather month with most stations receiving below normal precipitation and snowfall with temperature within 1.5 degrees of normal. Light precipitation occurred daily during the beginning of the month with a seasonably mild and dry break mid-month. The season's first real Arctic outbreak dropped temperatures into the single digits to as cold as 16 below zero at Klehini along the Haines highway during the final week of February. Precipitation for Coastal Southeast Alaska varied from 3.86 inches, 38 percent of normal, at Sitka to 10.17 inches, 119 percent of normal precipitation, 26 miles away at the monthly wet spot Hidden Falls Hatchery. The Southern Panhandle received 2.5 to 8 inches while northern areas had 1.5 to 5 inches for the month. Wrangell was the overall driest location with 1.26 inches for the month.

Snowfall was well below normal in February across the Panhandle. Near sea level, locations received 1 to 10 inches of snow when 10 to 40 inches is normal. Yakutat, Haines, and Skagway received 15 to 25 inches while the typically snowier Coast Mountains had 25 to 40 inches for the month. Haines Customs reported the most snow with 48.3 inches followed by Hyder with 36.8 inches. The snow pack at the top of Eaglecrest was at record low levels by months end.

SE Extremes September 2005 through February 2006

	First	Second
Wettest:	Little Port Walter 167.26 (inches)	Snettisham 131.22 (inches)
Driest:	Skagway 20.69 (inches)	Skagway Power 24.29 (inches)
Snowiest:	Annex Creek 196.8 (inches)	Haines Customs 184.6 (inches)
Warmest:	Annette 43.2 (deg F)	Craig Fire Station 43.0 (deg F)
Coldest:	Haines Customs 30.2 (deg F)	Annex Creek 33.9 (deg F)

DOPPLER RADAR ENHANCED BY GIS

By Nathan Foster

Doppler radar has been used for over a decade in the National Weather Service, but recently it has been enhanced with Geographic Information Systems (GIS) technology. The new radar display, nicknamed RIDGE (Radar Integrated Display with Geospatial Elements), is basically a fancy interactive map and is available to anyone on the Internet. There are several exciting features of RIDGE that helps users protect their lives and property.

Map Overlays

The first noticeable change with RIDGE images is the background. No longer is it just a plain map of the area, it is now a shaded topographical map which makes mountains and valleys easily discernible. However, if you don't need the topography you can deselect it and view a plain background with only an outline of the area.

You can also toggle on or off to view highways, cities, rivers, counties, and, most importantly, warnings. Previously, warnings could not be displayed on radar images. You could only view the text of the warning to find out which county was affected. Now, you can look at your area's radar image and overlay severe thunderstorm warnings, marine weather warnings, tornado warnings, and flash flood warnings. You can even display which portions of your county are affected and view the movement of the storm. If you planned to drive during the storm you could even overlay highways to see if your route would be affected. Or you could add rivers to see which streams are receiving the heaviest rainfall.

Figure 1 shows a RIDGE sample during the tornado outbreak in Tennessee on April 7th. It's very easy to see there was a lot of thunderstorm activity that day, but now it's also easy to find thunderstorms producing tornadoes. Each red box indicates a portion of a county under a tornado warning, meaning a tornado was sighted or was indicated on the radar. Each yellow box indicates a severe thunderstorm warning, meaning winds gusting above 58 mph or hail at least the size of dimes (3/4"). By overlaying roads on this map we can see that a drive north on I-65 out of Nashville might want to be delayed or canceled.

Range and Bearing

Below the radar image is another interactive feature available with RIDGE. Here you can find the distance and direction of anything on the map from the radar or your location. For example, if you wanted to know how far away you were from a thunderstorm, you can select your home

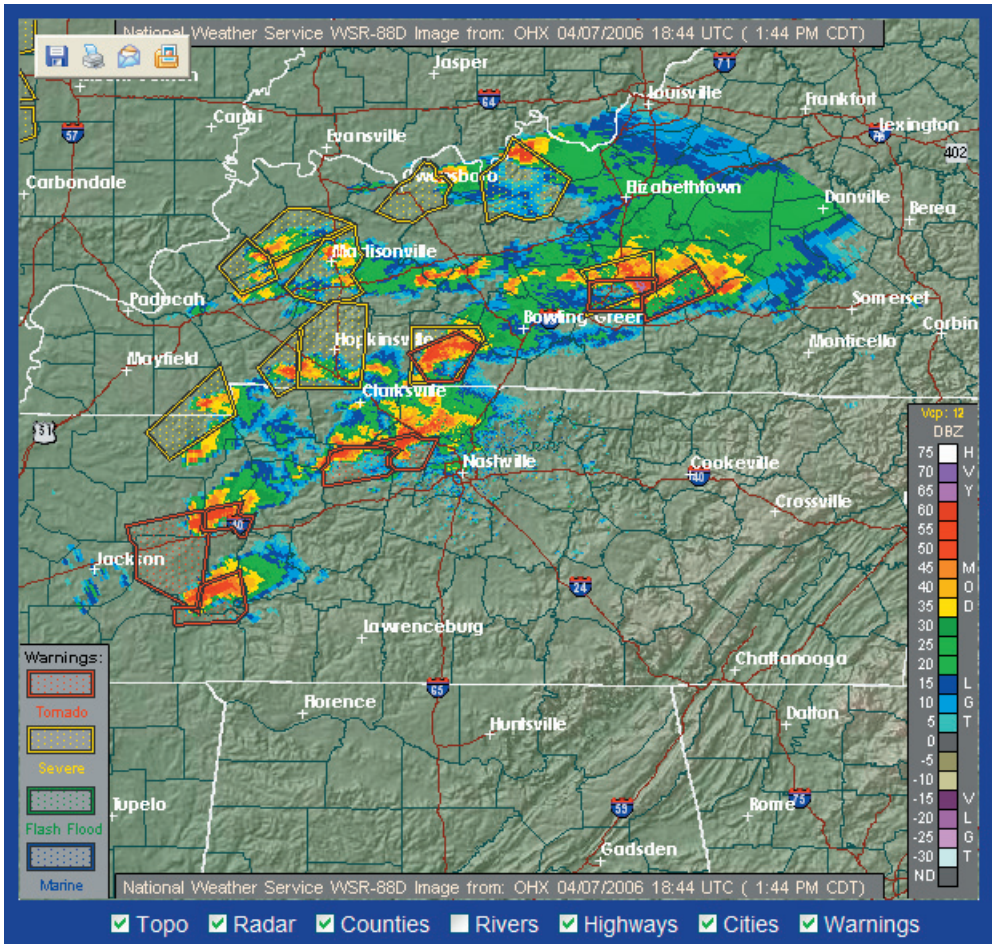


Figure 1

then move the mouse over the area of heavy weather and the box will give you the distance and direction from your home. You can even obtain the latitude and longitude of these places.

Southeast Alaska

For our forecast area in Southeast Alaska we will, hopefully, never have to issue tornado warnings, but RIDGE will have other applications. With the new topographical background it will be easier for you to find your exact location in relation to specific areas of precipitation or those rare thunderstorms. Occasionally, the forecast office in Juneau issues special marine warnings that will appear on the RIDGE radar. These might be issued for waterspouts, squalls, or shifting winds. Figure 2 is a sample of the Juneau RIDGE radar. You can see rain moving on to the coastline and maybe even some moderate rainfall just off the coast.

The use of GIS technology is becoming more widespread within the National Weather Service. The Juneau Forecast Office recently received an upgrade of its GIS software and more projects using this exciting technology are in the works.

For more information on RIDGE or to view it online for yourself visit: www.srh.noaa.gov/ridge

For more information on GIS including what it is and how it works, go to: www.gis.com ■

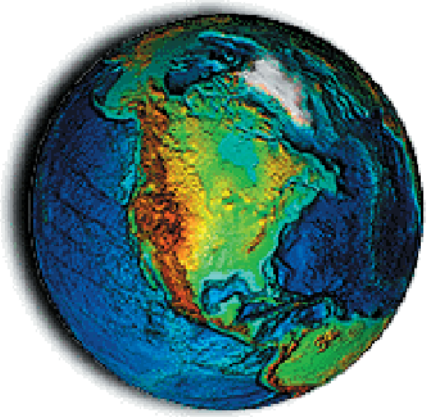
Did You Know?

There are 155 WSR-88D Doppler radar in the nation, including the U.S. Territory of Guam and the Commonwealth of Puerto Rico, operated by the National Weather Service and the Department of Defense. Radar is short for Radio Detection And Ranging.

Figure 2

Mayor Creates Panel to Look Into Climate Change

By Tom Ainsworth



Juneau Mayor Bruce Bothello has created a panel to gather and review relevant factual information about climate change and what impacts it may have on the City and Borough of Juneau (CBJ). The panel has until September to advise the mayor and city assembly members on the projected impacts and whether CBJ should participate in any regional or national initiatives to minimize the impacts.

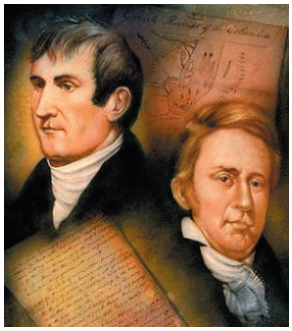
According to the Panel's Charter, "The national debate surrounding global warming no longer focuses on whether it exists. There is now a general consensus that the warming already underway will lead to changes in the earth's physical and biological systems that will be extremely adverse to human beings, their communities, economies, and cultures. Human activities clearly are contributing to this [climate change], though disputes persist over the extent of the human contribution. Debate is now focused on the extent to which governments should mandate limits on emissions, rely on voluntary cutbacks, or some combination of both. Several organizations have urged the City and Borough of Juneau to join them in focusing on global warming. These include the West Coast Governors' Global Warming Initiative, the Regional Greenhouse Gas Initiative, the Climate Protection Agreement, the U.S. Conference of Mayors, and Kyotousa."

Mayor Bothello appointed Dr. Brendan Kelly, Dean of Arts and Sciences and Vice Provost for Research at the University of Alaska Southeast (UAS) to chair the panel. Other panel members are: Mr. Tom Ainsworth, Meteorologist in Charge of the National Weather Service Forecast Office in Juneau; Dr. Douglas Boyce, Jr., Alaska Issues Coordinator at the Juneau Forestry Sciences Laboratory; Dr. Eran Hood, Assistant Professor of Hydrology at UAS; Ms. Peggy Murphy, Research Director of the Alaska Marine Conservation Council; and Mr. Jim Powell, Alaska Department of Environmental Conservation, Air and Water Division.

Panel meetings are tentatively scheduled the fourth week of every month May through August. All meetings are open to the public and advertised through the Municipal Clerk's office (http://www.juneau.org/calendar/clerk/cbjmeeting.htm). ■

LEWIS AND CLARK: EXPLORERS AND PIONEERS IN METEOROLOGY

By Jana Goldman & Ursula Jones



Lewis & Clark

Have you ever stopped to consider what early explorers might do on their trip besides explore? For Captain Meriwether Lewis and William Clark you can add meteorology to the list of pioneering achievements associated with their 1804-1806 expedition. This finding was uncovered by Susan Solomon and John Daniel of the NOAA Aeronomy Lab in Boulder, Colorado.

According to Solomon and Daniel, President Thomas Jefferson had hoped to send an expedition westward across America as early as 1783, but it was two decades before his dream was realized. Throughout the years, Jefferson took meteorological observations and he was successful in convincing others to do so. He is hailed among the founding fathers not only of the United States as a nation, but also of the principles behind our national meteorological Cooperative Observers Network, which was founded in 1891. Not having asked any of his colleagues to train Lewis for the expedition, it seems highly likely that Jefferson took it upon himself to provide him with this important part of Lewis's education.

Although hygrometers (they measure humidity) were available at the time of the expedition, only thermometers were taken; possibly because of the concern that hygrometers could break. From December 1803 to May 1804, Lewis and Clark spent most of their time at Camp Dubois in Illinois. During that

time period, Lewis took on the job of calibrating the expedition thermometers. Although Lewis and Clark left Camp Dubois on May 14, 1804, there weren't any temperature records until September 19, 1804. From September 19, 1804 to September 6, 1805, temperatures were recorded daily at sunrise and 4 p.m. Temperature readings stopped on September 6th because the expedition broke their last thermometer while crossing the Bitterroot Mountain range, near the Montana-Idaho border.

Solomon and Daniel's analysis shows that Lewis and Clark carried out their observations with skill, tenacity and considerable success. They credit much to Lewis' careful attention to the calibration of the thermometers. As lead author Solomon notes, "Comparison of their data to modern measurements reveals that Lewis and Clark clearly nailed this challenge, just as they did so many others on their pioneering journey."

According to the paper, Lewis and Clark's observations 200 years ago as they trekked across the North American High Plains agree very well with the modern record. For example, they experienced average minimum temperatures for June/July in Montana of about 50°F, in close agreement (within 2°F) of modern data. They also documented typical spring and fall Western snows, flash floods and warm Oregon winters – features of the climate that often surprised and occasionally plagued these men from the eastern seaboard of the United States. They described rivers that were "shut with ice," violent winds causing waves to rise, flowers in the snow, - and, in the High Plains of the Dakotas, "the difference between height of the mercury at sunrise and at 4 p.m. was 59°F in the space of eight hours."

Scientific observations were a prominent, though lesser-known, aspect of the expedition of discovery by Lewis and Clark. They chronicled flora and fauna, weather observations and astonishingly precise measurements of temperature until the rigors of the journey claimed their last remaining thermometer. Solomon and Daniel sleuthed the historical records and journals of the era, revealing a wealth of information not only in the writings of Lewis and Clark themselves, but also in the writings of President Thomas Jefferson, four of the expedition team members, and others.

Solomon and Daniel compared Lewis and Clark's 1804-1805 data with modern measurements gathered by volunteers of NOAA's Cooperative Observer Network at sites along the Lewis and Clark westbound trail. Some of those NOAA sites have a data record that extends back for a century or more.

For the complete research article by Solomon and Daniels, check out the September 2004 issue of Bulletin of the American Meteorological Society at their website http://www.ametsoc.org/. ■

Courtesy of Florentine Films

Corps of Discovery Expedition departed from St. Louis at the mouth of the Missouri River on May 14, 1804 and arrived at what's to be Fort Clatsop on November 24, 1805. They began their return March 23, 1806.

Cloudburst Classroom

by Kimberly Vaughan

Degree Days

By Kimberly Vaughan

The term "degree day" may be one of the most misunderstood weather parameters, unless you happen to be involved in the energy business or agriculture. There are several different degree day scales. Growing degree days assess the frequency and duration of optimum growing temperatures over time. Accumulated freezing degree days quantify the severity of winter temperatures. This article will take a closer look at the two most commonly used degree day scales: heating degree days and cooling degree days. We'll also consider how average values in Southeast Alaska compare to other cities in other climates.

Heating and cooling degree days are frequently referred to by engineers interested in quantifying the daily need for energy to heat or cool homes and businesses. In fact, it was engineers who developed the concept of degree days as a way to relate each day's temperatures to the demand for fuel. A 'degree day' is a quantitative unit of measurement derived from the average outside temperature for a particular day and comparing it to a "base" temperature of 65 degrees Fahrenheit. The base value of 65 degrees is used because it depicts a comfortable and energy efficient indoor temperature. Degree days are the difference between the average temperature for the day and the base of 65. When average daily temperatures are less than 65, energy must be used to increase, or "heat", the daily average temperature up to the base 65 and those values are called "heating degree days". Conversely, when average daily temperatures are greater than 65, energy must be used to lower, or "cool", the daily average temperature down to the base 65 and those values are called "cooling degree days".

For example, a typical summer day in Southeast Alaska might have a maximum temperature of 70 degrees and a minimum temperature of 50 degrees. These readings result in an average daily temperature of 60 and, hence, five heating degree days. On the other hand, consider a winter day with a high temperature of 40 degrees and a low temperature of 10 degrees. The average temperature that day is 25 degrees and has 40 heating degree days. Even in the summer, Southeast Alaska communities rarely have warm enough days for daily average temperature to be greater than 65 degrees and actual cooling degree days. During the record warm summer of 2004, when Juneau had eight consecutive days in the 80s, there was a grand total of only 24 cooling degree days all summer. This indicates overnight low temperatures were comfortably cool, keeping the average temperature for the day at or below 65, and relatively little energy was needed to cool down our homes and businesses.

Degree days are typically totaled up over extended periods of time, such as a month, a season, or a whole year. Together with average and extreme temperatures for the same period, one can discern how warm or cool the period was compared to similar periods of time in other seasons or other years. Where heating degree days add up to large numbers, more energy is needed for buildings to warm up to the base indoor temperature of 65 degrees. Cities with a large number of cooling degree days use more energy to run air conditioners and fans to cool indoor temperatures down to 65.

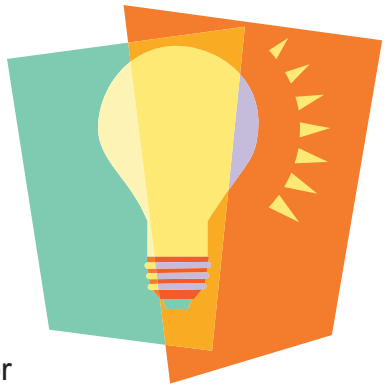
How do the heating and cooling degree days in Juneau compare to other cities and other climates? The table below lists the annual average number of heating and cooling degree days for selected sites in Alaska and other cities in different climate regimes of the U.S. In addition to a city's latitude, its elevation, and proximity to the moderating influences of large bodies of water play a large role in its average temperatures and degree days.

The use of heating and cooling degree days makes it easier for fuel companies to estimate fuel needs and agriculturalists to monitor crop growth. National Weather Service climate data such as degree days are used by businesses, industries, and even home owners, to monitor utility consumption, crop productivity, and the "bottom line" economic impact of weather. Today, more than ever, degree days and climate trends are a "hot" topic that can be really "cool", too! ■

Location	Annual Heating Degree Days	Annual Cooling Degree Days
Anchorage International Airport	10470	0
Fairbanks International Airport	13980	74
Juneau International Airport	8574	0
Seattle – Tacoma International Airport	4797	173
Los Angeles International Airport	1274	679
Denver International Airport	6128	695
Chicago O'Hare Airport	6498	830
New York JFK Airport	4947	949
Miami International Airport	149	4361

Official data from the National Climatic Data Center publication "Annual Degree Days to Selected Bases, 1971 – 2000"

Cloudburst Trivia



1. What was the highest official temperature recorded for Southeast Alaska for June through August? a. 93°F b. 98°F c. 89°F d. 96°F
2. What was the lowest official temperature recorded for Southeast Alaska for June through August? a. 16°F b. 32°F c. 27°F d. 9°F
3. What is the driest June on record for Juneau? a. 1958 b. 1936 c. 2001 d. 1982
4. What is the highest official recorded rainfall for one day for SE AK for June through August? a. 7.34" b. 6.08" c. 7.99" d. 10.34"

WEATHER WATCHERS
SOUTHEAST ALASKA SPOTTER NETWORK

Our Most Valuable Spotters!

Record high and low temperatures, record amounts of rainfall, flood warnings, and now rain that just won't quit. There were many spotter reports conveying invaluable information to us over the past few months and it is very appreciated. Although it was hard to decide, ***Ken Skaggs from Shelter Island***, and ***William & Wynn Hopkins from Ketchikan*** are our Most Valuable Spotters. They conveyed numerous timely reports. For their efforts they will be receiving the an *Alaska Cloud & Weather field guide*. Congratulations and thanks for the great reports!

For COOP's and anyone else interested, be sure to sign up for our free email subscription list at http://www.weather.gov/os/coop/coopnews_list.shtml.

Winter trying to take hold one last time during a late season snow on April 30th in Juneau. Arriving too late for the Eaglecrest, the local ski resort to use, it was a sight to see - especially if you were expecting rain. WFO Juneau received 1.3" of snow on this day, over 75% of the snow received for the month of April. One house even had enough to make a family of snow people. I don't know about you, but I am looking forward to the "slightly above normal temperatures" mentioned in the Summer Climate Outlook article.

WRITING FOR THE READER

- Questions about weather you want answered
- Suggestions for improving this newsletter

Send your questions & suggestions to ursula.jones@noaa.gov.

Don't forget to send any photos you want to share.

Trivia Answers: ***1.*** B. 98°F Haines takes this record that was recorded on July 31, 1976. 2. A. 16°F on June 4, 1972 in Kake. Too cold for summer if you ask me. 3. B. 1936 Only .54" of rain was recorded at downtown Juneau. 4. D. 10.34" fell on August 13, 1955 at Little Port Walter on the east side of Baranof Island near the south end. For more climate information including temperature, precipitation, snowfall, and more go to: http://www.arh.noaa.gov/clim/akcoopclim.php?wfo=pajk

This quarterly educational newsletter is designed for Southeast Alaska's volunteer weather spotters, schools, emergency manager, and the news media. All of our customers and partners in Southeast Alaska are welcome to subscribe to it.

NOAA's National Weather Service Forecast Office in Juneau, Alaska is responsible for weather forecasts and warnings from Cape Suckling to the Dixon Entrance.

This publication, as well as all of our forecasts and warnings, are available on our web site: http://pajk.arh.noaa.gov.

Comments and questions regarding this publication should be directed to Ursula Jones at (907) 790-6802 or e-mail: ursula.jones@noaa.gov.

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