Southeast Alaska

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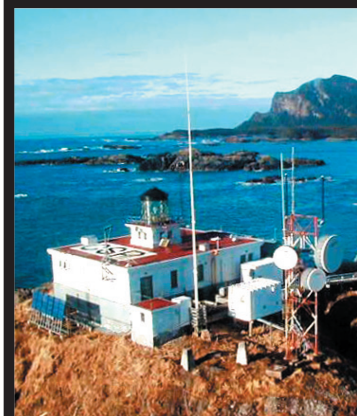

Cape Spencer
First operational December 1925, it received Alaska's first radio beacon summer 1926. Manned until 1974 when the station became automated and is currently run using solar power.

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Voluntary Ship Observing Program

By Ursula Jones

The National Weather Service (NWS) receives information from a variety of sources in an effort to prepare the most accurate forecasts possible. Even with sources ranging from high tech satellites to community volunteers, there is always room for more data. The Voluntary Ship Observing Program (VOS), which is coordinated under the World Meteorological Organization (WMO), is one of the programs used by the NWS to provide vital data for preparation and issuance of all forecasts and warnings.

The Voluntary Observing Ship program began when Lieutenant Matthew Fontaine Maury of the U.S. Navy realized the scientific and commercial value of weather information collected from ships. He organized the first International Meteorological Conference in Brussels in 1853 to consider international cooperation and a uniform system of observation. Ships' meteorological observations were recognized from the start as being essential for the provision of safety related meteorological services for ships at sea, as well as for climatological purposes. Observations taken from ships traveling the oceans formed the basis for early oceanography.

Radio communications in the early 20th century made it possible for ships to transmit weather observations to shore stations and for shore-based meteorological agencies to broadcast forecasts and warnings to ships. At the 1929 meeting of the International Convention for the Safety of Life at Sea (SOLAS), a provision was made for the international encouragement of meteorological work at sea. This agreement was updated in 1948 and 1960 with the current Convention being adopted in 1974.

Though many U.S. ships have made weather observations at sea since 1853, the current form of the U.S. Voluntary Observing Ship program effectively began as a result of the 1974 SOLAS Convention. In 2005, there were 5,429 ships participating in the VOS program worldwide, with the United States VOS program being the largest in the world with almost 1,000 vessels participating. The program operates at no cost to the vessel: communications charges, observing equipment, and reporting supplies are provided by NWS.

Observations taken by VOS program vessels may include any or all of the following elements:

- Wind direction and speed
- Atmospheric pressure
- Air temperature
- Humidity
- Sea-surface temperature
- Waves (sea and swell)
- Present and past weather
- Clouds
- Visibility
- Ship's course and speed
- Sea ice, when appropriate

In Alaska, currently there are 292 vessels participating in the VOS program. The Arctic Sun, one of our Alaska VOS ships, has taken more observations than any ship in the world this year and continues to take them at a record pace. Alaska ships hold five of the top seven spots in the world in terms of number of VOS weather reports submitted so far in 2006. During the 2006 cruise ship season, running May to September, 22 VOS cruise ships faithfully supplied weather observations from within Alaskan waters. Holland America Line was especially active with all eight of their ships assigned to Alaska participating. The Zaandam was one of the most conscientious vessels with 277 observations taken in May and 146 taken in June. The Holland fleet alone took over 1,500 observations! In addition, cruise ships from Princess (part of the United Kingdom VOS program), Celebrity, Carnival, Norwegian, and CruiseWest cruise lines submitted observations throughout the summer.

Zaandam crewmembers - 3rd Officers Emmely Kik and Sean Gill

A question frequently asked by mariners is "Do we really need observations from ships now that we have weather satellites?" The answer is "YES"!

Observations from VOS significantly complement the bird's eye view of the global distribution of clouds, weather systems and ocean variables obtained from satellites, as well as, provide a long-term observational record. They supply information on variables and phenomena which cannot, as yet, be accurately, reliably, and consistently observed from space. In addition, VOS report utilization in weather forecast preparation provides a constant "reality check" on actual weather conditions, contributes directly and significantly to short-range prediction, and important inputs to numerical weather prediction. Without VOS observations, the provision of timely and accurate weather forecasts and warnings for mariners would be seriously compromised. The advent of the weather satellite has in no way diminished the importance of reports from VOS. So, when you are sitting at home by a nice, warm fire while a gale is howling outside and you're thinking "Gee, I was going to actually try and fish in this stuff." The information you received from the weather report might have been enhanced by a VOS report from some vessel working its way to a distant port.■

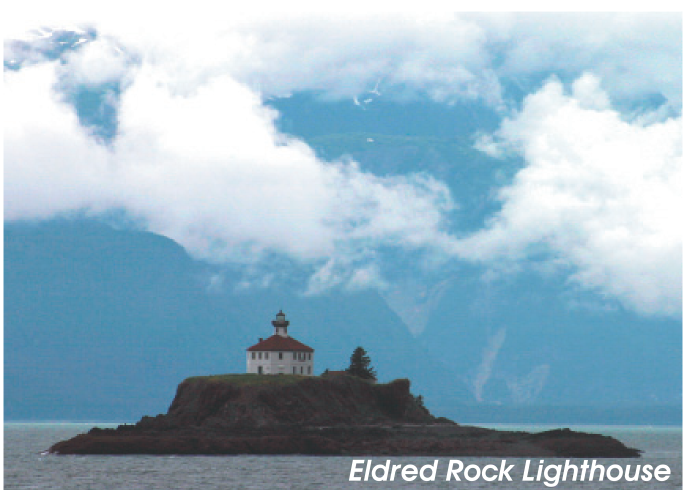
A Trip to the Southeast Alaska State Fair, July 27 - 30

By Nathan Foster

Amy and I arrived at the Auke Bay ferry terminal early Thursday morning. Laden with all the brochures and posters we would need for the fair, we boarded the high-speed ferry ironically named the *M/V Fairweather*. It was a rainy and cold summer day even by Southeast Alaska standards. Nevertheless, we sat on the outside deck and watched the incredible scenery go by as we cruised up Lynn Canal heading for Haines.

It wasn't long before we spotted a pod of whales. We quickly grabbed our cameras and snapped away, but the flukes of the whales had already crashed into the water. The thirty-knot speed of the ferry ensured we would be long past the whales when they resurfaced. Amy, a summer intern from Missouri, was happy enough just to have seen them.

We took more pictures as we sailed past Eldred Rock Lighthouse, a notoriously windy location, but eerily calm on this wet day. The photography classes Amy and I completed in college came in handy as we delicately framed the lighthouse with the misty Chilkat Mountains.



Eldred Rock Lighthouse

Nicole, our other summer intern originally from Haines, but now attending school in New York state, had already arrived the previous week and was visiting her relatives. She greeted us on our arrival with her dad's pickup truck and we tossed our luggage and exhibit materials into the back and headed straight for the fair. There was no time to waste as the fair was opening in an hour. Nicole went to the fair office and downloaded the latest weather forecast onto her laptop, while Amy and I strategically placed our posters and handouts around the booth.

NWS Booth

The booth was unique. It was really an outdoor stall attached to a barn. This quickly became apparent as a rooster inside the barn crowed every five minutes for the duration of the fair. We were across from a stage though, so the music drowned out the noisy bird most of the time. Facing the stage definitely had its advantages because we got to enjoy all the great acts that came to the fair.

We enjoyed talking to many locals from Haines during the fair, but we also got to meet many travelers from the Lower 48. It seemed the local folks were mainly interested in our marine weather services, so we handed out maps showing our marine forecast areas and a guide to our products. Most of the visitors to Haines were excited to talk about the climate back home and in Alaska. We gave them our *Summer Climate Guide to Southeast Alaska* and often discussed the NOAA Weather Radio since many of the travelers had RVs equipped with weather radios.

By the end of the first day, we were all chilled to the bone but took comfort in knowing that forecasts for Friday and Saturday was calling for nicer weather. In fact, the most common question the first day was "when is the weather going to get better"? "Tomorrow", we replied with confidence.

Friday morning I woke up early to travel to Skagway and visit our two cooperative weather observers in the area. It was a bright sunny morning as forecasted, but patches of fog were lying low over the harbor. It was another Kodak moment, but I could only snap a few pictures before the ferry departed. After a quick thirty-minute ride through the magnificent fjord of Taiya Inlet, I arrived in Skagway. I visited with our weather observer at the Skagway Power Company, who informed me the river gage they read daily had a frayed wire. So, on my way out of town I stopped to check out the river gage equipment attached to the middle of the bridge. The gage would have to be moved since the channel had shifted significantly. It was essentially measuring rocks this late in the summer. The condition of the wire and the box containing it required attention and a second visit is needed sometime in the near future.

Skagway River Gage

Skagway Customs

My next stop was the customs station six miles outside of Skagway. It's a steep and winding drive up the Klondike Highway, but there was more spectacular Alaskan scenery to be seen along the way. I checked our equipment, thanked the customs agents for their service, and then continued toward the U.S.-Canada border. Located at the very top of the Klondike Highway is White Pass, a 3,400-foot mountain pass where stunted trees barely grow out of the rocky landscape. Recently, the State Department of Transportation installed a new camera and weather station there. I took some measurements of the signs and landmarks within view of the camera to use for reference when the snow begins to pile up. After I returned to Skagway, while waiting for the ferry, I noticed something very odd - it was hot! Later I found out it had reached 80°F after having only been in the low 50s the day before. I was unprepared for the sun exposure and received a rare Southeast Alaska sunburn. It was another hot day and the line at the ice cream stand was long. We tried, unsuccessfully, to stay in the shade. By the end of the day, Amy and Nicole had sunburns and mine had become worse. Undaunted by the sun, we were able to successfully recruit a couple of new weather spotters and, possibly, a new cooperative observer. Sunburns were especially rare in 2006, a summer that will be remembered for being exceptionally cool and wet.

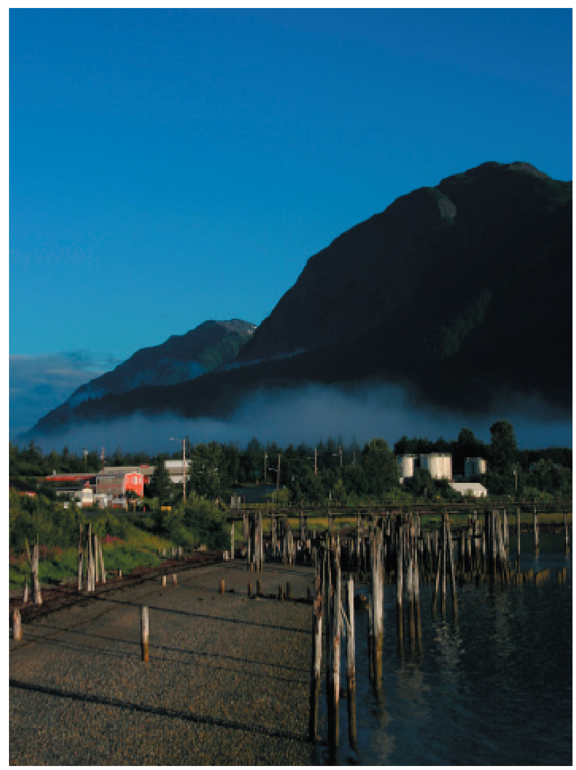
White Pass RWIS Site

Early Saturday morning, Amy and I stopped by Paul Swift's house. Paul is our Coop observer in downtown Haines. Some cedar trees he planted had grown quickly and were beginning to surround the rain gage. I decided it would be best to move it to prevent inaccurate measurements. We then headed up to the Haines customs station 40 miles west town. It was another brilliant, sunny morning as we drove along the Chilkat River. Thousands of bald eagles flock to the river in the fall and early winter for some late-season

Amy (Summer Intern) & Paul (Observer)

dining on salmon. Today, we only saw one because of the hot weather, but it was worth another picture. At the customs station we talked with the agent about their rough winters and how the road can close for days on end. We re-wrapped a plug on the thermometer sensor to ensure the coming wet fall and winter weather would not damage the equipment. Finally, we headed back to town in time for the start of Saturday's edition of the fair.

Sunday was a transition day, weather-wise, and the last day of the fair. The clouds increased as the day progressed and the wind began to kick up. By early afternoon, all our brochures had to be held down with whatever paperweights we could find. Dust blew into the booth temporarily blinding us and leaving a layer of dirt on everything. Fortunately, the fair ended before the rain started. We packed up all our stuff and headed home.



Haines

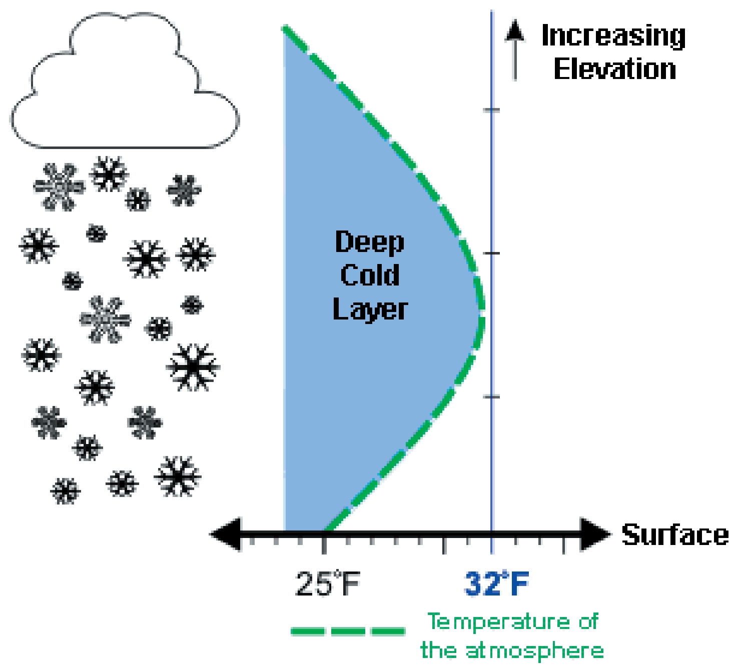
We were all tired from the long days and unusual weather, but enjoyed it very much. We hope to return to the Southeast Alaska State Fair next year with two new students and, maybe, some sunscreen.

Types of Winter Precipitation

By Amy Schnetzler and Tom Ainsworth

When people think of winter precipitation in Alaska, most probably think of snow. However, snow is only one of several types of precipitation that falls during the cold months. Precipitation is categorized by whether it is in a liquid, frozen, or freezing state when it reaches the ground. This is determined by the air temperature aloft, as well as at the surface. After all, rain drops and snowflakes that reach the ground began their decent about 15,000 feet above us!

To receive snow at the surface, the air column temperature remains entirely below freezing: the snowflake is never allowed to melt. Rain, on the other hand, may start falling as snow or rain at high elevations, but completes its journey in a thick layer of air with above freezing temperatures. Both snow and rain can fall for many consecutive hours. These two forms of precipitation are common in Southeast Alaska. But there are "in between" types of precipitation that fall in the winter when temperatures aloft vary above and below freezing depending on elevation.

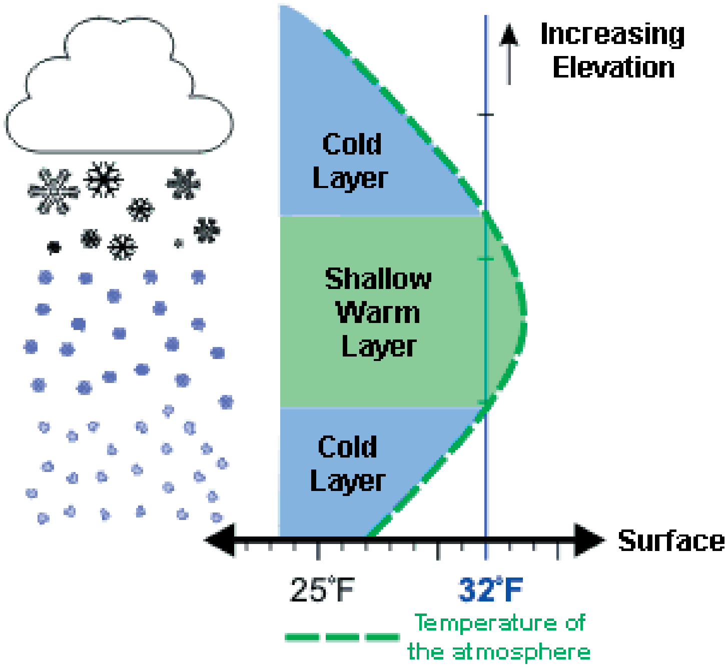


The green dashed line is the temperature in respect to elevation. The surface temperature is 25°F and increases with height before decreasing. However, since the temperature remains below freezing any precipitation that falls will remain as snow.

When the column of air above the ground is above freezing, the precipitation falls mainly as liquid (rain). But if there is a shallow layer of sub-freezing temperatures at ground level, the liquid precipitation quickly freezes into hard ice pellets or sleet just before landing. Sleet is identifiable by its bounce upon landing and is usually short-lived.

Another type of precipitation is freezing rain. Freezing rain results when rain or melted snow falls through a warm layer above the ground then falls into a very shallow layer of subfreezing air and onto ground surfaces that are frozen. Freezing rain differs from sleet in that it does not bounce upon landing. Instead, it creates a coating of ice on all objects – roads, trees, power lines, aircraft, etc. Only ¼" of ice from freezing rain can make it almost impossible to drive or walk safely. Freezing rain may fall for an hour or more and should be reported to the forecast office.

Snow pellets are another example of winter precipitation occurring in Southeast Alaska. These are fairly large "clumps" of congealed, wet

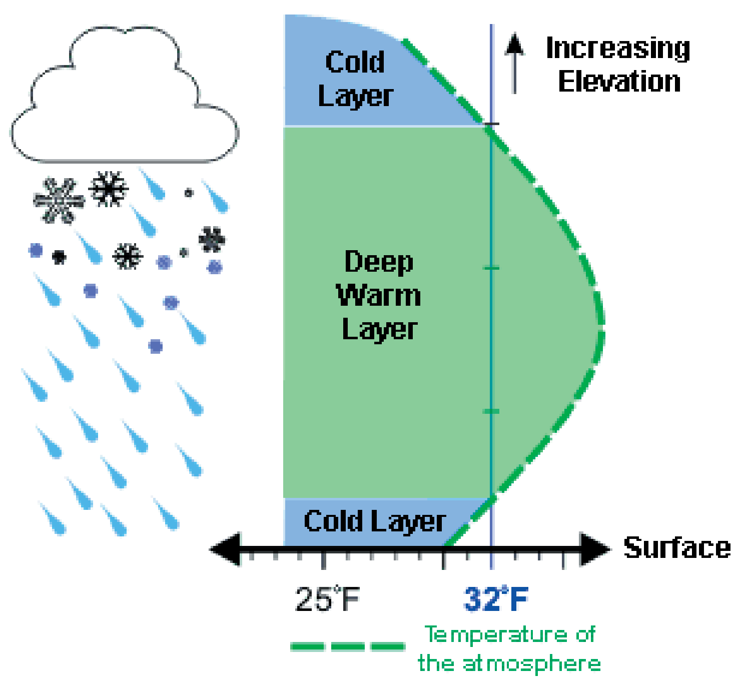


In this image the surface temperature is higher, 27°F. Also, as elevation increases, the temperature increases to a point where some of the atmosphere is above freezing before the temperature lowers again below freezing.

As snow falls into the layer of air where the temperature is above freezing, the snow flakes partially melt. As the precipitation reenters the air that is below freezing, the precipitation will re-freeze into ice pellets that bounce off the ground, commonly called sleet.

snowflakes. Snow pellets form in environments of rising and falling air currents that cycles the precipitation through air temperatures barely above freezing then barely below freezing several times on its journey to the surface. Snowflakes partially melt and are sent skyward again by turbulent air currents. The melting and refreezing of the snow makes them sticky and other snowflakes collide and adhere together making a sort of falling snowman. Eventually, the puffed up pellets fall to the ground where they may fracture like a loose snowfall. Snow pellets are most common in brief snow showers.

To predict what type of precipitation will occur, forecasters must consider temperature readings from not only the ground-based reporting stations, such as airports and weather spotters, but must also stay aware of the "temperature profile" through the entire depth of the air mass which the drops are falling. Subtle changes in air temperature – either horizontally or vertically – can make the difference between rain, snow, or something much different. ■



Freezing rain will occur if the warm layer in the atmosphere is deep with only a shallow layer of below freezing air at the surface. The precipitation can begin as either rain and/or snow but becomes all rain in the warm layer. The rain falls back into the air that is below freezing but since the depth is shallow, the rain does not have time to freeze into sleet.

Upon hitting the ground or objects such as bridges and vehicles, the rain freezes on contact. Some of the most disastrous winter weather storms are due primarily to freezing rain.

A Short History of Weather and Technology - Part III

By Paul Shannon

20th Century

In the past two editions of *Cloudburst Chronicle*, we have written a short history of weather and technology. From observations of the Chinese and Greeks 3,000 years ago, to the inventions of instruments in the recent past, changes and improvements have been constant. In this final chapter of our series, we'll look at how computers and satellites have changed the field of meteorology.

This medal, reserved for distinguished research in atmospheric sciences, was established by the European Geosciences Union, Division on Atmospheric Sciences in recognition of the scientific achievements of Vilhelm Bjerknes.

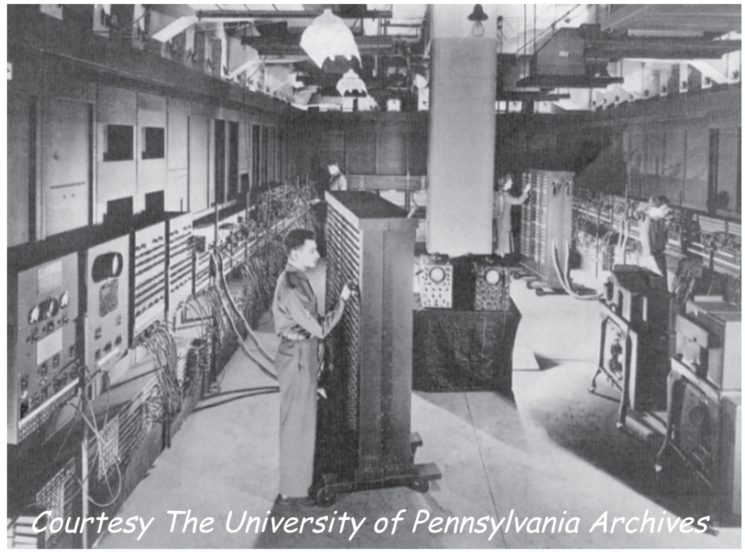
The 19th century saw an explosion in the scientific understanding of the physical properties of the atmosphere. In 1860, the American meteorologist William Ferrel published a collection of papers that were the first to apply mathematical theory to fluid motions on a rotating Earth. This work was the impetus behind the modern-day field of dynamical meteorology, which uses physics and mathematics to explain atmospheric motions. At the beginning of the 20th century these advancements came to a head with Vilhelm Bjerknes, considered by many to be one of the founders of modern meteorology and weather forecasting.

In a paper published in 1904, Bjerknes proposed the procedure now known as numerical weather prediction. Bjerknes suggested that with enough information about the current state of the atmosphere, scientists could use mathematical formulas to predict future weather patterns. Unfortunately, due to the lack of processing power, the calculations he envisioned were not feasible at that time. To move forward we needed what is one of the two most important technological advances in the history of weather forecasting – the computer.

Computers

Shortly after World War I, the first person to apply mathematics to make actual weather predictions was Lewis Fry Richardson. Working alone, it took Richardson several months to produce a wildly inaccurate six-hour forecast for an area near Munich, Germany. In his book Weather Prediction by Numerical Process, published in 1922, Richardson describes a scheme for predicting the weather before it actually happens. Richardson's idea involved a roomful of people, each computing separate sections of the equations, and a system for transmitting the results as needed from one part of the room to another. Unfortunately, Richardson's estimated number of human computers needed to keep pace with weather developments was 64,000 - all located in one very large room.

It was not until the 1950s that a team of meteorologists and mathematicians at the Institute for Advanced Study in Princeton, New Jersey were able to gather Richardson's 64,000 "computers" together in the form of ENIAC (Electronic Numerical Integrator And Computer), the world's first electronic computer. The ENIAC was a general-purpose computer that could be programmed to do different tasks. It did not have programmable memory; it could not store programs. This meant that every time a new problem was put to the ENIAC, a team of programmers had to spend as much as an entire day rewiring cables and turning dials on the machine's panels. Although ENIAC was capable of doing 5,000 additions per second, it was a tortoise compared to modern computers that are capable of billions of operations per second. It took 24 hours to produce its first 24-hour weather forecast.



Courtesy The University of Pennsylvania Archives

ENIAC Computer, 1947

Computers generate forecasts using mathematical equations that describe the physics and dynamics of the atmosphere. The science of predicting the weather using models of the atmosphere is known as numerical weather prediction. A model divides its domain into a number of gridpoints or cells and calculates how the atmosphere will change at each point with time. Worldwide, there are at least a couple of dozen computer forecast models in use, each with its own different methods and strengths.

Manipulating the huge datasets and performing the complex calculations necessary to model the weather on a resolution small enough to make it accurate requires some of the most powerful supercomputers in the world performing quadrillions (that's 1,000,000,000,000,000!) of arithmetical operations. Even that is too coarse to model tornadoes and other local weather phenomena.

Numerical weather prediction today has several other problems. The equations used to describe the atmosphere are too complex to be solved precisely, so approximations must be made to solve them in a reasonable amount of time. This leads to some error in the predictions. Also, models are initialized using observations from many sources, including ships, buoys, aircraft, radars, weather balloons, and weather satellites, but there are many gaps in the initial dataset, especially over mountains and the ocean. If the initial state is not completely known, the computer's prediction of how that initial state will evolve over time will not be entirely accurate.

This sensitivity to initial conditions is the famous "butterfly effect" which theorizes that a butterfly flapping its wings in Tokyo might influence the weather in Alaska. Small variations in the initial conditions of a system produce large variations in the long term behavior of the system. In the 1960s, Edward Lorenz argued that the nature of the atmosphere is essentially chaotic and this limits the predictability inherent in atmospheric modeling.

Today, computers touch all aspects of weather forecasting. They are used in everything from data collection to forecast preparation and dissemination. Even the format of the forecast is changing as the National Weather Service transitions from the text-based forecasts that began in the days of telegraph, radio, and newspapers, to today's digital forecast tailored for access over the Internet and wireless devices.


Courtesy Marshall Space Flight Center

Dr. Wernher von Braun with the famous V-2 rocket

Satellites

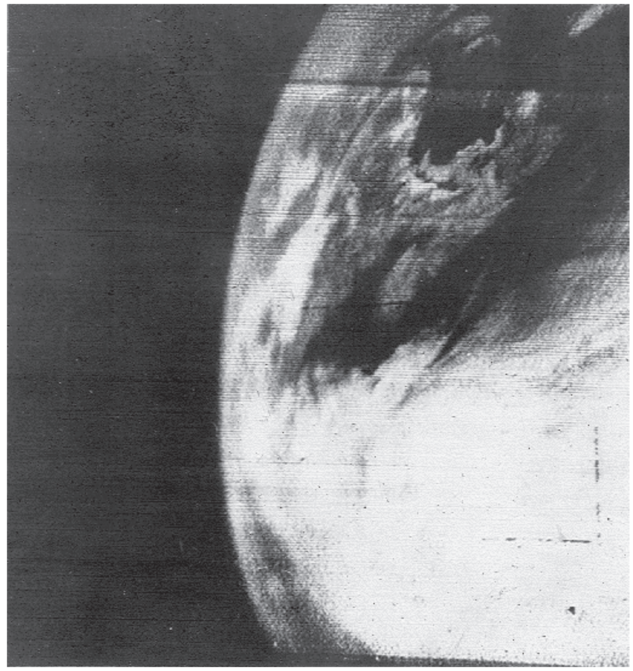
Many technological advances came out of the efforts of both sides to win World War II: jet aircraft, submarines, ENIAC, synthetic rubber, and radar to mention a few. The one most pertinent to weather came out of Germany's V-2 rocket program and Wernher von Braun's group of rocket scientists. Their research eventually led to the second of the great 20th century advancements in weather forecasting – the weather satellite.

Toward the end of World War II, von Braun engineered the surrender of 500 of his top rocket scientists, along with plans and test vehicles, to the Americans. He came to the United States in September 1945 to continue his work on rockets with the U.S. Army Ordnance Corps. On July 29, 1958, President Eisenhower signed the National Aeronautics and Space Act of 1958 establishing the National Aeronautics and Space Administration (NASA). Eventually, von Braun became the first director of NASA's Marshall Space Flight Center and the chief architect of the Saturn V launch vehicle, the superbooster that would propel Americans to the Moon.

The first attempt to look at the earth's weather from space occurred early in the history of the United States space program. In 1947, an unmanned U.S. Navy V-2 rocket carrying a camera reached 100 miles in altitude and took the first pictures of Earth from space. In 1959, the U.S. Navy Research Lab's Vanguard II was launched with light-sensitive cells able to provide information about the earth's cloud cover. Unfortunately, the satellite tumbled in orbit and was unable to return any information. NASA's Explorer VI, also launched in 1959, was more successful and transmitted the first photographs of the earth's atmosphere from space.

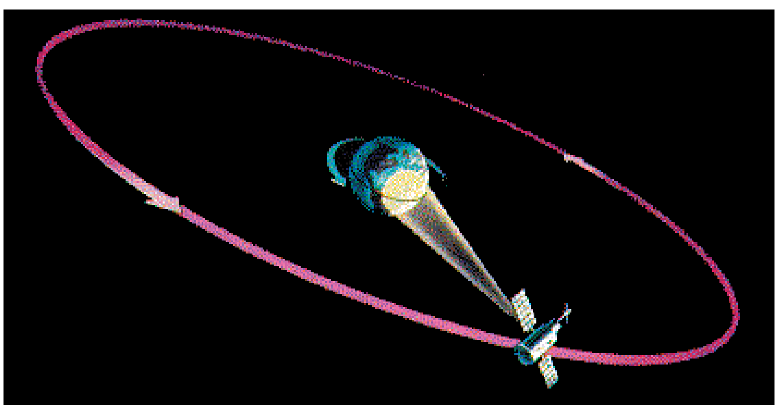
Finally, in 1960, the first weather satellite was launched into orbit around planet Earth. Called TIROS, for Television InfraRed Observational Satellite, it carried a video camera to make regular observations of the atmosphere below. This was a revolution in the study of weather as the new "birds eye view" allowed meteorologists to compare their local observations with a true synoptic view of the weather for the first time.

Today's weather satellites come in two main categories – geosynchronous and polar-orbiting. A satellite in geosynchronous orbit appears to hover over one spot on the Equator as it circles the Earth once a day at an altitude of around 22,300 miles. This allows a continuous image of the full disc of the Earth for tracking the development and movement of storms from the synoptic down to the local scale. A polar orbit takes a much narrower close-up image from only 500-600 miles up. As the Earth rotates below it, the entire surface is covered twice per day.

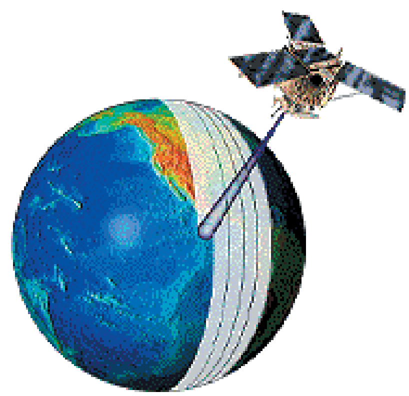


The very first television picture from space, taken by the TIROS-I Satellite on April 1, 1960.

The early satellites took images using only the visible light spectrum, measuring reflected sunlight much like a regular photograph. Visible light imagery is only useful during the daytime. Infrared images measure the amount of infrared energy emitted by the clouds and ground below, and computers interpret the data, generating images for meteorologists to use 24 hours a day. A third kind of image measures the amount of energy that water vapor molecules emit. Meteorologists can use these to track the movement of clouds, precipitation, and even the moisture content of air without clouds.



Geosynchronous satellite



Polar-orbiting satellite

Modern weather satellites carry sensors for a broad range of environmental monitoring applications besides weather forecasting including climate research and prediction, global sea surface temperature measurements, ocean research, sea and lake ice monitoring, volcanic eruption monitoring, forest fire detection, global vegetation analysis, and search and rescue missions. "Sounder" instruments, similar to radars, on the satellite can even give a three-dimensional vertical profile of temperature and moisture.

Into the Future

Huge advances in understanding the Earth and its atmosphere have been made over the last several thousand years, many of them driven by advances in technology as we have seen. However, no one could argue that we have reached a complete understanding of the complex system of weather analysis and forecasting. As we move into the 21st century, it should be exciting to see what new scientific discoveries and technological advances await in the future.

Summer Climate in Review: Record Breaking Summer

By Ursula Jones

In the last edition of the *Cloudburst Chronicle*, the summer seasonal outlook called for at or below average temperatures and above average precipitation. Let's look at how it actually turned out.

The month of April seemed to set a trend for upcoming months, being cooler and wetter than normal over the last 30 years. April's average temperature was 39°F, 1.8°F below normal for the month. High temperatures reached the 50's only 5 days and dropped to at or below freezing on 16 days. The coldest temperature for the month was 24°F on the 1st, but it wasn't even close to the record of 6°F set on April 5, 1963. Precipitation was reported on 27 days and the monthly total of 4.24 inches exceeded the average by 1.28 inches (33%). The heaviest rainfall at the airport occurred on the 22nd with 0.74 inches. The month was kind enough to go out with a bang, with three different airport records being set or tied on the 30th: 0.5 inches of snow fell (none previously reported for that date), 0.55 inches of liquid precipitation (melted rain/snow), beating 0.37 inches set in 1992, and the lowest high temperature for the date with 42°F (1970 also had a high of 42°F). May is normally our driest month, so it had to get better, right?

May actually ended up being slightly wetter than normal, raining a little more than an inch above average with a total 4.56" falling for the month. Average temperature for May finished near normal at 47.6°F, only 0.3°F below average. Expecting the weather to improve, I hoped the rest of the summer would include more sunshine – boy, was I wrong.

Headlines for our June Monthly Climate Summary read "Third Wettest June on Record, But Temperatures Near Normal." A series of low-pressure systems in the Gulf of Alaska kept the Panhandle in an unusually moist southwest flow most of the month. A total of 5.93 inches of rain fell in June, which was a whopping 2.57 inches above normal. June 2006 was the third month in a row of above normal precipitation and the third wettest June on record. June 1996 had 6.22 inches, making it the wettest June on record. Two daily rainfall records were broken during June: 1.01 inches fell on the 3rd and 1.17 inches fell on the 25th. Despite the record-breaking rainfall, Juneau did have a streak of six days, from the 9th to 14th, where high temperatures reached the 70s.

July was the only month this summer that offered weather close to normal. The average temperature in July was 56.3°F, only 0.5°F below than average. Rainfall was well within the range of normal values, topping out at 4.43 inches, a mere 0.29 inches above normal. Here is where it really started getting wet.

Flooding at Mendenhall Lake Campground

August 2006 will be remembered for nearly non-stop rainy days. Juneau broke a dubious record with 29 out of 31 days having measurable precipitation. The old record of 25 days was set in 1955 and again in 1956. (Hope this is not a sign for August 2007!) Fortunately, we did not beat the 1961 record of 12.31 inches of rainfall for the month of August, but we did come in second with 11.02 inches. Still, the monthly precipitation was more than twice the August average of 5.37. Temperatures in August remained cool throughout the entire month, never rising above 64°F. Some northern locations were not quite as lucky.

Flooding at Jordan Creek in Juneau.

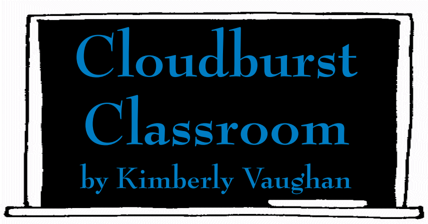
Widespread rain over much of central and south central Alaska the week of August 13 produced major flooding in the Matanuska Valley, Susitna Valley, and Prince William Sound zones from August 18-23. Twenty-four hour rainfall amounts of up to six inches were reported through the Susitna River Valley, while 48-hour rainfall of over 13 inches was reported near Cordova.

The flooding made national news due to numerous roadway, bridge, and railroad outages, along with many reports of flooded homes. Rockslides closed the Crow Creek Road near Girdwood, just south of Anchorage, and approximately 30 hikers were assisted to safety by Alaska Air National Guard Pavehawk helicopters. With the flooding subsiding, we slid into September.

September saw more wet weather and the 1st sub-freezing temperatures of autumn. The highest temperature of the month (64°F) and the fall's first freeze (30°F) were both on September 15th. This is two weeks earlier than the normal first frost. Temperatures dropped below freezing again on the 16th, but remained above freezing for the rest of the month. The Juneau Airport recorded measurable precipitation 24 out of 30 days with 2.73 inches falling on the 24th alone. The 13.01 inches of precipitation that fell in September was 7.54 inches above average. The record amount of rain in September is 15.14 inches, set in 1991.

Flooding on Montana Creek Road in Juneau

During the period between April and August, Juneau had 109 out of 153 days of measurable precipitation. This breaks the record of 106 days of measurable precipitation days in 1973, making the overall Spring/Summer season in Juneau one of the wettest ever based on the number of wet days. Juneau received 30.18" during this period, putting this only a few drops below the greatest amount of rain for a summer, 30.24" (in 1961). Yakutat also broke a record with 113 of 153 days having measurable precipitation. The previous record was 111 days with measurable precipitation in 1970. Overall, this summer was really soggy and cool.



The "Crown" Jewels of the Sky

For centuries, mankind has been looking up to the sky for answers to life, the future, and more. In this issue, I hope to answer some questions about a couple of optical effects: coronas and iridescence. We will cover the big questions of what makes the beautiful displays of color in the clouds and when they can be observed.

Solar corona seen during a total solar eclipse.

Coronas are luminous rings of light that appear around the moon and sun, as one or more disks. The ingredients for good corona viewing are thin clouds covering the sun or moon usually containing water droplets of nearly the same size. This light show occurs as light passes through the cloud and the light is bent (diffracted). This bending of the light separates the light spectrum into different colors (like a rainbow), as each color will bend at a different angle. Violet is the shortest wavelength and, hence, forms as the inner ring of color with red being the longest wavelength appearing as the outer ring. Blue and red are two most common colors, but on occasion violet, green, yellow, and orange are visible. The best conditions for viewing a corona is through clouds with uniformly small water droplets and with a bright moon behind them. The moon allows for better viewing since it is not as bright as the sun and allows the more subtle colors to be seen.

Iridescence

Iridescence is nothing more than a deformed or incomplete corona as the light is diffracted. Iridescence appears as fringes of colors along the edge of clouds or as diffuse area of color within the cloud. There is one small difference with the viewing of iridescence. The moon produces a better opportunity to see them, although the colors will be paler. The sun will produce the brightest colors if the colors are not overwhelmed by the brightness. Coronas and iridescence are only two of many optical effects that can be viewed in our skies. They occur because of simple physics, but can produce a view that defies explanation. Remember to take time to look at the world around us and enjoy all its wonders.

Wind Trivia

1. Warm, dry winds that appear in Southern California during the autumn and early winter are called: A) Chinook Winds B) Westerlies C) Santa Anna Winds D) Beaufort Winds

2. In ancient Greek mythology, the four winds personified as gods were called the: A) Anemoi B) Coriolis C) Fohn D) Venti

3. Wind is caused by: A) Differences in pressure B) Uneven heating of the earth's surface C) Rotation of the planet D) All of the above

4. Hurricanes, typhoons, cyclones, and willie-willies are all the same meteorological phenomena? A) True B) False

5. The highest gust of wind ever recorded occurred at Mt. Washington in New Hampshire April 12th, 1934. The speed was: A) 112 mph B) 231 mph C) 169 mph

6. Mt. Washington in New Hampshire has a mean annual wind speed of 35 mph and is the windiest location in the US. Where is the second windiest? A) Chicago, Illinois B) Cold Bay, Alaska C) Goodland, Kansas D) Boston, Massachusetts

7. A High Wind Warning is issued by the National Weather Service when the sustained wind or frequent gusts reach: A) 40 mph B) 55 mph C) 60 mph D) 70 mph

WEATHER WATCHERS SOUTHEAST ALASKA SPOTTER NETWORK

Our Most Valuable Spotters!

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, ***Chris & John Spute from Gustavus*** 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!

On September 29th, Hydro Meteorological Technicians Nathan Foster and Brian Tassia worked together to led several tours totaling 30 students and 17 adults (pictured above) from the Interior Distance Education of Alaska (IDEA) program. These homeschooled students ranged in ages from toddlers to teenagers. In addition to seeing the Juneau Forecast Office operations, the visitors saw a presentation on the various ways we collect weather data. The kids even took a fun quiz on pictures of different weather phenomena. This was one of the largest tour groups to visit our office and had to be broken up into three separate groups. We enjoyed having the IDEA program students visit and hope to see them again sometime in the future!

Trivia Answers: *1. Santa Anna Winds are warm dry winds that come from the deserts of Southern California. 2. The Anemoi were wind gods who were each ascribed a cardinal direction. Boreas (North), Notus (South), Zephyrus (West), Eurus (East). 3. Winds are caused by all of the above. 4. True - All of them are what we call hurricanes, just in different locations around the world. Willie-Willie is a nickname for an Australian cyclone. 5. 231 mph 6. Cold Bay, Alaska has a mean annual wind speed of 17 mph. 2nd windiest in the U.S. 7. 60 mph. A wind advisory is for 40 mph.*

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.

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Don't forget to send in photos to share!

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