Southeast Alaska

Cloudburst Chronicle

National Weather Service
Juneau, Alaska

April 2012

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Local Tsunamis – A Threat for All of Southeast Alaska

By Joel Curtis

The earthquake and tsunami that occurred March 11, 2011 in Japan killed over 15,500 people, with over 4,500 still missing, while completely destroying entire towns. This event is a stark reminder of the deadly forces in nature that occur around the "Ring of Fire" on the Pacific Ocean. The first waves hit Japan in as little as 5 minutes after the magnitude 9.0 earthquake off the coast of Japan was registered and felt throughout the region.

Southeast Alaska is susceptible to local tsunamis, which are also known as short distance tsunamis. Although we are close to several major fault lines, local tsunamis are limited by geography and event. A local tsunami can be an added component of the teletsunami (long distance tsunami) that originates near a distant earthquake's epicenter. More commonly, these can be waves confined to the area of generation within a fjord, bay, or harbor which are caused by movement of the bay itself or by a landslide into the water or a submarine landslide. Our rugged terrain along our many deep channels has the potential for landslides if a very strong earthquake occurs.

It may not be possible to issue a warning before the waves are generated and make landfall along our vast coastline. Tsunamis travel approximately 500 mph in deep water and will slow to around 40 mph in shallow water. The local tsunami is a very serious threat because it strikes suddenly, sometimes before the earthquake's shaking stops – and you cannot outrun these waves.

The closer you live to sea level, the greater the chance that a significant tsunami can hit your location. In the event that you observe a very strong earthquake,

Don't Wait Around! Get to Higher Ground!

A guideline for a strong earthquake is one that lasts 20 seconds or longer and causes difficulty in standing. A rapid rise or fall of coastal water or a large ocean roar may precede a tsunami. If you can see the tsunami from sea level, it is too late - tsunamis move faster than you can run.

Tsunami safety rules:

- Keep calm. Listen to Emergency Officials when possible.
  A tsunami is a series of waves that continue for many hours - not one single wave.
- Move to high ground; 100 feet above sea level or 1 mile inland, away from river valleys.
- If you cannot move to high ground, a concrete building's upper floor may be safe.
- Do not use elevators. Use the stairs.
- Not every earthquake will cause a tsunami.
- Local tsunamis often happen quicker than can be warned for. When in doubt, evacuate.
- A tsunami may cause only small waves at one beach and damaging large waves only a short distance away. All tsunamis are extremely dangerous even though they may not damage every coastline they strike.
- Stay tuned to your radio, marine radio, NOAA Weather Radio, or television.
- Keep an emergency kit packed and ready. Prepare for power failures, water shortages, and include instructions on how to evacuate safely.
- Wait for the local Emergency Officials' "ALL CLEAR" before returning to your residence.

Flooding along Mendehall River at View Drive

Juneau Jökulhlaup Flood Event

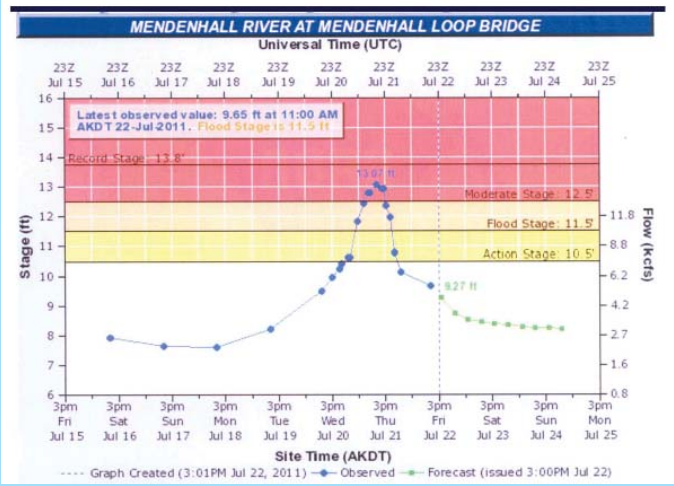
By Aaron Jacobs

From July 19-21, 2011 the Mendenhall Valley in Juneau experienced a Jökulhlaup, an unusual hydrologic event. A Jökulhlaup is an Icelandic term for a sub-glacial outburst flood that occurs once a body of water that is being dammed by a glacier empties in its entirety. Much of the science behind what causes these bodies of water to empty is still unknown. The current thinking is that pressure from the impounded water builds up and lifts the glacier, allowing the water to flow underneath to the terminus (end or snout of glacier) of the glacier. As the water flows under the glacier, the friction melts the ice and allows more water to flow from the lake through a tunnel to the terminus. Once the lake fully empties, there is a large tunnel underneath the glacier and, by either the weight of the ice or freezing temperatures, this tunnel will close up and the lake can refill. There are some instances that if a glacier

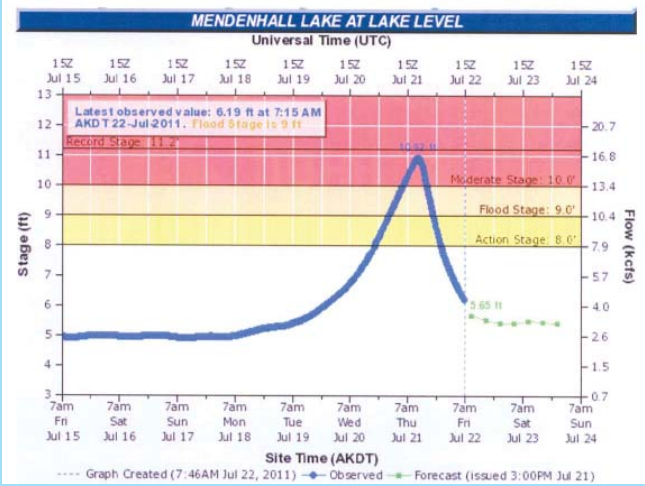
dam release happens in late spring/early summer, it could refill and produce a second release later in the summer or early fall. It has been found, from past glacier dam releases, that they are typically triggered by heavy precipitation.

The Juneau area is not unfamiliar with glacier lake outburst floods (GLOF) since the Taku River, 5 miles south of downtown Juneau, experiences a GLOF annually from Lake No Lake on the Tulsequah Glacier in Canada. The Tulsequah River is a tributary to the Taku River, and as flood waters from the draining Lake No Lake flow into the Taku River flooding can happen with potential damage to cabins along the river. The Juneau area has not seen a GLOF of significant magnitude in recorded history. In summer 2007, there was a small GLOF on the Mendenhall River system, but it went relatively unnoticed due to the small magnitude and it did not affect the public.

On Tuesday, July 19, 2011 the Mendenhall Lake and Mendenhall River saw a steady rise in the water level of about 1-2 inches per hour which continued for 2 days. By mid-day Wednesday, the National Weather Service



Hydrograph of Mendenhall River



Hydrograph of Mendenhall Lake

Flood waters flowing from underneath the Mendenhall Glacier. The flat rock, the water is flowing over is about 75 feet wide.

(NWS) in Juneau was confident that the rising waters were due to a GLOF, and that the water would continue to rise but not flow over its banks. The water level continued to rise at the 1-2 inches per hour rate and, by Wednesday evening, the NWS coordinated with the Alaska Pacific River Forecast Center (APRFC) to issue a Flood Advisory since the lake and river level had exceeded minor flood stage. The water levels continued to rise through the night and, in the early morning hours, a Flood Warning was issued for the Mendenhall Valley.

There were a lot of unknowns since it wasn't clear where the source of the water was and how much additional water was going to flow into the Mendenhall Lake and Mendenhall River. A group consisting of staff from the University of Alaska Southeast (UAS), the City and Borough of Juneau (CBJ), and the National Weather Service (NWS) worked together to locate the water source to try calculating how much more water was expected to drain from the lake. Dr. Eran Hood, (professor of Environmental Science at UAS), Tom Mattice (CBJ's Emergency Manager), and Aaron Jacobs (NWS Forecaster and hydro focal point) flew from the Juneau International Airport via a helicopter to locate the glacier dammed lake and find out if the lake had totally drained or if more water was expected to flow into the Mendenhall Lake/River system. This critical information was needed to accurately forecast the flood crest since both the Mendenhall Lake and Mendenhall River were approaching record levels and additional homes could get flooded if the water continued to rise.

The team flew up to the Mendenhall Glacier and, based on helicopter reports, headed towards an area called Suicide Basin as the potential source of the flood waters. Suicide Basin is located on the eastern side of the main stem of the Mendenhall Glacier, about 2 miles from the terminus, and encompassing an area of approximately 178 acres. When the team viewed Suicide Basin, they were amazed at the size of the ice covered lake. There were massive stress fractures in the glacier that were created when the lake drained causing the "floating" ice to drop. The team landed safely, although the ice was still shifting, evidenced by the cracking sounds and ice falling into the hole formed when the water drained. While on the ground, the team was able to estimate the lake level had dropped about 200 feet by using high water marks.

Flooding on Skater's Cabin road

Once the recon flight returned to the airport, reports were coming in that both the Mendenhall River and Lake crested and water levels were beginning to fall. The Mendenhall River and Mendenhall Lake crested at 13.07 feet and 10.92 feet, respectively. Both of these crest levels were the second highest ever recorded and above moderate flood stage of 12.5 feet for the river and 10.0 feet for the lake. Impacts of the flooding were extensive, with the Mendenhall Campground being evacuated in addition to a sub-division that lies next to the Mendenhall River, since the road leading to the sub-division was flooded and impassable. One home was flooded with up to 3 feet of water within that sub-division and the Skaters Cabin spur road, near

Mendenhall Lake, flooded with about 2.5 feet of water. Residents below the Back Loop Mendenhall River bridge saw flood water inundate their back yards.

There is concern among hydrologist's with the USGS, NWS, and UAS that this GLOF on the Mendenhall system will become an annual event similar to what occurs on the Taku River. Steps are being taken to set-up a monitoring program in Suicide Basin. This monitoring program would allow hydrologists at the APRFC and forecasters at NWS Juneau to accurately forecast when a GLOF is underway and approximate how high the Mendenhall Lake and Mendenhall River may get. This will provide the public with important information to help decide what action to take if flooding is expected. Since the July 2011 event, the Suicide Basin glacier dammed lake refilled and produced a second release during a heavy rain event on August 20, 2011. The threat is real and we need to be as prepared as possible when the dam breaks again.

Notable Achievements

The Volendam received a 2010 VOS award for submitting a total of 6,190 marine observations! That's an average of over 16 observations submitted each day.

Photo by Ursula Jones

Back row (Left to Right): Peter Bos, Colm Ryan, Harry Hobma, George Hale, Marienus Hazelman, Adam Wilson, Folkert Visser, John Prins, Maarten Janse, Kayleigh Tait

Front row (Left to Right): Radhityo Nugroho, Jefri Sipahuta, Alhudori, Muhazin, Sapei, Mochamad Achyat

Notable Achievements cont.

The Zuiderdam received a 2010 VOS award for submitting over 1,800 marine observations. Congratulations!

Left to Right: Andy Glendinning, Joshua Banyard, Henry Jones.

The Norwegian Star received a 2010 VOS award for submitting almost 1,500 marine observations. Congratulations!

Left to Right: Alan Vera, Aldin de Juan, Peter Engwall, Carl Hammerin, Richard Desalesa, Mikko Kovalainen, Alvin Del Rosario.

"Like Us" on Facebook!

By Ursula Jones

The National Weather Service Alaska Region (NWSAR) has begun using Facebook as a supplemental channel for improving weather awareness. Postings to this page will be used to share different types of information, ranging from forecast graphics to weather safety and preparedness information to photos and other outreach events.

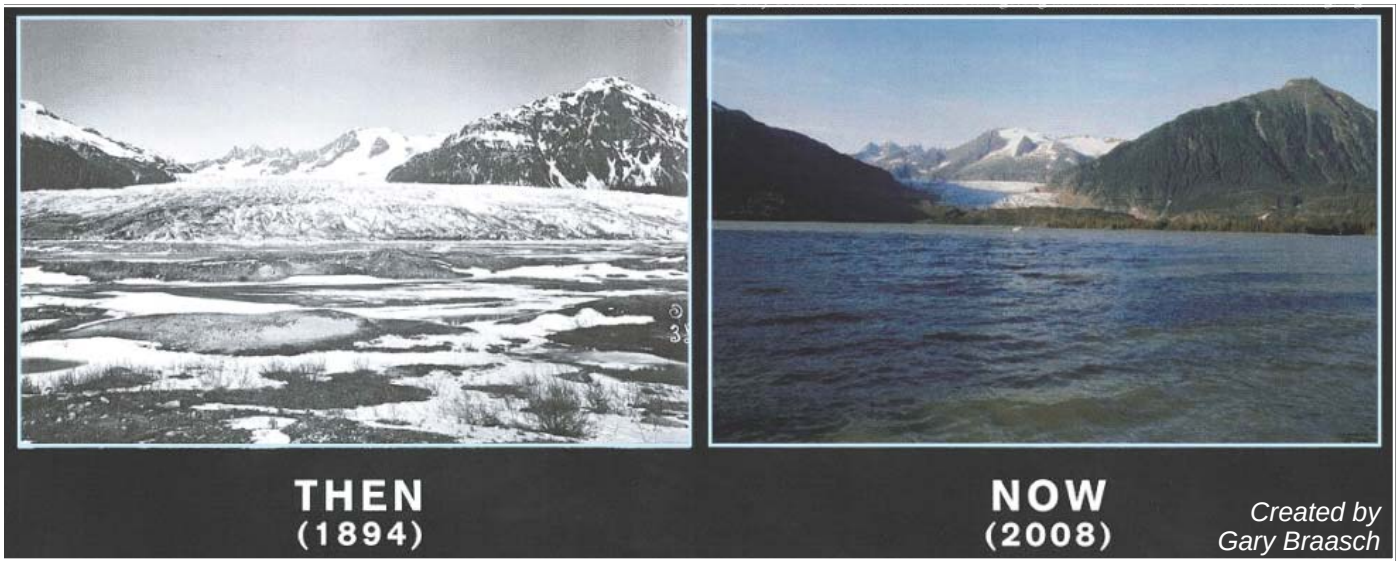
Facebook users can find the National Weather Service page by searching for "US National Weather Service Alaska" on Facebook or at: http://www.facebook.com/US.NationalWeatherService.Alaska.gov.

Active for a little over a year, the NWSAR page is a prototype effort by NWS in exploring ways to expand its Facebook presence. This prototype page is in preparation for an experimental service which will be open for public review and comment when available.

The use of Facebook provides an avenue for the NWSAR to reach out, collaborate, and interact with the public. Facebook gives NWSAR 'fans' the capability to 'write on their wall' (provide their own postings) and comment on posts on the page. Comments and posts can range from weather spotter reports to simple statements or detailed questions.

Fans are cautioned not to rely on this service as the primary means of receiving alerts and warnings of hazardous weather. NWS alerts and warnings are available on NOAA Weather Radio and our official website: http://www.arh.noaa.gov/. The use of social media is not intended to replace any of the other ways people already obtain weather information, but it's going to help the National Weather Service get it to more people.

There are now over 120 U.S. National Weather Service Facebook pages. You can not only "Like Us", but you can also "Like" some or all of the others. Just enter "National Weather Service" in your Facebook search bar and select "Pages" as a search filter. Remember to slide your sidebar down and click on "See More Results".



New Climate Normal Period Begins This Year

By Rick Fritsch

December 31, 2010 marked the end of a new "climate normal period," a 30-year period used to determine climate normal (e.g. average rainfall, snowfall, temperatures, etc.). Thirty years is the accepted standard to derive "normal" values of various weather parameters. These normals are re-calculated every 10 years for the previous 30-year period. Climate normals can be created for any location where regular weather observations are taken and there aren't any significant gaps in the record over the past 30 years. They are really quite simple and are nothing more than the mathematical average of the parameter in question over the course of those 30 years. For example, the climate normal August temperature would be the sum of the average August temperature for those 30 years divided by 30. One can define a climate normal for just about any measured weather element, ranging from the "normal" daytime high temperature for February 12 to "normal" annual snowfall. Some of the more common elements included in climate normals are high, low, and average temperatures, heating and cooling degree days, precipitation and snowfall. The most common climate normal timescale is the month, which is used extensively in the monthly weather summary issued by WFO Juneau on or about the first of every month for the previous month. An important distinction must be made between the word "average" and the use of the word "normal" in the case of climate normals. The word "average" refers to the mathematical average of the weather element in question. A "normal" is also a mathematical average, but for a very specific period, in this case, the 30-year climate normal period. Therefore, while the average January low temperature for Juneau International Airport is 20.0 degrees F, based on a record that goes back to 1943, the normal January low temperature is 23.7 degrees based on the years 1981 through 2010.

With global climate change becoming a major environmental topic over the past decade, it is interesting to see how the normal values for Juneau are trending.

The annual average temperature over the new climate normal period (1981 – 2010) has indeed warmed measurably, but there is more to it than that. Specifically, the winters are getting warmer faster than the summers are. Additionally, there is a slight trend for overnight lows to be getting warmer more than daytime highs, meaning that there is less diurnal temperature variation. One of the predictions made by the International Panel on Climate Change was that as the global climate warms, there would be an increase in annual precipitation. This trend is captured in the Juneau data, with an increase of 3.93 inches of average annual precipitation in the 1981-2010 climate normal period when compared to the 1971-2000 period. Again, the increase is greatest in the cold portion of the year – October through March. With warming temperatures and a warmer climate normal, one might expect a reduction in annual climate normal snowfall. This is the case, with 6.2 inches less annual snowfall on average for the new climate normal period (86.8 inches). For details, see the tables below.

Juneau Climate Normals (annual)

	1971-2000	*1981-2010*	*Change*
Average Max Temp deg F	47.6	48	0.4
Average Min Temp deg F	35.3	36	0.7
Mean Temp deg F	41.4	42	0.6
Annual Precipitation (inches)	58.24	62.17	3.93
Annual Snowfall (inches)	93	86.8	-6.2
First Freeze	Oct 4th	Oct 3rd	1 day earlier
Last Freeze	May 8th	May 6th	2 days earlier

Juneau Climate Normals (October - March)

	1971-2000	*1981-2010*	*Change*
Average Max Temp deg F	37	37.8	0.8
Average Min Temp deg F	27.2	28.1	0.9
Mean Temp deg F	32.1	32.9	0.8
Annual Precipitation (inches)	31.45	33.65	2.2
Annual Snowfall (inches)	92	85.7	-6.3

Juneau Climate Normals (April - September)

	1971-2000	*1981-2010*	*Change*
Average Max Temp deg F	58.1	58.3	0.2
Average Min Temp deg F	43.5	44	0.5
Mean Temp deg F	50.8	51.1	0.3
Annual Precipitation (inches)	26.79	28.52	1.73
Annual Snowfall (inches)	1.0	1.1	0.1

Monitoring Climate and Weather Extremes

Deke Arndt, Chief, Climate Monitoring Branch
NOAA's National Climatic Data Center
Earth System Monitor, June 2011, Vol.18, No.4

Climate extremes are measures of the limits of how "big" weather events can be for a place: the highest flood, the coldest winter, the longest drought. Extreme climate and weather events are important because they can stress economic conditions, cause damage or even threaten lives.

Extreme events are rare and therefore very unusual, such as the December 2010 storm that brought a total of 6.72 inches of rain to Los Angeles in just two days; an amount equivalent to more than one-third of L.A.'s annual average precipitation. Extremes also differ from one location to another: a snowfall considered extreme in Louisiana would not turn many heads in Vermont.

Yet even rare events can be anticipated. The question is, which extreme events can we prepare for? When building a sea wall, for instance, an engineer will have to make judgments: is it high enough for a 100-year flood? Can we afford to build a wall that can withstand a 500-year flood?

Planners and policy makers must take into consideration the possibility of rare, extreme events. Cities make building codes, zoning rules, and infrastructure decisions that will protect people from harsh effects of extreme events. In New York City, for instance, subway sills and grates were raised a few inches after a series of extreme rain events flooded tunnels and brought the entire subway system to a standstill. Understanding and quantifying climate extremes helps thousands of towns and cities plan for extreme events, affecting policy decisions from watering rules to applications for federal disaster assistance.

In Florida, orange growers know that every once in a while the state will experience a fruit-damaging freeze. Coastal residents know their homes will periodically be threatened by hurricanes. County governments know they will occasionally have to evacuate an area in anticipation of major flooding. Scientists create the records, maps, and analyses of extreme events of the past. In doing so, this helps fruit growers, insurance companies, energy utilities, road builders and others understand where and how often extreme events or disasters are likely to occur in the future. They use the information to plan a safe environment and healthy economy.

How do we define extreme climate and weather events?

Given the significant impact of climate and weather events on people, NOAA tracks these climate and weather extremes to better understand what our climate is capable of delivering as well as how a changing climate impacts these extreme events. There are many ways to monitor extremes, some more complex than others. Perhaps the simplest way to define a weather or climate extreme is by tracking record events: what is the warmest, wettest, driest, or windiest event at a location, for a specific day, or month, or ever? Climate scientists also categorize extreme events according to the probability that they will happen: a flood with a 100-year return period, or "100-year flood" has only a 1 percent chance of occurring in a given year. A 10-year event would have a 10 percent chance of occurring during a given year, and so on.

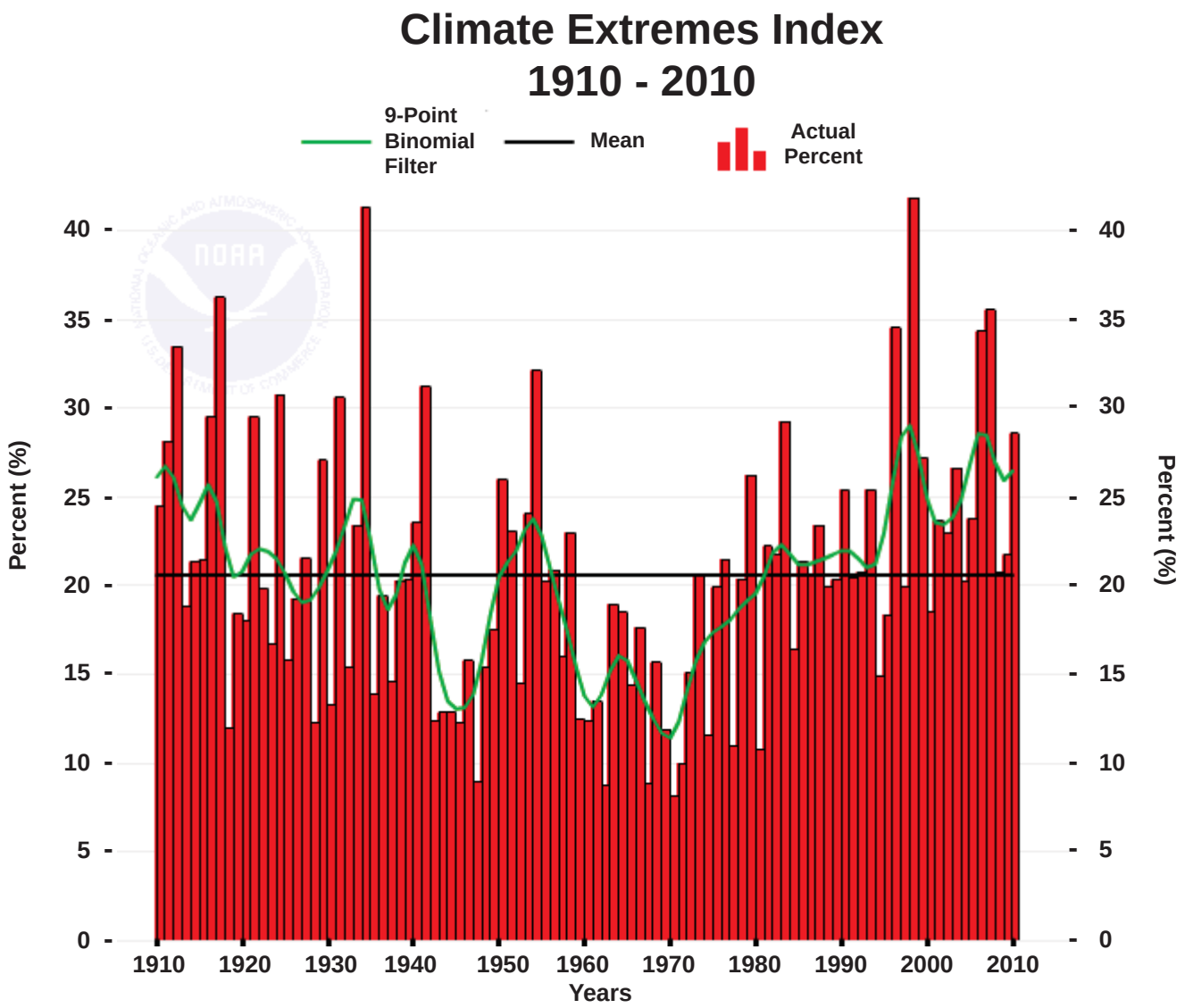
The Climate Extremes Index (CEI) is one tool developed and used by NOAA's National Climatic Data Center to help us better understand the relationship between climate change and extreme events. Think of the chance, based on a location's historical climate record, weather conditions will occur as a bell curve, with the most common occurrences happening in the middle of the curve, and the lease common happening in the "tails" on either end. The CEI tracks events that occur in the "tails" of that distribution. Specifically, it tracks "outliers" in the high and low 10 percent of that curve. Or, put another way, the CEI uses this "tenth percentile" approach to define events that are "much below" or "much above" average. The extremes that are part of the CEI include:

> "Yet even rare events can be anticipated. The question is, which extreme events can we prepare for?"
>
> - Deke Arndt

- monthly maximum and minimum temperature
- daily precipitation
- monthly drought severity

An "extreme" occurrence is one where the indicator is either much above or much below the average expected. In any given month or year, we expect each of the conditions (in both the "much above" or "much below" category), to have an "extreme" occurrence about

20 percent of the time. We then measure actual occurrences and see if it is more or less than the expected 20 percent. When extreme events occur more than 20 percent of the time in a given year, it can be an important indicator that something is happening in our climate – perhaps due to natural variability like El Niño or the Arctic Oscillation. When it happens over multiple years and decades, it helps us see how human-induced climate change is impacting extreme events.



In the CEI graphic here, we see that 2010 had more than the expected number of extreme events. The CEI score of about 28.6 means that 28.6 percent of the country had weather and climate conditions defined as "extreme". This is almost half again more than the long-term expectation of 20 percent.

Diving deeper into the CEI allows us to see which events, and which seasons, are getting more extreme, by allowing scientists

to quantify how our country's climate is changing over time. In recent years, scientists tracking climate extremes have noticed that there have been more warm extremes, such as heat waves, occurring, but fewer cold extremes. For example, a major driver of 2010's higher-than normal value was the broad coverage of much warmer than normal overnight lows, especially in the summer. This has major implications for energy consumption and public health. In addition, the water cycle is becoming more extreme; both the number of extreme single-day rainfall events and the number of days with precipitation are on the rise. Averaged across the country, 2010 was the fourth most extreme year of the last 100 years in terms of extreme single-day precipitation events.

Tools to Help Monitor Climate Extremes – The U.S. Drought Monitor

Drought is another extreme that combines what is going on with the physical climate system versus what people have come to expect. When drought develops it has serious impacts on agriculture, the energy industry, and water supply management. Drought varies according to region and time of year. As temperatures increase, some areas of the United States are likely to see increasing periods of drought. This spring, Texas and other parts of the South and Southwest have experienced record drought conditions, which led to some of the worst wildfires in the history of Texas.

To provide the most up to date climate information on drought, NOAA, in partnership with the U.S. Department of Agriculture, National Drought Mitigation Center, and the Western Regional Climate Center, develops the weekly U.S. Drought Monitor. The U.S. Drought Monitor indicates which areas of the United States are in drought conditions and how severe the drought is. It also points out areas that are dry and could devolve into drought conditions. This weekly information provides people the information to make decisions about current drought, where drought might be developing, and the ability to look at historical drought trends.❄

Additional input from Katy Vincent, NCDC, and Jennifer Freeman, American Meteorological Society.

Derek "Deke" Arndt, Chief, Climate Monitoring Branch, NOAA's National Climatic Data Center. Deke Arndt joined NCDC in March 2009 as the Chief of the Climate Monitoring Branch, which is responsible for monitoring and assessing the state of the Earth's climate system. As an applied climatologist, his work encompasses research and service aspects that are centered in utilization: helping people make better climate and weather-sensitive decisions. His most prominent work has been in the drought monitoring community.

Visit Our Office - Virtually

By Ursula Jones

The Weather Forecast Office in Juneau (WFO Juneau) now has a new way to visit it – virtually! "Our Office" pages, located at http://pajk.arh.noaa.gov/OurOffice/VTIntro.html, were created to give a brief overview of everything our office does. The reader can get an idea of the types of weather they can expect if they visit Southeast Alaska, meet the staff, learn a little about how our forecasts are created, and much more.

The office tour has ten pages beginning with a short introduction that discusses our area of responsibility. A second page offers an explanation of what each person's duties are and provides a picture of each staff member. It really is nice to put a face to a name!

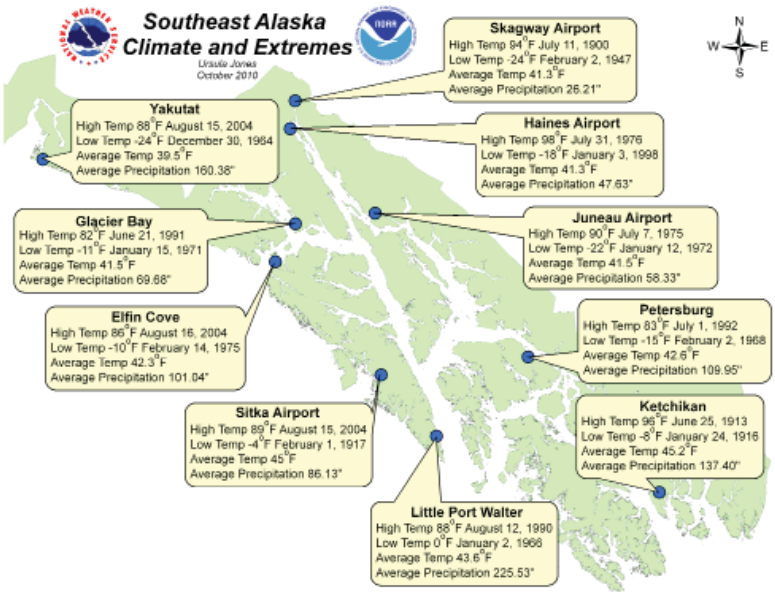
The Operations page shows how much we rely on computers and some of the ways that we gather our information to help create the most complete forecast packages possible. After checking out the Operations page, you will want to take a peek at our Forecast Products page. This page appears compact at first glance, but it holds a lot of information that you might find useful. For each product listed, there is a link to the actual forecast. Some of the forecasts are offered seasonally, like fire weather and our highway mountain pass forecast, so there won't always be a forecast available for those.

Another important part of our tour is the Local Area Information page. This page discusses the kind of weather you can expect if you visit Southeast Alaska. There is a map that display's highs and lows as well as the average temperature and precipitation for certain Southeast locations. Also, on the same page is an outdoor activities portion that provides suggestions on what types of outdoor activities are available and the kind of clothing you should plan on wearing to be safe.

Next is the Marine Forecast page that talks about the marine products we issue for Southeast Alaska and where we collect some of our marine observations that are often used to verify our product accuracy.

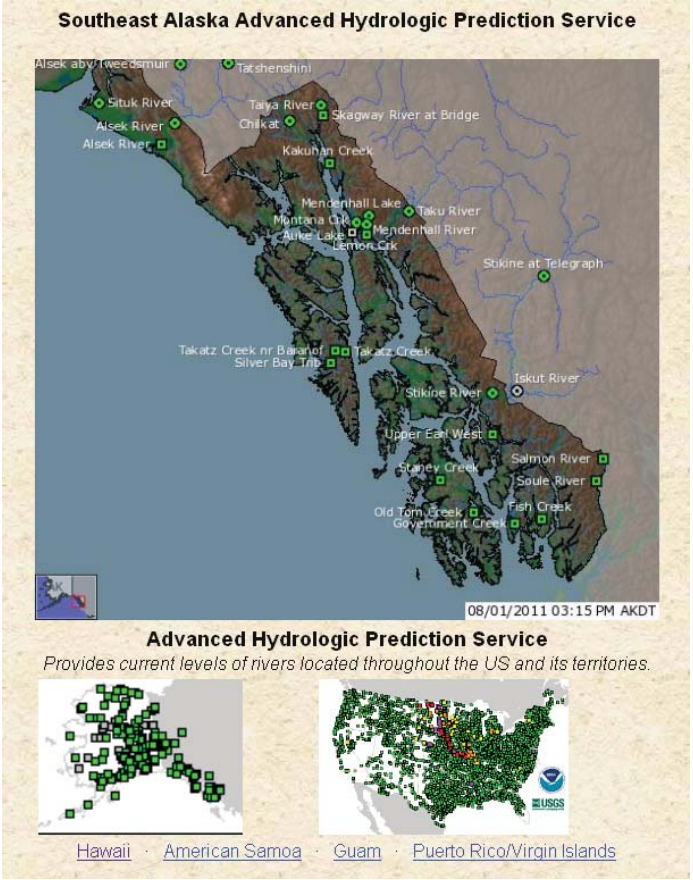
After that, you might want to check out our Fire Weather page. You may think that forest fires aren't a big concern for WFO Juneau because Southeast Alaska is a rainforest, but it only takes a short, dry spell in Southeast Alaska to increase the threat of wildfire. We do monitor various fire weather parameters so we can inform land managers and campers alike about potential problems. On our Fire Weather page you will find forecast products and the criteria we use to decide whether we should issue additional statements to increase public awareness of fire danger.

Satellite information is a vital resource forecasters use to analyze the state of the atmosphere and to help validate weather Forecast model solutions. Two different kinds of satellites, Geostationary Operational Environmental Satellites (GOES) and Polar Operational Environmental Satellite (POES), are used to gather weather information to assist staff with their forecasting decisions. The GOES provide constant monitoring from several fixed positions around the planet at an elevation of 22,500 miles. POES makes



regular 360° orbits around the Earth passing over the poles at about 833 km (517 miles) above the Earth's surface.

Hydrology is another important page we have that shows you what hydrology products can be issued and why they might be issued. There are some nice graphics here that provide you with up to date river level and precipitation information across Southeast Alaska and the rest of the United States. If you click on one of the images, it will take you to one of our hydrology pages that gives you information like what areas are currently flooding, current observations, and water level history.



The final page on WFO Juneau's virtual tour talks about the history of WFO Juneau and the National Weather Service. The National Weather Service was officially organized in 1870, but the Juneau Weather Bureau (the original name of our office) didn't begin taking observations until 1917. Weather observations were taken beginning in 1881 by Weather Bureau volunteers and the U.S. Army Signal Service.

What we do, how we do it, where we live, who we are, and more!

That's Our Office Virtual Tour in a nutshell.

Temperature Trivia

Where was the coldest temperature in the Southeast Alaska, Alaska, and the World?

Within Southeast Alaska, Canyon Island holds the record for the lowest observed record at -28°F on January 29, 1996. Canyon Island is located on the Taku River, near the Canadian border.

The coldest recorded temperature in Alaska, -79.8°F, was observed at Prospect Creek Camp on January 23, 1971. The Prospect Creek Camp is located in the Endicott Mountains of northern Alaska, along the Alaska pipeline about 20 miles north of the Arctic Circle.

The coldest recorded temperature in the World, -128.6°F, was observed at Vostok, Antarctica on July 21, 1983.