Newsletter of the Alaska-Pacific River Forecast Center and
Alaska's NWS Service Hydrologists

# Kuigmek: from the river

**(Yup'ik, pronounced "Kwig-mek")**

January 2025

We know it's winter, but we're still interested in river conditions. **Please let us know if there are any anomalous river events -- mid winter breakups, uncommon ice thickness, above/below average snowpack, etc**. These observations let us better anticipate breakup issues. We can take observations through a partnership with UAF using the website Fresh Eyes on Ice (http://freshеyesonice.org/) or to us directly: nws.ar.aprfc@noaa.gov

### In This Issue:



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## Greetings from the Alaska-Pacific River Forecast Center!

It was a busy year at the Alaska-Pacific River Forecast Center. We started out the year with another dynamic breakup on the Yukon and Kuskokwim Rivers. In June, the focus shifted to wet-season operations: forecasting river levels for over 100 points across the state, monitoring roughly 20 glacier-dammed lakes in southeast and southcentral Alaska. The summer and fall were relatively quiet for flooding with one major exception in Juneau. The Mendenhall River experience record flooding with significant impacts to the community. Along with all Alaskans, we are all supporting Juneau during the recovery and preparations for future flood events.

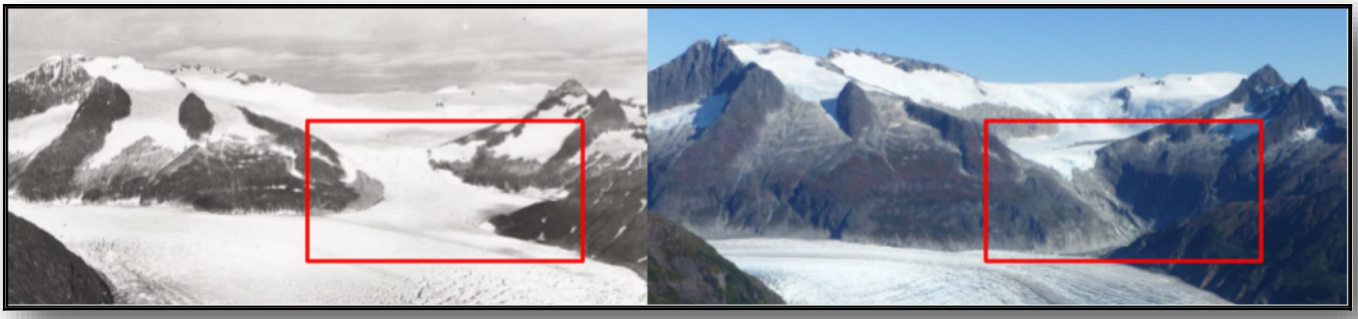
## 2024 Mendenhall River Jökulhlaup!

*By Aaron Jacobs and Crane Johnson*

The Mendenhall Valley experienced another record flood event in August of this year. The flood crest came a day later than in 2023 and peaked almost one foot higher on the USGS gage on the Mendenhall River. The flood originated from Suicide Basin/K'óox Ḵaadí Basin[1] which is a side basin located less than one mile from the terminus of the Mendenhall Glacier. Suicide Basin was once filled with ice from Suicide Glacier/K'óox Ḵaadí Glacier, but as the glacier recedes, ice is no longer deposited into the basin. Now, water from annual snowmelt, ice melt, and rainfall fills the basin. In addition to a calving face of the glacier that holds back water in the basin, floating icebergs from ice calving off the main trunk of the Mendenhall Glacier further complicate the understanding of this dynamic system, along with other factors.

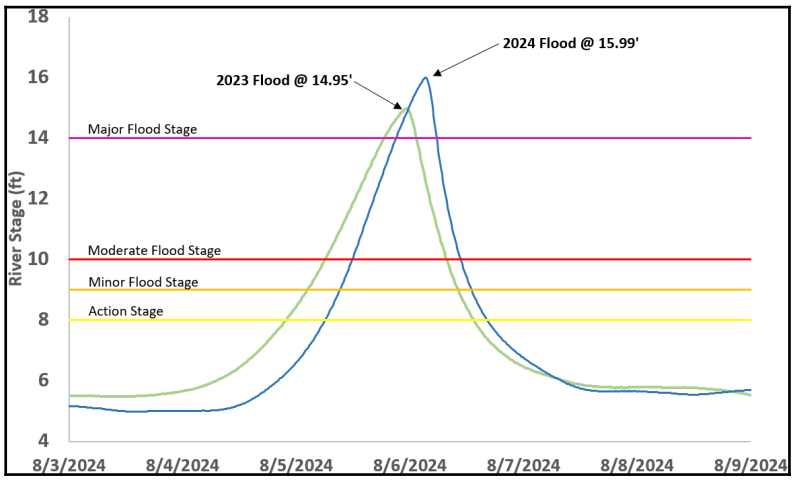
This year, the basin filled with water through August 1st and then began to flow over the side drainage channel and down towards the main valley. Thanks to a unique real-time monitoring station installed by the USGS that includes cameras and a laser water level sensor, changes in the basin water levels are detected early. On the

Jökulhlaups (an Icelandic word pronounced yo-KOOL-lahp) are glacial outburst floods. They occur when a lake fed by glacial meltwater breaches its dam and drains catastrophically. Glacier lake outburst floods, which occur when water dammed by a glacier suddenly releases and floods downstream areas, happen across Alaska and in glacial landscapes around the world.



***Images from the Alaska Climate Adaptation Science Center show the Mendenhall Glacier in 1893 (left) compared to 2018 (right). The K'óox Ḵaadí/Suicide[1] Glacier has retreated forming a basin in the side valley highlighted in red. This basin fills with water each year. Explore the history and formation of this glacial dammed lake: https://akcasc.org/2020/09/03/hidden-waters-view-the-suicide-basin-story-map/***

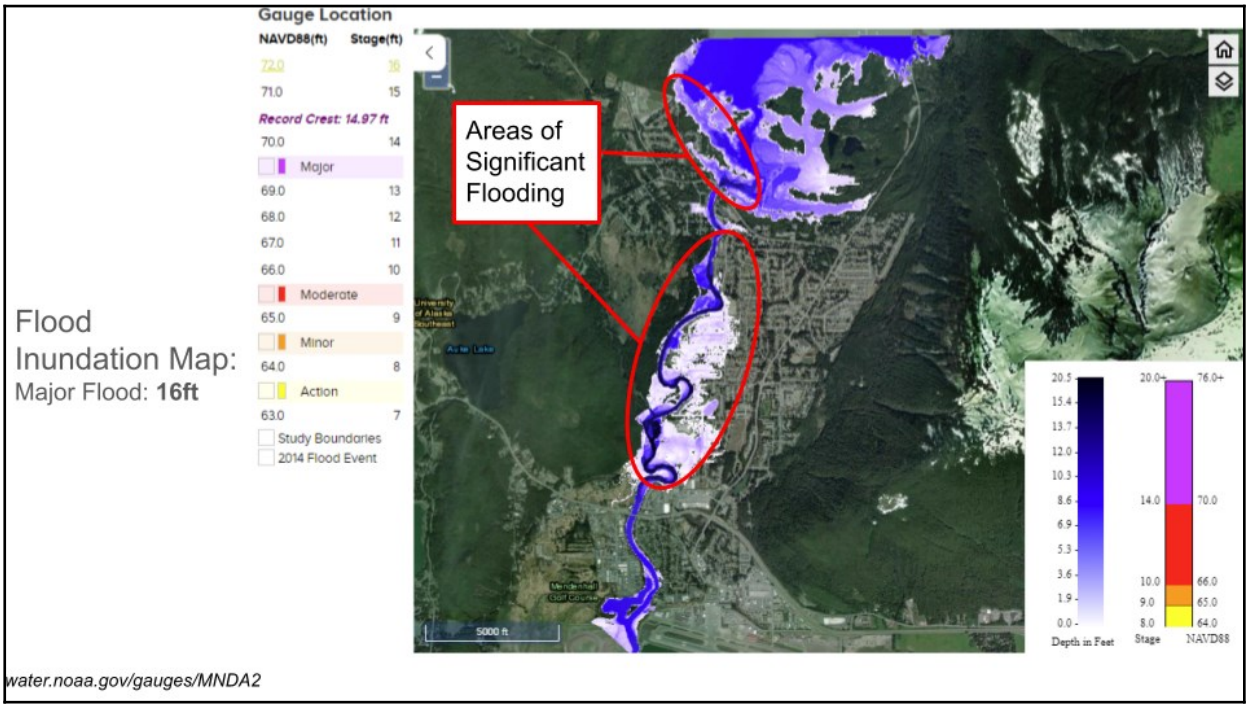
morning of Sunday, August 4th, water in the basin began dropping quickly as the drainage started sub glacially, and Mendenhall Lake slowly began to respond. The USGS Mendenhall River gage was reading approximately 5 FT before the event. Water levels rose rapidly over the next 2 days and crested at 15.99 ft early on August 6th. The Mendenhall River remained above flood stage for approximately 28 hours. The hydrographs for the 2023 and 2024 events are shown below. The 2024 event crested one day later in the year and approximately 1 foot higher on the river gage compared to 2023.




***Hydrograph of the Mendenhall River showing the 2023 and 2024 flood events. The river crested approximately one foot higher and one day later in 2024. Data Source: USGS - Mendenhall R NR Auke Bay AK - 15052500***

***Multiple areas experienced major flooding, affecting approximately 290 homes, some of which were inundated with 4 to 6 feet of water.(Photo Credit - Alaska Senator Lisa Murkowski, via Facebook)***

[1]The geographic name Suicide Basin has been officially proposed for renaming to K'óox Ḵaadí Basin, which means Marten's Slide Basin in the Tlingit Language – referring to the animal in the weasel family.




***A map of Mendenhall Valley, overlaid with the 16-foot Flood Inundation Map developed in 2014, shows widespread flooding west of Riverside Drive, along View Drive, and around Mendenhall Lake where Forest Service infrastructure is impacted.***

The Mendenhall Valley experienced widespread flooding, impacting nearly 300 homes. One tool used during the event to identify potentially impacted areas was flood inundation maps, which were developed in 2015 after a large glacial outburst flood in 2014. The mapping library included scenarios up to a gage reading of 16 feet. The NWS is working with the City, Borough of Juneau, and other partner agencies to update the flood inundation maps using the best available data.

## 2024 Breakup Summary

*By Kyle van Peursem and Michelle McAuley*

Following one of the worst breakup seasons in recent memory, APRFC hydrologists, state Emergency Managers, and community leaders prepared for another potentially impactful season in the spring of 2024. While seasonal indicators—such as snowpack, ice thickness, and temperature patterns—suggested a less severe breakup than observed in 2023, significant concerns remained. Above-average snowpack across the West Coast and the Porcupine River basin, coupled with a below-average spring temperature outlook for the western half of the state, kept forecasters vigilant. As a result, an above-average flood potential was issued for communities along the lower Kuskokwim and Yukon Rivers, as well as the Porcupine River.

The Kuskokwim River Watch team activated on May 1st, beginning reconnaissance flights from Bethel upriver to Stony River. Breakup commenced at Stony River the following day and progressed steadily downstream without incident past Aniak, aided by normal to below-normal snowpack in the upper and middle Kuskokwim basin. However, conditions deteriorated below Aniak, where above-average snowpack and persistently cold spring temperatures delayed icemelt.

As the breakup front reached Kalskag, the first of several ice jams formed downstream, causing minor flooding in the community. Over the next few days, the breakup front advanced

downstream, repeatedly jamming against stronger ice, flooding Tuluksak, Akiak, and Kwethluk.

The situation worsened downstream of Bethel, where the breakup front stalled, causing some of the most significant flooding of the season. Water levels in Bethel rose to their highest since 1989, with the river gage at Brown's Slough crested at 11.46 feet. Low-lying areas, including Brown's Slough and Alligator Alley, were inundated.

Farther downstream, Napaskiak experienced widespread flooding that lasted several days. The flooding damaged boardwalks, flooded homes, and caused minor oil spills. Oscarville and Napakiak also experienced minor flooding, though the impacts were less severe.

***Flooding in Napaskiak along the Kuskokwim River on May 9th. Photo: Kyle Van Peursem***

By May 12, water levels receded as the breakup front moved past the Johnson River and toward the river's mouth. In total, eight communities on the Kuskokwim experienced flooding during the 2024 breakup season, with moderate impacts reported in four of them.

The Yukon Riverwatch team mobilized on April 30 to Eagle, AK, with ice jams in place upriver. The breakup front advanced without incident downriver from the Canadian border over the next several days. Meanwhile, an ice jam on the Tanana downriver from Manley Hot Springs caused minor flooding on May 1. The Yukon breakup front stalled for several days when an ice jam developed 12 miles above Circle; the jam eventually released May 12, and the Yukon at Circle broke up with little impact. The River Watch team proceeded over to Galena to monitor breakup at Bishop Rock, a usual choke point. Breakup continued down the middle and lower Yukon throughout the week. An ice jam formed between Pilot Station and Pitkas Point on May 18, causing moderate flooding in the lower portion of Pilot Station. The ice jam released late the next day, and flood waters receded. The Yukon at Emmonak started to break up on May 23, a few days later than the historic median. Ice jammed just downstream of Emmonak, and low-lying areas quickly flooded, including the road to the airport. Alakanuk also reported flooding on May 24. The river began moving at Emmonak later that day, and water levels began to drop, giving way to the boating season.

***Flooding in Pilot Station along the Yukon River on May 19th. Photo: Rex Nick***

*We would like to thank the State of Alaska Emergency Operations Center as well as the many Tribes, local leaders, non-profits, and community members that are part of River Watch. Working together for community preparedness and response to breakup each spring.*

## Bill Carter: A Lifelong Commitment to Ice, Fish, and Community Safety

*By Mike Ottenweller*

Bill Carter's path to becoming a Science Program Manager for the Selawik National Wildlife Refuge in Kotzebue Alaska began in 1995 when he moved to the state to race sled dogs for a winter. A native of Florida, Bill quickly fell in love with Alaska and never left. His career began in fisheries as a technician counting salmon in 1997, and in 2014, he transitioned into a biologist role.

Bill's work with ice measurement began in 2015 after a conversation with NWS employees Crane Johnson (APRFC) and Ed Plumb (Alaska Region HQ). They suggested he help track ice conditions, which led him to start monitoring the Selawik River and a tundra lake near Kotzebue. His goal was simple: help local communities stay safe by providing accurate, timely ice reports. Bill shares these updates on the USFWS Selawik Facebook page, where locals can access crucial information about ice conditions during the winter and spring. Bill has been collecting and sharing ice thickness measurements around the first of the month throughout the winter. Starting in 2018, Bill has collected over 100 ice thickness measurements, which are available here: https://www.weather.gov/aprfc/icethickness.

***Bill Carter working in the field in northwest Alaska.***

As the only biologist at the Selawik Refuge, Bill has a wide range of responsibilities. While his primary focus is on whitefish biology, there are no salmon spawning populations in the Selawik River drainage. He is also involved in river discharge studies, permafrost monitoring, and harmful algal bloom research. Bill's work has also included studying the largest permafrost thaw slump in Alaska, which impacts the Selawik River.

In addition to his scientific work, Bill engages with local students through outreach programs. He teaches them about fish biology and conducts hands-on activities like otolith (ear bone) analysis, helping students understand the science behind the fish they catch. When I called Bill for this interview, he was actually in the middle of processing otoliths for aging. Bill is also involved in the Science and Culture Camp, where students travel up to 250 miles by snowmachine to engage in science-based learning.

Throughout his 27 years with USFWS, Bill has focused on one core mission: helping Alaskan communities stay safe and connected to the natural world. Whether tracking ice or educating the next generation of Alaskans, Bill's work continues to make a lasting impact on the region's people and environment.

The APRFC thanks Bill and all of our river and ice observers! We could not play this critical role in keeping Alaskans informed and safe without each of you! You can also research and submit river ice observations with our partners Fresh Eyes on Ice: https://freshEyesonice.org/

## Welcome, Heather Best
## Senior Service Hydrologist NWS Fairbanks

Heather has spent the last 21 years working as a hydrologist for the U.S. Geological Survey in Fairbanks, AK. During this tenure, she operated streamgages across the Arctic, worked with research groups attempting to quantify streamflow with remotely sensed data in Alaska as well as internationally, and is a subject matter expert at measuring streamflow with ADCPs in open water channels and under ice cover. Much of her recreational time is spent on rivers as well – in packrafts and other non-motorized watercraft in the summer, and on bikes and skis during the winter! Heather is excited to join the WFO Fairbanks team as the Senior Service Hydrologist and continue to work with communities throughout northern Alaska .

## Pacific Corner:
## 'Ua Net' - Contributing to NWS Decision Support in Real-time

*By Kevin Kodama*
*Honolulu Senior Service Hydrologist*

The NWS Honolulu forecast office (HFO) installed, and maintains a network of real-time rain gages across the Hawaiian islands. HFO's '*Ua Net' network of tipping bucket gages includes over* ***65 sites*** *across the State of Hawai'i. The network is managed by the forecast office hydrologist and maintained by NWS Pacific Region electronic technicians. Most of the gages are telemetered via geostationary satellite (GOES), with a smaller number transmitting data via VHF radio using the ALERT protocol. Redundant workstations provide forecasters with data alarms at four threshold levels. They are 0.25, 0.50, 0.75, and 1.00 in 15 minutes, translating to rain rates of 1, 2, 3, and 4 inches per hour.*


***Oahu 24-hour rainfall totals for December 10th, 2024. The Hawaii Ua net accounts for approximately 25 or 45% of the real-time rainfall reporting stations on Ohau.***

Real-time rainfall data can be helpful with the flash flood warning and flood advisory decision-making process and can provide some lead time for the warnings depending on where the event occurs. Typical flood advisory rain rates are in the range of 1 to 2 inches per hour. Rates of 3 to 4 inches per hour or more warrant consideration of a flash flood warning, especially if significant rainfall has recently occurred and the heavy rain is expected to continue for 30 minutes or more. In addition to providing forecasters with notifications of heavy rainfall, real-time gage data also serve as a ground truth verification data source for radar-based rainfall estimates and can help adjust biases in the radar-based estimates. The bias-adjusted estimates are the observational forcing for the National Water Model's Hawai'i domain.

The Hawai'i Ua Net is one of the unique NWS programs that support decision support services.

## Alaska PRISM Update 1990-2020: We need your data

PRISM is a set of monthly, yearly, and single-event gridded data products of mean temperature and precipitation and max/min temperatures, primarily for the United States. In-situ point measurements are ingested into the PRISM (Parameter elevation Regression on Independent Slopes Model) statistical mapping system. PRISM products use a weighted regression scheme to account for complex climate regimes associated with orography, rain shadows, temperature inversions, slope aspects, coastal proximity, and other factors. Climatologies (referred to as "normals") are available at 30-arcsec (800 meters), and monthly data are available at 2.5 arcmin (4 km) resolution.

The APRFC has collaborated with the USDA Forest Service Pacific Northwest Research Station and the Oregon State PRISM group to update the 14-year-old PRISM maps for Alaska (1980-2010). This project will update Alaska's current PRISM dataset, including annual and monthly average temperature and precipitation from 1990 through 2020. The spatial extent will be expanded to include all transboundary watersheds as well.

The project team is looking for temperature and precipitation datasets in Alaska. If you are aware of any unique datasets, please contact Kyle.Vanpeursem@noaa.gov.


***The shaded area of the maps shows the extent of the 1990-2020 PRISM update. This update will also include all transboundary watersheds.***

## NWS Alaska Streamgage Network and UAA AKFlow

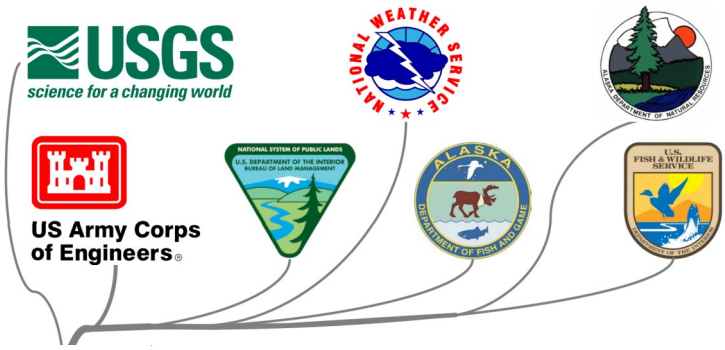
NWS Alaska and APRFC are unique within the National Weather Service and other River Forecast Centers in the CONUS, as they operate a network of streamgages. NWS Alaska uses these streamgages to supplement the real-time river level data collected by the USGS, Water Survey of Canada, and other federal, state, municipal, university, and private partners. The NWS Alaska-operated stream gages have historically been co-located in or near communities with elevated flood risks from freezeup or breakup ice jams, in regions with no other water level information, or where partner gages have been discontinued but a community of users has become accustomed to the data and forecasts.

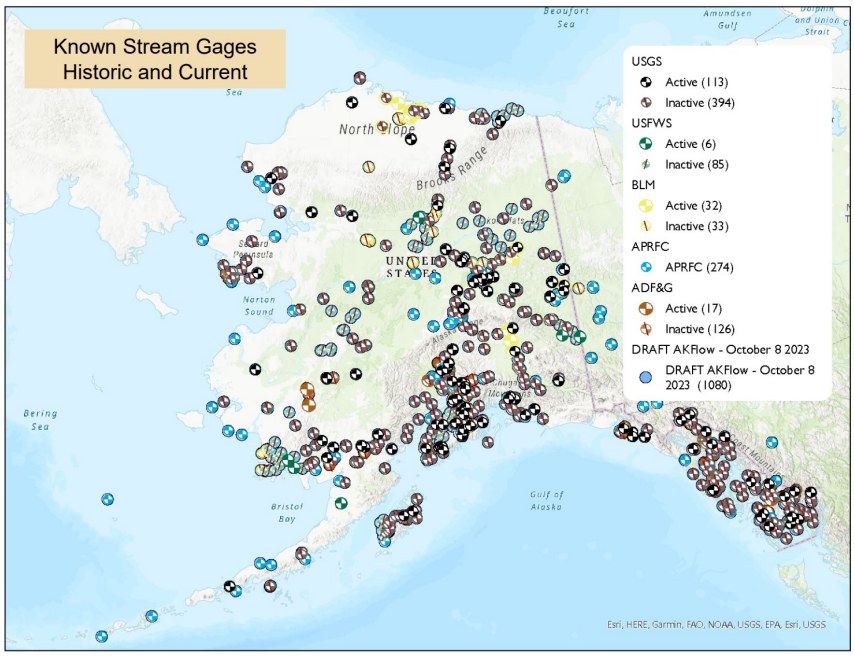
In March 2024, the National Water Prediction System (NWPS) refreshed the familiar Advanced Hydrologic Prediction System (AHPS). NWPS and the Weather Forecast Office Hydrologic Forecast System (WHFS) allow APRFC to serve telemetered real-time river data and provide a

centralized public platform to host and display river data for partners without a service of their own. We like to think of NWPS as a “one-stop shop” for real-time data, daily NWS river official deterministic and probabilistic forecasts, individual location flood categories and associated impacts, flood inundation maps, and other site-specific information. If you are telemetering river stage data and need a public place to display it, NWPS may be that place- get in touch with us at nws.ar.aprfc@noaa.gov!

In 2024, NWS Alaska operated 54 streamgages across the state: 8 in Southeast, 27 in Southcentral and Southwest, and 19 in the Interior, Northwest, and on the North Slope. 40 of the 54 gages are automated ultrasonic or radar sensors transmitting either by Iridium or GOES satellite or via data ingest. The other 14 gages are measured by community river observers, who manually measure the water level or a cross-section slope distance every day and call the values into NWS. These community partners are essential to NWS Alaska. The NWS Alaska gages do not meet the quality standards of USGS stream gages, but through annual APRFC visits for datum and stage-discharge rating validation provide what is required for community awareness and to produce accurate daily river forecasts.

While NWPS provides a suitable platform to host real-time stream gage data, it is not designed to support the deeper dive into the full network of available river data in Alaska. In 2024, the University of Alaska Anchorage’s (UAA) Alaska Center for Conservation Science (ACCS) released AKFlow - an interagency catalog web map inventory of Alaska’s streamgages. Through a cooperative effort between Interagency Hydrology Committee for Alaska (IHCA) members, ACCS compiled AKFlow with basic metadata pertaining to 1184 stream gages, including “gage location, status (active or inactive), dates of operation, contact information, and links to available online data where available,” and made this discoverable via an online web map application. Beyond metadata, the AKFlow inventory also includes “775 polygons representing the upstream drainages for 837 gage” locations. UAA ACCS encourages IHCA partners to use and provide feedback on AKFlow as it is further developed. For more information about AKFlow please contact UAA ACCS Geographer Marcus Geist (mageist@alaska.edu).



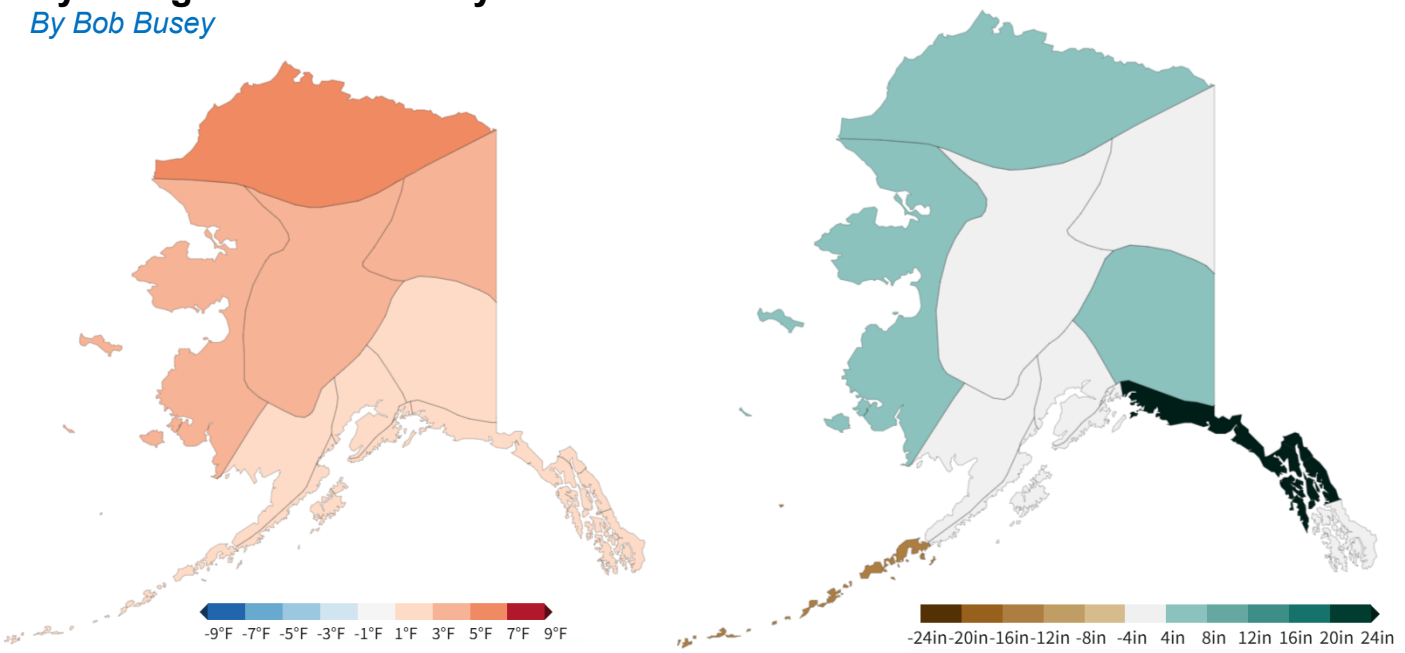




***The AKFlow online web map application highlighting the inventory of stream gages across Alaska. Visit the site: https://arcg.is/1Pv1Xy0***

Link to full Web Map

## Hydrologic Year Summary

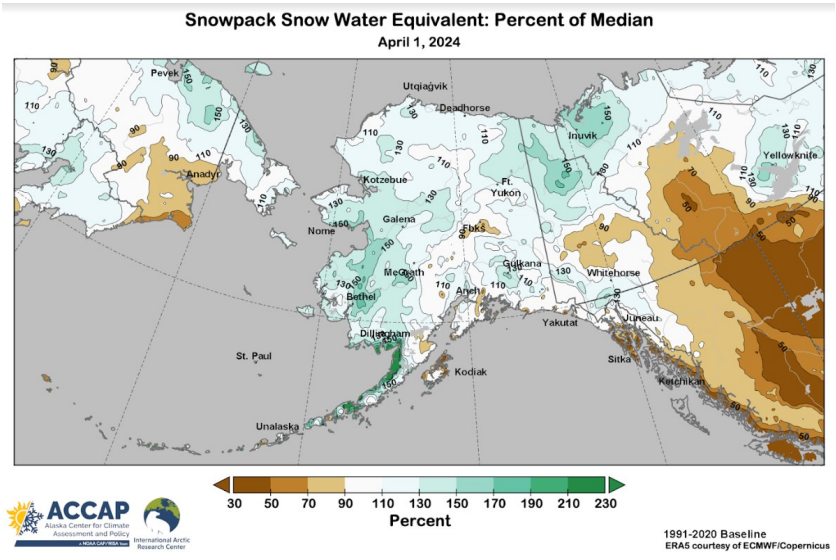
*By Bob Busey*




**Right: Alaska Divisional Precipitation Anomaly from October 2023-September 2024 Period: 1925-2024**
**Left: Alaska Divisional Temperature Anomaly from October 2023-September 2024 Period: 1925-2024**

NOAA National Centers for Environmental information, Climate at a Glance: Divisional Mapping. https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/divisional/mapping

The figures above show the annual temperature and precipitation anomalies for the state of Alaska. The excessive amount of precipitation in northern Southeast AK really stands out, receiving 27 inches over the long term mean (14th wettest all time). The north slope accumulated a bit over 16 inches of precipitation for the entire year (2nd wettest year on record). In contrast, for a second year in a row the Aleutians islands were drier than average. In 2024 there was quite a bit of variability compared to the long term mean depending where you are living in the state. Southeast Alaska was notable for the lack of snowfall throughout the archipelago. The exception to this was the Porcupine River basin. It originates in Canada and enters the Yukon at Ft Yukon. The darker green to the east of Ft Yukon highlights this basin. The Yukon-Kuskokwim delta received quite a bit of snow from several later winter storms. Estimates of snow water equivalent (SWE) from the Natural Resources Conservation Service (link), who rely mainly on measured snow observations across the state, complement the European Center for Medium-Range Weather Forecasts ERA-5 reanalysis (which incorporates quite a bit more computer modeling to estimate snow water equivalent).




***Snow Water Equivalent percent of normal for April 1st 2024 from the ERA5 Reanalysis 1991-2020. Courtesy of the Alaska Center for Climate Assessment and Policy (https://uaf-accap.org)***