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

Kuigmek: one who watches the river

November 2020

Please Note:

Observers, don't forget to send in your Freeze-up Forms! These can now be completed on the web at https://www.weather.gov/aprfc/freezeForm, or let us know if you need a paper copy. Also note that the web form can be submitted multiple times if you want to submit the timing of 'unsafe', 'freeze-up', and other events separately.

In This Issue:

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A Renewed Push for Freeze-up Forms and Photos

The APRFC is trying to improve our information about freeze-up timing and early season ice conditions for the purposes of extending our climate record, providing guidance to barge and boat traffic, and helping local emergency managers keep people safe. This year we are collaborating with a group from the University of Alaska Fairbanks (UAF) on a project called Fresh Eyes on Ice. Links to our freeze-up form can be found in the left sidebar. More about the UAF project can be found at fresheyesonice.org. Anyone can share photos and freeze-up information via the form or email; you do not need to be a formal observer.

Focus on: Skilak Glacially Dammed Lake

The topic of glacially dammed lakes (GDLs) appears in so many of our newsletters because they can cause impactful flooding in populated areas like Juneau's Mendenhall Valley and communities along the Kenai River, while remaining difficult to see and understand. Skilak GDL, in the Harding Ice Field, is a good example, sitting far up on a margin of the Skilak Glacier, where it meets another unnamed glacier, about 3000 feet above sea level. This GDL sits next to a subglacial lake, which also drains, and at the terminus of the glacier is now a proglacial lake. That lake drains into the Skilak River, and into Skilak Lake, which drains into the Kenai River.

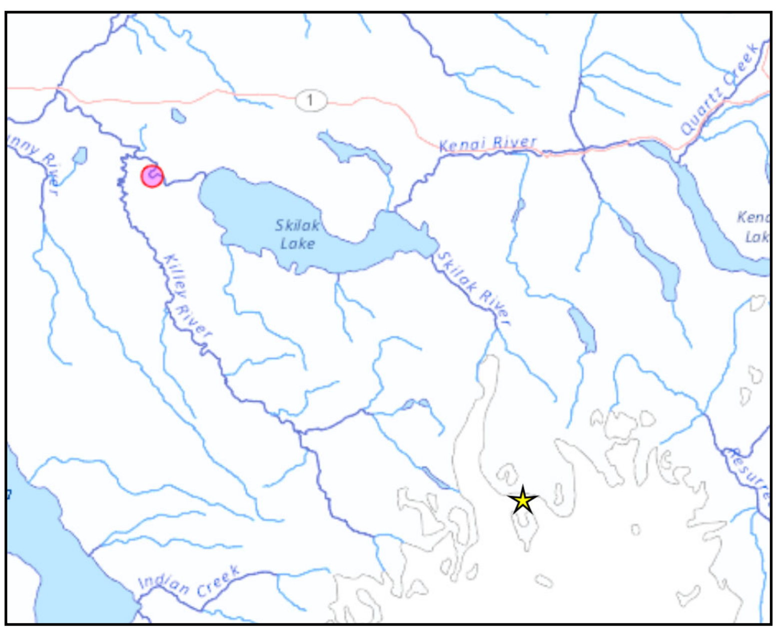

Figure 1: Map showing location of Skilak GDL (yellow star) relative to Skilak River, Skilak Lake, and the Kenai River where gage is located (magenta circle).

(Focus on Skilak GDL continued)

The APRFC's records on Skilak GDL outbursts go back to 1969, when a January event caused significant ice jam flooding on the Kenai River. We took some time this month to do a deep dive on existing research, imagery, and data on the glacier system and learned some interesting facts. Fundamentally, we want to know if the system will continue responding as it has over the period of record, or how it is changing.

The Skilak GDL has certainly been impacted by glacier changes over the period of record, especially retreat and upglacial thinning, but how that has and will impact the frequency and magnitude of outbursts is still inconclusive. Since we started partnering with the Civil Air Patrol to collect photos in 2008, average lake levels seem lower, with some anecdotal satellite evidence of smaller volumes of water in Skilak GDL, even though there is no statistically significant downward trend in outburst volumes, once they reach the nearest gage on the Kenai River.

The Skilak GDL tends to release every two years, but in the instances when it has been a longer interval, followed by a winter-time outburst, these have been more impactful. It seems logical that volume released would be tied to the number of days since last release, but with so few observations, this statistical relationship is not strong. We can tell from historic photos that sometime between 1962 or earlier to 1986, the Skilak GDL went from being well within the accumulation zone of the glacier, to significantly below it. From satellite imagery and measurements, we can also surmise that sub-glacial water storage and routing has probably changed over that period, but *how* is yet to be revealed.

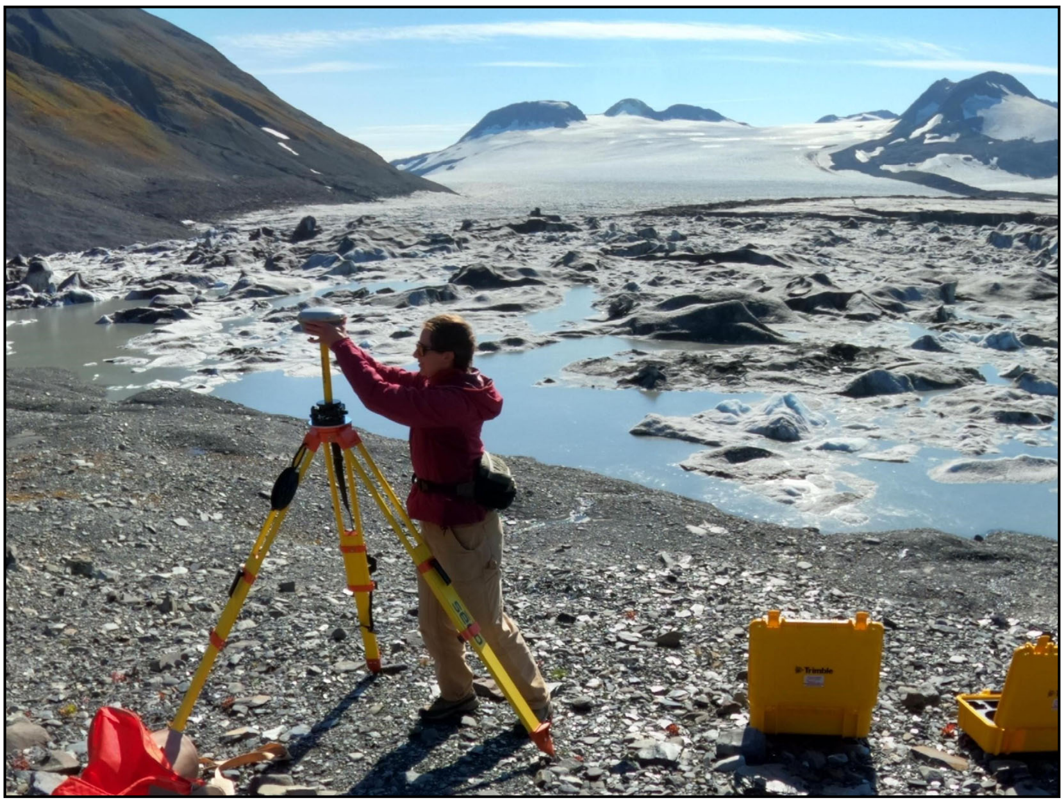

Figure 2: Senior Service Hydrologist Celine Van Breukelen sets up a GPS base station to take measurements of new reference markers for aerial photos collected by the Civil Air Patrol.

In September, meteorologist Kyle Van Peursem and service hydrologist Celine Van Breukelen traveled via helicopter to the Skilak GDL to paint some new lake level reference markers for the Civil Air Patrol. Recent lake levels have been low enough that historic markers have been too high to use for volume estimates. However, what if the GDL was no longer the major holding tank for water that it once was? What if subsurface storage was a bigger contributor to outburst floods? For information about what is happening under the glacier, we may need to turn to new tools and develop new predictive capacity with our research partners. Stay tuned!

Changes to the APRFC Staff

This spring, two new staff members joined our group at the Alaska-Pacific River Forecast Center and Rebecca Leighton (formerly Perry) has sailed off into a pleasant retirement with her partner Hugh. We still get phone calls asking for Becky and her long-term knowledge is already missed.

Michelle McAuley, our new Hydrometeorological Analysis and Support forecaster, moved across the hall from the Anchorage Weather Forecast Office. Before coming to Alaska in 2018, Michelle spent five years forecasting in Medford, Oregon. The focus there was fire weather, and she got an intense introduction to forecasting in rugged terrain with limited observations. Eager to spend more time forecasting snow and less time issuing heat advisories, she migrated north with her husband and dog and hasn't looked back! In her free time, Michelle enjoys hiking, cross-country skiing poorly, making the occasional snowman and spending time in the Alaska wilderness. She is also an impressive baker of bagels and other breads, which makes working from home that much harder for the rest of the APRFC.

Figure 4: Michelle McAuley

Johnse Ostman, our new Hydrologist, comes to the APRFC from the USGS Alaska Science Center Water, Ice, and Landscape Dynamics group where he was a Hydrological Technician in the Anchorage Field Office for 11 years. Most recently, Johnse served as liaison to the USGS Benchmark Glacier program Icefield-to-Ocean surface water biogeochemistry research on Wolverine Creek, the Alaska Energy Authority Bradley Hydroelectric project, and the University of Alaska-Alaska Native Science and Engineering Program. Extracurricular to USGS work, Johnse began M.Sc. graduate studies in 2013 at Alaska Pacific University. His nearly complete research focuses on presenting a 10-year seasonal continuous discharge and intra-basin meteorological time-series in the upper Eklutna River watershed, and quantifying glacier runoff and melt-season water balance within neighboring headwater basins using the distributed hydrological model WaSiM. Prior to relocating to Anchorage from Juneau in 2009, Johnse worked as a contract hydrologist with a local ecology group modeling watershed interactions and maintaining water quality permit requirements. Johnse received his B.S. in Environmental Science with an emphasis in hydrology from the University of Alaska Southeast in 2003. Johnse grew up on the East coast and attended Kutztown University in Pennsylvania until 1991 when he moved to coastal Southeast Alaska where he fished commercially and plied the art of wooden boats for the next twenty years. Johnse spends whatever time is left running through the mountains, with his family, and playing old-time music.

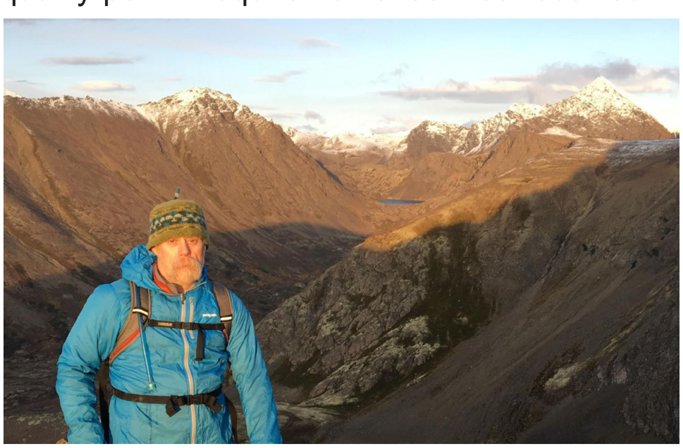

Figure 5: Johnse Ostman

Changes to Operations During COVID-19

Like for most of our readers, the work life of the staff at the APRFC has changed since the start of the COVID-19 pandemic. Normally, we perform the forecast duties as a rotating, two-person team in a crowded space with an open floor plan, while other staff provide support and development from their personal cubicles. To reduce the number of people in the building, no more than two APRFC staff are in the office at any time now and most duties can be done from home. The Riverwatch campaign did deploy this spring, due to the heightened flood risks, but we also depended heavily on phone calls from communities and pictures from pilots, to minimize any potential exposure between our Riverwatch travelers and community members. We are trying to provide the same level of service to the public and our core partners, despite the challenges, and we hope all of our community members are staying safe and healthy during this difficult time.

Water Year Summary

What we and other agencies call the Water Year runs from Oct 1-Sept 30. Here we provide a brief summary of this year's climate and hydrologic events. For the fall period (October 2019-December 2019), much of the state was a couple of degrees Fahrenheit above normal in terms of average air temperatures. Southcentral, Southwest and the central Interior had above normal precipitation while the northern Panhandle saw ongoing dry conditions consistent with drought. By the end of December snowpacks in the Interior were already above normal, while snowpacks on the Kenai, Copper River, and headwaters of the Yukon were below normal. Winter (defined here as January-March) was colder than normal and the coldest winter Alaska's experienced in a long time. The Interior, in particular, was as much as 5 degrees colder than normal. Winter precipitation was normal throughout much of the state, but dry in Southcentral. The southern-most area of the Southeast Panhandle started to see some above average precipitation, helping alleviate the drought there.

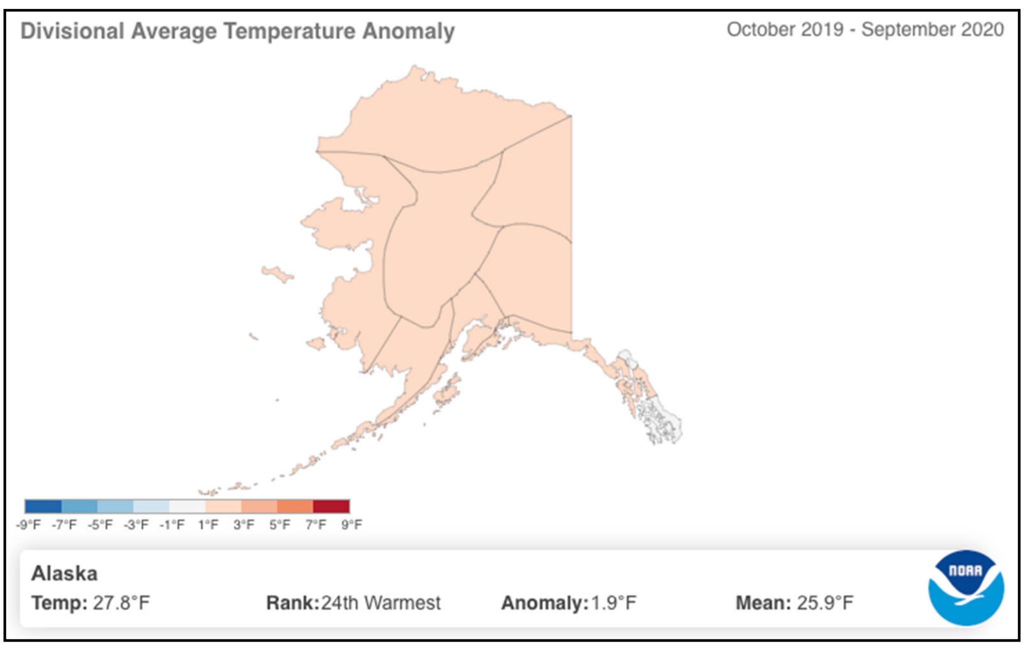

Figure 5: Water Year 2020 Average Air Temperature anomalies.

Spring (April-June) saw above average temperatures, especially in western Alaska, and generally normal precipitation. The eastern Interior saw some above normal precipitation. The fact that snow surveys around April 1 showed significantly above normal snowpacks throughout the Interior reminds us that precipitation estimates from gages during the cold season have systematic errors. Summer (July-September) saw most of the state average air

(Water Year Summary continued)

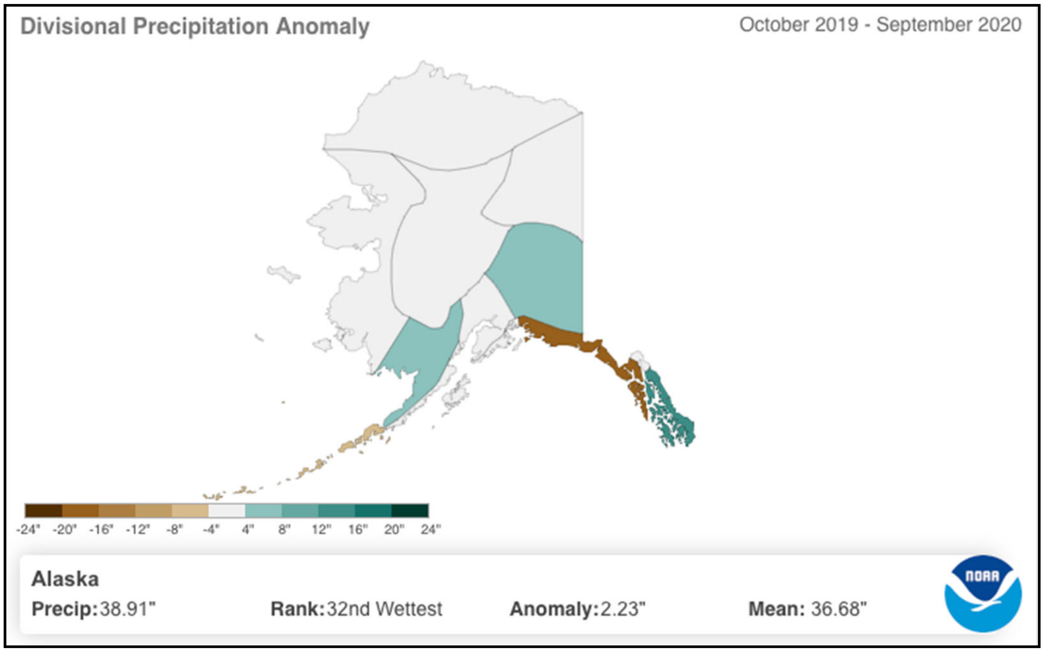

Figure 6: Precipitation anomalies for water year 2020.

just slightly above normal and precipitation normal, except on the western coast, which was dry and the Panhandle, which was split between dry (northern) and wet (southern). These seasonal averages do cover up what happened on a month by month basis. The 12-month averages cover up these individual events further, but give a general overview of the climate that drove hydrology over the past year. Virtually the entire state was 1-3 degrees Fahrenheit above normal and the eastern Interior (including the Fairbanks area), and the southern Southeast Panhandle had a wet year. At the end of summer, river gages were reflecting the temperature and precipitation trends with values above normal in parts of the Interior and southern Southeast Panhandle.

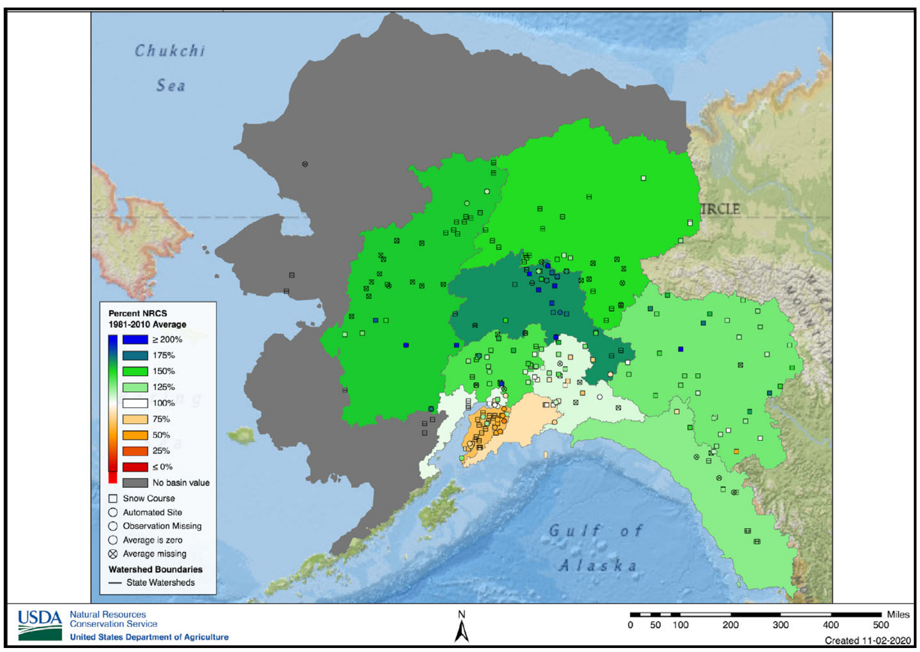

Figure 7: Snowpack conditions at the end of March, 2020.

Specific notable events were that by early August, Juneau was already close to its wettest summer on record, for some much needed drought relief. In the Interior, some of the rain events were especially heavy, including a historic record rain event at the start of August in the far western part of Denali National Park.

Explanation - Percentile classes						
● (red)	● (dark red)	● (orange)	● (green)	● (cyan)	● (blue)	● (black)
Low	<10 Much below normal	10-24 Below normal	25-75 Normal	76-90 Above normal	>90 Much above normal	High

Figure 8: Hydrologic conditions at the end of September, 2020.

New Estimates of Precipitation

One of the biggest sources of error in our forecasting process is estimating precipitation. Our gages are sparse and the ones we do have are prone to physical and mechanical problems. This year we began experimenting with a product called the Multi-Radar Multi-Sensor (MRMS) precipitation estimate, which has recently been extended to cover Alaska. MRMS blends information from our five weather radars with gage data and the High Resolution Rapid Refresh weather model. In this case the model is helping us estimate how much rain or snow already fell, not forecasting. For now, we are watching how the MRMS product does, relative to just gage data, in a variety of cases. Of course, unlike in the lower 48, we also have large gaps in radar coverage, but over time we should get a good sense of how and when to use this product in our river forecasting.

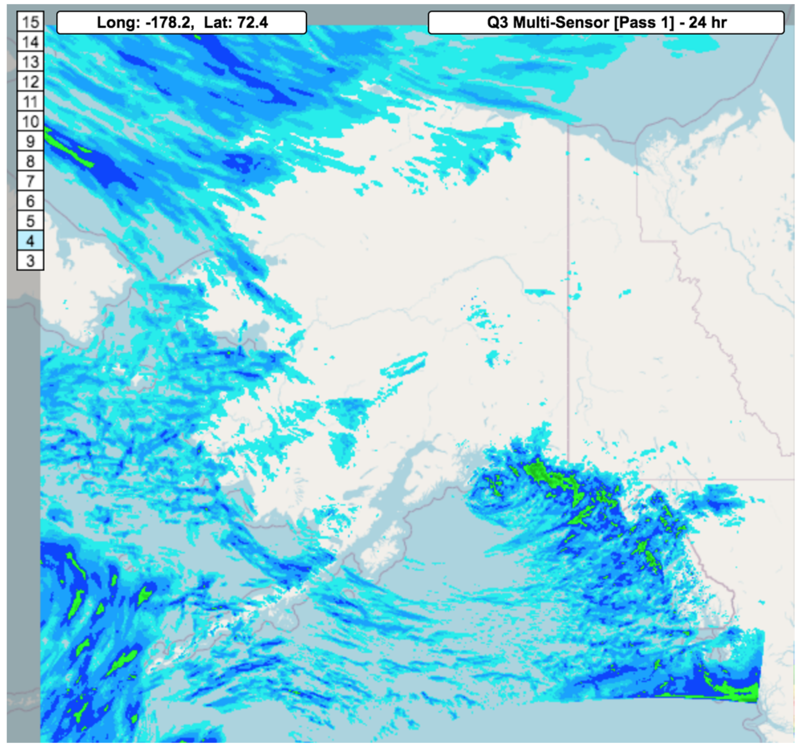

Figure 9: Sample 24-hr precipitation totals from new MRMS product.

Traveling igage

This year we tried something new. Typically, our gage network is most valuable for forecasting when the instrument has been in place for a few years, and a number of field measurements have been made that relate the stage and discharge reliably, in high flow, moderate, and low flow conditions. However, our office and the Weather Forecast Offices saw the need for a temporary gage that just measures water height in a flooded area, so we have a better sense of when water conditions change. The ultrasonic igage developed by Crane Johnson, currently our acting Hydrologist-in-Charge, is a perfect tool for this task, because of its small, self-contained form factor. This summer minor flooding occurred in the Rosie Creek Subdivision in Fairbanks, as well as in Salcha, and the temporary igage deployment proved to be a valuable source of information about changes in inundation. We anticipate more usage of this tool in the future. Also, congratulations to Crane for receiving NOAA's 2020 Technology Transfer Award for this igage.

Figure 10: Fairbanks WFO Electronics Technician Keith Flewellen standing next to a temporary igage deployed to a flooded area on the Delta River. The igage measures distance to the water and transmits the data via Iridium satellite. A small solar panel and battery make the system self contained.

Flood Level Changes

On our website, we depict action and minor and major flood levels at many of our forecast points across Alaska, based on historic documentation of impacts at specific flow rates and water stages. Where no flood levels are indicated, we typically don't have enough information about historic events to do so. At some sites, there is a need to change the defined flood levels from time to time. Establishing new flood levels and redefining flood levels is one of the duties of our Senior Service Hydrologists (SSHs). These staff members have a background and knowledge base in hydrology, but are part of the Weather Forecast Offices in Fairbanks, Juneau, and Anchorage. This autumn, Anchorage SSH, Celine Van Breukelen, worked with APRFC staff members to adjust the flood level definitions at Talkeetna, where erosion and channel shifting have impacted the gage measurements, and Eagle River, where bridge construction has impacted measurements. Now flood levels should be set to where water heights meet standard definitions of position and impacts, with respect to the river banks, yards, and on nearby structures. This should reduce confusion as to why a gage indicating 'minor flood' was actually still well within-bank.

Drone program

Another new tool here at the APRFC are Uncrewed Aerial Systems (UAS). In 2019, we won a NOAA grant to design and operate a UAS project for three years. We went ahead and purchased four aircraft and completed training in 2020. A number of staff have earned their Federal Aviation Administration Part 107 UAS Pilot's licenses, which allows them to fly the UAS for NWS. We've done a few data collections so far and are learning more about how to pull mapping data into our workflow to improve our forecasting.

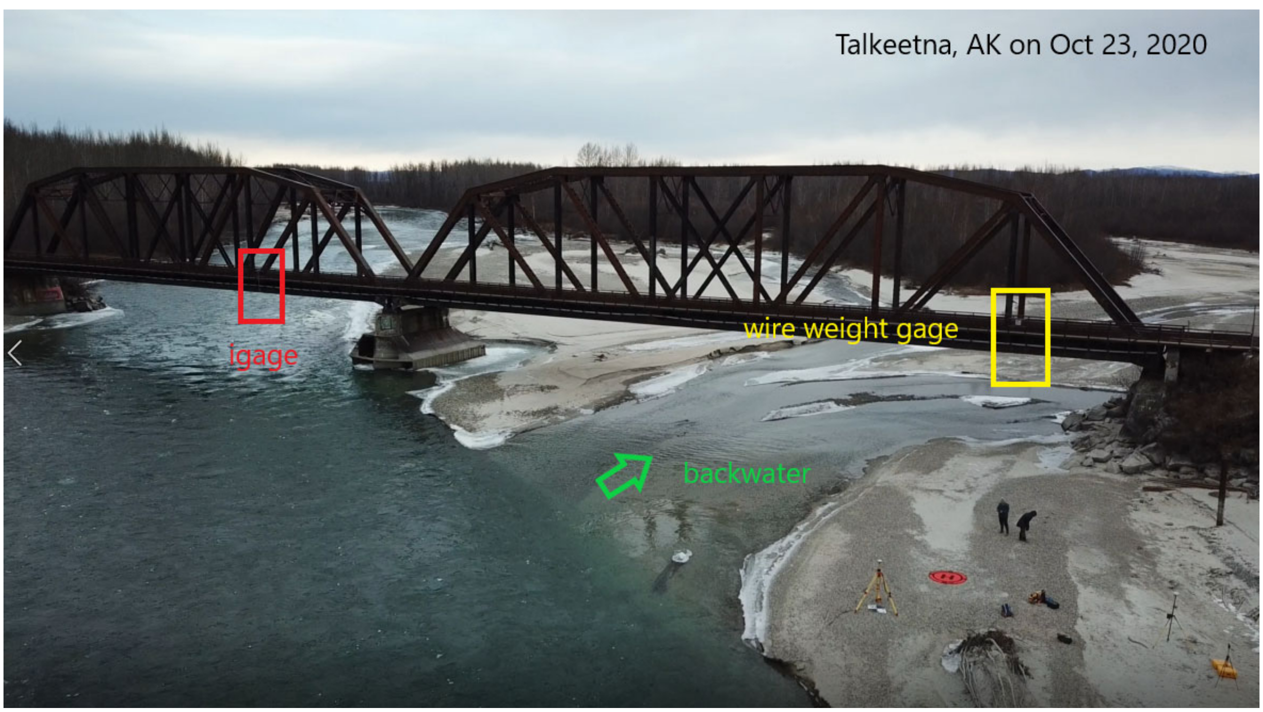

Figure 11: shows a photo from an APRFC UAS mission at the railroad bridge at Talkeenta, where flood levels have also recently been adjusted. Historic measurements took place at the wire weight gage, which has been impacted by sediment buildup. This photo was taken during the extreme low flow conditions of late October.

Pacific Sector

We never forget about our responsibilities in Hawaii, though the environment could not be more different. Because Hawaii does have reasonable radar coverage (relative to Alaska), the same new precipitation product mentioned above, MRMS, is proving useful for estimating precipitation in Hawaii, and driving the experimental National Water Model implementation there. Our Development and Operations Hydrologist, Dave Streubel, has helped oversee the effort of running MRMS for Hawaii for hydrologic awareness, including the newest version (v12), that includes gage precipitation, along with radar, and weather model output. We look forward to continuing hydrologic support for the Hawaii region. The closing image here shows that even Hawaii is no stranger to snow, at its highest elevations. Aloha!

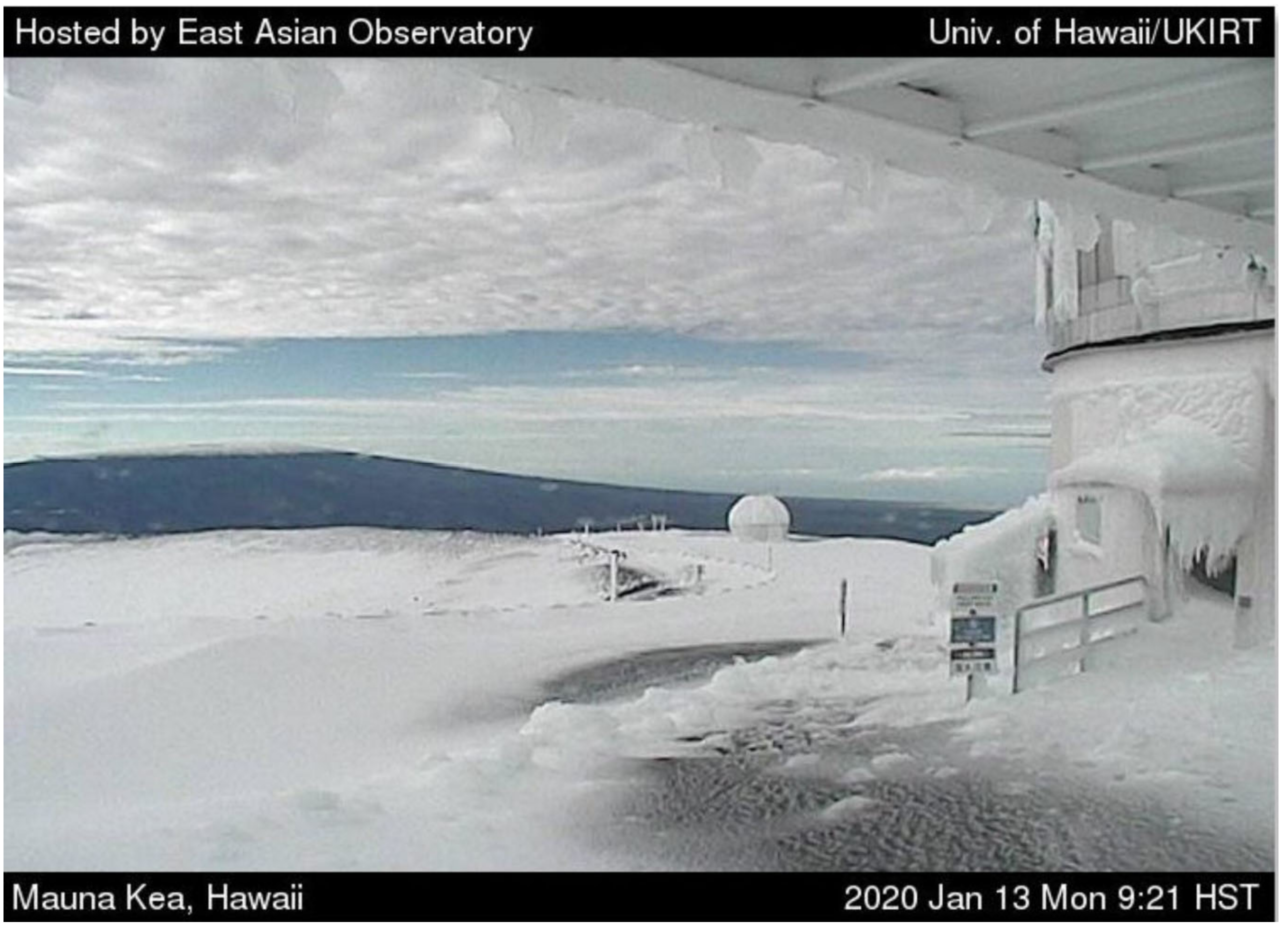

Figure 12: shows a photo from a webcam atop Mauna Kea on Hawaii's Big Island. Precipitation and cool temperatures in winter can deposit significant snowfalls at Hawaii's highest elevations, where permafrost also exists. Maybe Hawaii and Alaska are not so different after all.

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