Kuigmek

One who watches river

October 2011

A newsletter for Alaska river and ice observers

Please Note. . . .

Observers...
Don't forget to send in your Freeze-up Forms.

Inside This Issue…

Mendenhall Valley Jökulhlaup Flood Event

Hurricane Irene Service Assessment

Welcome New Observers

Observer Milestones

What's Happening on the Kandik River?

Start of Ice Thickness Measurements

Susitna Hydroelectric Project

2011 Breakup Summary

High Water Mark Signs Commemorate Record Flooding

Spring Flooding on the Porcupine River

End of 2011 Open Water Season

Forecast Verification at the APRFC

Welcome Dave Snider Our New TV Meteorologist

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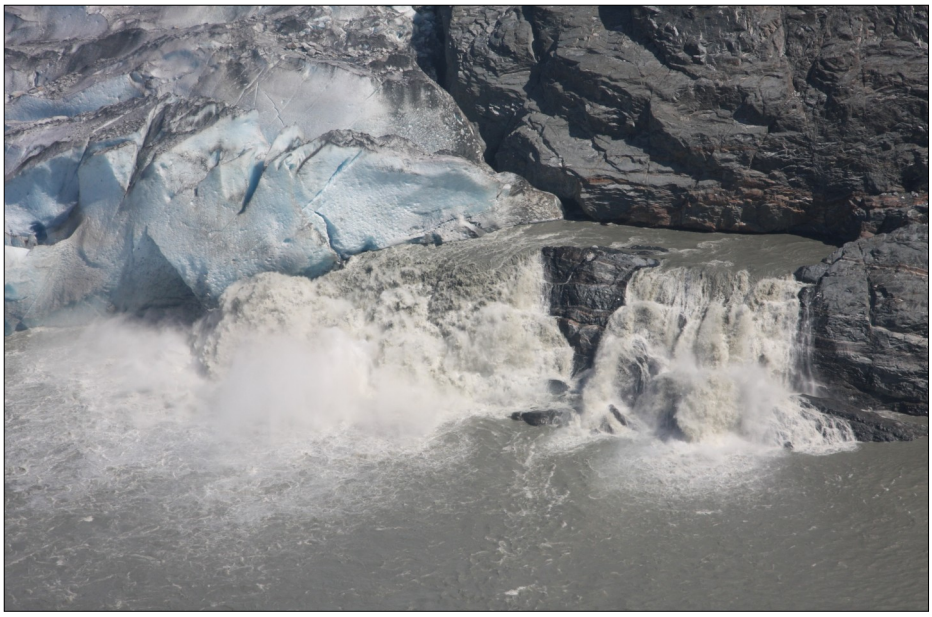
Mendenhall Valley Jökulhlaup Flood Event
by Aaron Jacobs

The Mendenhall Valley near Juneau experienced an unusual hydrologic event, a Jökulhlaup occurred on July 19-21. Jökulhlaup is an Icelandic term for a sub-glacial release that occurs when water dammed under a glacier empties. Exactly what causes these glacial dammed lakes (GDLs) to empty is unknown, but current thinking is that pressure from the impounded water lifts the glacier, allowing the water to flow underneath the glacier and carve a tunnel to the terminus. Once the GDL fully empties, the access to the drainage tunnel closes and the lake begins to refill. A glacier may have several GDLs of different sizes.



Flood waters flow underneath the Mendenhall Glacier. The flat rock the water is flowing over is approximately 75 feet wide.

The Juneau area is familiar with glacier lake outburst floods (GLOF). Every year the Taku River, 5 miles south of downtown Juneau, experiences a GLOF from Lake No Lake on the Tulsequah Glacier in Canada. There had not been a GLOF of significant magnitude on the Mendenhall system during the period of our records, although there was a small glacial outburst event in the summer of 2007.

On Tuesday, July 19, Mendenhall Lake and River began a steady rise of about 1-2 inches per hour, which continued for 2 days. ***cont'd on Page 4...***

Our last weekend staffing is scheduled to be 10/29 - 10/30. For those of you continuing to take measurements in November or beyond, please hold your weekend measurements and give them to us on Mondays.

Hurricane Irene
Service Assessment
by Scott Lindsey

Bridge destroyed on Hwy 100
near Rochester, Vermont

Following a significant weather event that results in a substantial amount of damage and loss of life, the National Weather Service (NWS) puts a team together to examine how well we served our customers and partners. Hurricane Irene affected the eastern US from Puerto Rico to Maine, causing billions of dollars of damage and the loss of over 40 lives. I was asked to serve on the assessment team determining how well we forecast the event and how well we warned residents in the affected area of the seriousness of what they would face.

Hurricane Irene was never stronger than a Category 2 hurricane. By the time it reached New England, the wind speeds had dropped below the 75 mph threshold that defines a hurricane, and Irene became a Tropical Storm. Nevertheless, residents of Vermont and upstate New York will remember Irene for generations.

Between 4 and 7 inches of rain fell within a few hours on August 27th and 28th in these areas, causing flash flooding as very small streams became raging rivers that took roads, bridges and homes downstream in many communities. Because the National Weather Service Office in Burlington, Vermont had highlighted the very dangerous nature of this storm, the governor of Vermont declared a state of emergency on Saturday, August 27 (which was a nice, sunny day), leading people to stay home and prepare on Sunday. This likely saved many lives, as only a couple of fatalities occurred during the event (compared to the previous flood of record in 1927, when hundreds of people died). Although this was a very damaging and costly storm, the accuracy of the forecasts and the efforts of the NWS forecasters no doubt saved lives, and the local authorities had nothing but praise for their efforts. The final report on this event will be published sometime in early 2012. This report, along with service assessments from other weather disasters, can be found at:

http://www.weather.gov/os/assessments/index.shtml

Route 4 near Rutland, Vermont

Route 131 near
Cavendish, Vermont

(Photos courtesy of: Lars Gange & Mansfield Heliflight)

Welcome New Observers

Nicholas Lloyd
Little Susitna River at Parks Highway
June 2011

David MacMillan
Walker Fork of the Fortymile River
June 2011

Mark and Lori Richards
Kandik River
July 2011

Ron Stickman
Yukon River at Nulato
August 2011

Jonathon Happ
South Fork of the Fortymile River
August 2011

Welcome Back…

Rich Thorne
Koyukuk River at Bettles
April 2011

The Alaska-Pacific River Forecast Center staff thanks you all for your river and weather observations this season, and looks forward to working with you again next year.

Observer Milestones

The following observers have provided water level readings at their location for:

Five Years

Eran Hood
Auke Lake near Auke Bay

Robin Hammond
Mosquito Fork of the Fortymile River

Clay Koplin
Eyak River at Cordova

Brad Sipperley instructs Mark and Lori Richards how to read the rain gage.

What's Happening on the Kandik River?
by Ed Plumb

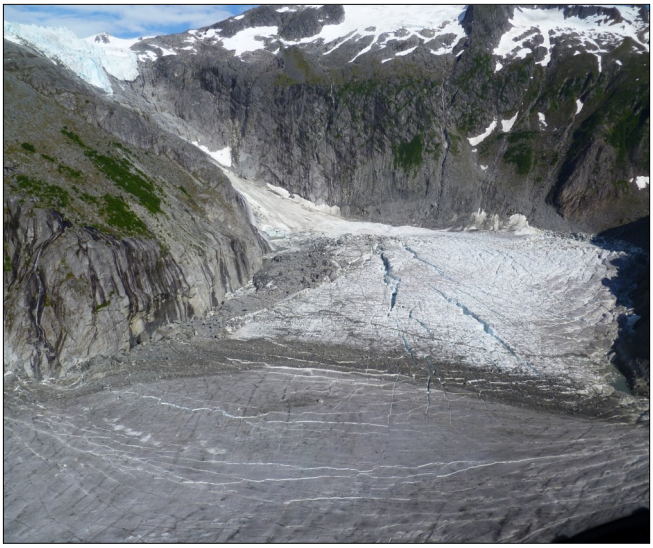
Most people in Alaska have likely never heard of the Kandik River. This remote tributary of the Yukon River originates in the Ogilvie Mountains in the Yukon Territory and flows southwestward into Alaska. The Kandik is a clear-water river that is fed by spring snowmelt and summer rainfall and empties into the Yukon River between Eagle and Circle City.

So what's happening on the Kandik River? Staff from the National Weather Service (NWS) in Fairbanks visited the scenic outpost of Mark and Lori Richards on the Kandik about 50 miles upriver from its confluence with the Yukon River. The Richards are one the newest river and cooperative weather observers in Alaska. Their small cabin on the banks of the Kandik is the epitome of isolation. It can only be accessed by a small bush plane when the river level is low enough to expose a nearby gravel bar or during the winter when skis can be used to land on the river. Motor boat access is limited to periods of high water. The other alternative is to drop a canoe loaded with gear into the Yukon River at Eagle and float more than 70 miles down to the Kandik and then spend another week painstakingly lining (or dragging) the canoe up river to the place they call home.

The Richards arrived at what they call "Beaver Bend" on the Kandik River in 1981 after being inspired to relocate to the area after reading John MacPhee's 1976 book "Coming into the Country." Since then, they have raised a family, trapped and fished the country, run dogs, and survived off the land. In addition to the routine tasks of survival, Mark and Lori are now providing daily river readings during the summer and year-round temperature, rainfall, and snowfall data to the NWS. We are excited to have the Kandik River on the map because this will provide river and weather data for a very remote, data-sparse region of the state.

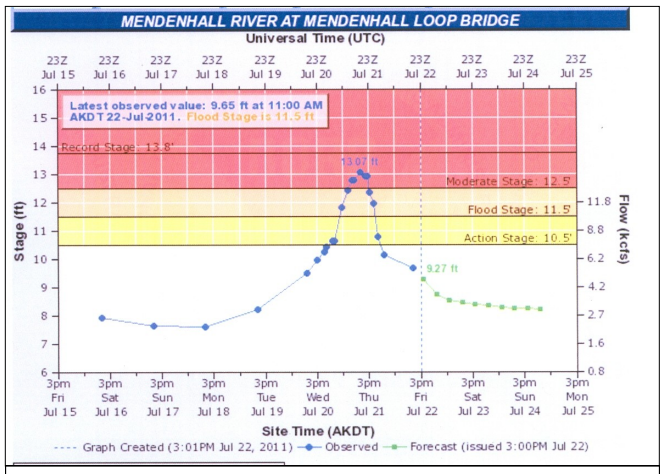
cont'd from Page 1…

There had been some rain a few days earlier, so initially there was not much concern. By mid-day Wednesday the National Weather Service (NWS) in Juneau was confident that the rising waters were due to a GDL release, but because the only historical release on the Mendenhall River was the minor event in 2007, it was thought that this release would also be minor. The water continued to rise, and by Wednesday evening the Lake and River level had exceeded minor flood stage, and the NWS in Juneau issued a Flood Advisory. Water levels continued to rise through the night, and early Thursday morning a Flood Warning was issued for the Mendenhall Valley.

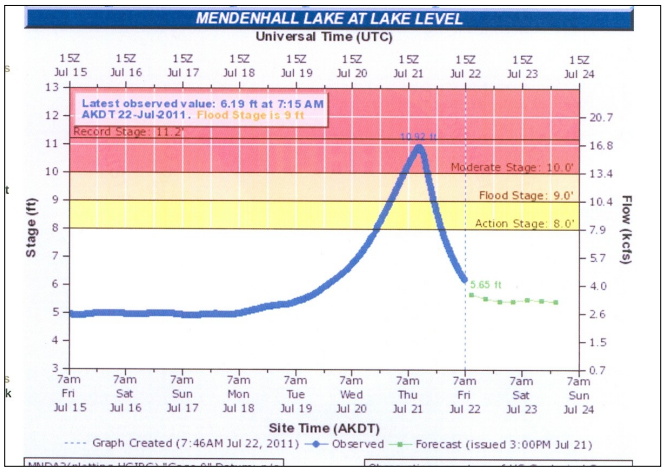


Suicide Basin beginning to drain. Note the bulge in the center of the glacier surrounded by large cracks.

Without knowing where the releasing GDL was, and how much water it still held, there was no way to forecast how much longer and higher the water levels would climb. This was critical information, as both the Mendenhall Lake and River were approaching record levels, and many more homes could be flooded if the water continued to rise. On Thursday Dr. Eran Hood (professor of environmental science at University of Alaska Southeast), Tom Mattice (City of Juneau Emergency Manager) and Aaron Jacobs (NWS forecaster and hydro focal point) took a helicopter flight to the Mendenhall Glacier and, based on previous helicopter reports, headed to an area called Suicide Basin (or Suicide Valley) as the potential source of the flood waters. Suicide Basin is on the eastern side of the main stem of the Mendenhall Glacier, about 2 miles from the terminus, and covers an area of approximately 178 acres. When the helicopter turned into Suicide Basin, the team was amazed at the size of the ice covered lake. High water marks could be seen on the rock walls, and there were grounded icebergs in the back portion of the basin. There were massive stress cracks in the ice where ice that had been floating had dropped to the lake floor as the lake drained. The team was able to land on the ice in a safe area, and while on the ground, estimated that the lake level had dropped about 200 feet from the location of the high water marks.



Hydrograph of Mendenhall River



Hydrograph of Mendenhall Lake

By the time the team returned to the airport, reports were coming in that the both the Mendenhall River and Lake had crested and water levels were beginning to fall. The Mendenhall River crested at 13.07 feet and the Lake crested 10.92 feet, these levels were the second highest ever recorded for these gauges. The impacts of the flooding were extensive, including:

- The Mendenhall Campground was evacuated.
- A sub-division that lies next to the Mendenhall River was evacuated because the road leading to the sub-division was flooded and impassable, one home in that sub-division flooded with up to 3 feet of water.
- The Skaters Cabin Spur Road near Mendenhall Lake also flooded with about 2.5 feet of water.
- Residents below the Back Loop Bridge along the Mendenhall River had flood water in their back yards.

Hydrologists with the USGS, NWS and UAS are concerned that this GLOF will become an annual event on the

Mendenhall system. Steps are currently being taken by the NWS, UAS and The City of Juneau to set-up a monitoring program in Suicide Basin, which will allow hydrologists at the Alaska-Pacific River Forecast Center and forecasters at NWS Juneau to know when a GLOF is underway and more accurately forecast how high the Mendenhall Lake and River will get. Surprisingly, on August 20, just one month after this GLOF, and during a heavy rain event, there was another, smaller GLOF on the Mendenhall Lake and River.

Flooding along the Mendenhall River below the Back Loop Bridge

Flooding along the Mendenhall River at View Drive

Start of Ice Thickness Measurements

Those of you who measured ice thickness last year are requested to do so again this year. Please let us know if you need more forms or envelopes for this season. For those of you who have measured in the past but do not intend to this year, please contact us to get instructions on sending the valuable equipment back to us so that we can use it at another location.

We will enter your data into a database and use the data in a monthly analysis of snow and ice for forecasting breakup characteristics next spring. We would like you to make the measurement as close to the last day of each month as possible and mail the results to us. Be sure to include the date and location on the form. A phone call to our 800 number would also aid in the analysis process.

The ice thickness measurements should be made in the same locations as in the past, preferably far enough from the shore line to prevent drilling in mud and not so far as to encounter strong currents. Before drilling the ice, measure the depth of the snow on top of the ice at that point and record the snow depth in inches. It is preferable to drill a new hole each time rather than use the previously drilled hole. Inaccuracies due to differences in heat transfer can occur at previously drilled holes.

Flooding of the Mendenhall Campground

Suicide Basin after the lake drained

Susitna Hydroelectric Project
by Celine van Breukelen

This July, Governor Parnell announced that the state would be moving forward on the plan to build the $4.5 billion Susitna-Watana hydroelectric power plant, to be completed in 2023. As many long-time Alaskan's know, the Susitna hydroelectric plan is not a new concept. The Army Corps of Engineers did a feasibility study in the early 1980's; however the plan was shelved in 1986 due to dropping oil prices and the newly discovered availability of natural gas in Cook Inlet. In 2010, the Alaska legislature passed house bill 306, requiring 50% of Alaska's energy needs to be met with renewable or alternative energy sources by 2025. A large scale hydroelectric dam on the Susitna River is widely considered to be the only method of reaching this goal.

The proposed reservoir would be located on the Susitna River, approximately 184 river miles upstream of Cook Inlet and 15 miles upstream of Devil's Canyon. It would be located approximately 90 miles northeast of Talkeetna. The dam would be 700 feet high and create a reservoir which would be up to 39 miles long and 2 miles wide. The four-unit powerhouse would provide 2600 GWhrs annually, approximately 40% of Alaska's current electricity usage[1].

The largest environmental impact would be to fish. Fish passage would be blocked for the small number of Chinook salmon who spawn above the proposed dam site. The creation of the reservoir would also impact 9 miles of arctic

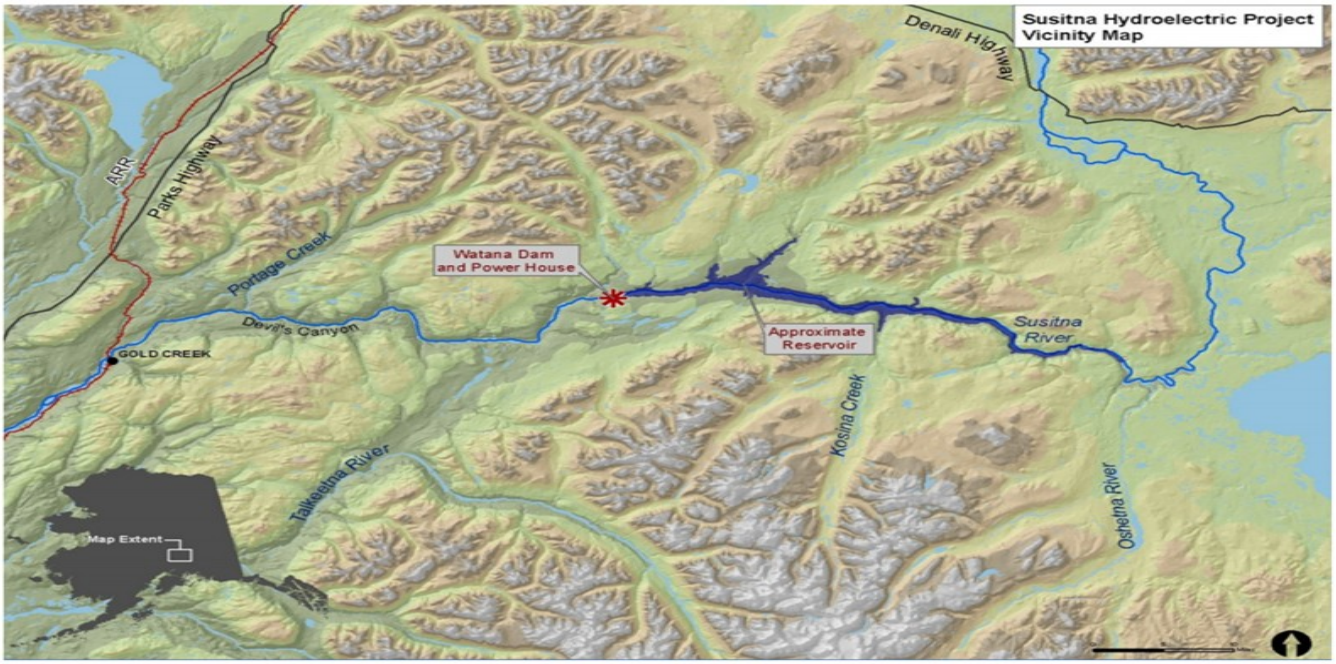


Figure 1, Susitna Hydroelectric Vicinity Map

grayling spawning habitat. The dam would create colder spring/summer water temperatures and warmer fall/winter temperatures. The cooler spring/early summer water temperatures may delay the onset of favorable summer rearing conditions for salmon and the warmer fall temperatures may extend the summer rearing period later into the fall. The warmer winter temperatures may also provide more favorable conditions for overwintering salmon eggs.[1]

The reservoir is expected to be completed by 2023. The process is expected to take 11 years; 3.5 years for design, 2 years for licensing by The Federal Energy Regulatory Commission (FERC), and 5 years for construction[2]. Construction would include extending the railroad from Gold Creek and building an access road from the Denali highway.

The USGS has recorded river discharge at Gold Creek (50 river miles downstream of the proposed dam) from 1949-1996 and 2001-present. This long term record shows that the average annual flow has remained constant; however the average February and April flow is increasing and the average June flow is decreasing with time[3]. According to the hydrology study, "The increased winter flows, the earlier initiation of spring snowmelt, and the reduction in peak snowmelt runoff are all favorable for increased firm [winter] and average total ***cont'd on next page***

hydroelectric energy production."

What does this mean to the RFC? The RFC currently issues forecasts for the Susitna River at Gold Creek and at the Denali Highway. The most likely outcome is an increase in the number of USGS gages and RFC forecast points in the Susitna watershed. If the dam is built, the RFC would likely provide spring snow estimates to help water managers budget the reservoir releases throughout the summer season.

[1]Railbelt Large Hydro Evaluation, Preliminary Decision Document. Published November 23, 2010. Accessed September 7, 2011. http://www.susitna-watanahydro.org/Docs/AEA%202010_ PrelimDecDoc.pdf

[2]Susitna-Watana Hydroelectric Project, FERC Project No. 14241. Published July 2011. Accessed September 12, 2011. http://www.susitna-watanahydro.org/Docs/ SusitnaWatanaLicensingPlanFINAL%2008_26_11.pdf

[3]Hydrology and Power Studies to Date, Technical Memorandum AEA11-022. Published April 15, 2011. Accessed September 13, 2011. http://www.susitna-watanahydro.org/ Docs/Hydrology%20and%20Power%20Studies%20to%20Date%204%2015%202011%20_2_.pdf

2011 Breakup Summary

In November 2010, uncharacteristically warm temperatures, coupled with rainfall, led to a Thanksgiving partial breakup on the Kuskokwim River. Bethel Search and Rescue reported that, "Ice was breaking up and moving along the entire length of the Upper and Middle Kuskokwim as far downstream as Aniak." By November 26, the breakup front had extended to below Kalskag. Water levels were reported to have risen as much as six feet with this surge of water. As temperatures cooled again, the river refroze around the ice that had moved. This event likely contributed to the spring ice jam flooding in the villages of Crooked Creek and Red Devil.

Major flooding occurred at Crooked Creek during breakup. An ice jam downstream of the village held for days before flooding began on May 8. Many homes were damaged or destroyed, and more than 50 residents were evacuated. The Governor declared a state disaster for the breakup flooding that damaged both Crooked Creek and Red Devil.

Ice jams and snowmelt caused minor flooding in the village of Buckland on the Buckland River, and the village of Kobuk on the Kobuk River. Minor flooding also occurred at Colville Village on the Colville River delta.

Breakup on the Yukon was, for the most part, uneventful. Water levels were generally well below normal breakup levels. An ice jam between Eagle and Circle remained in place for several days, delaying breakup at Circle until May 16, six days later than the average breakup date.

The Gakona River had 8.5 feet of aufeis* built-up underneath the bridge when it was measured in April, leading to concerns about possible flooding during breakup. But low snowpack in the upper Copper River basin and the slow snow melt during early May allowed the melt water to wear a channel through the ice, and the expected flooding never materialized.

May 10, 2011 - Front Street in Crooked Creek on the Kuskokwim River

*Aufeis - a German word meaning "ice on top.'" Aufeis is a sheet-like mass of layered ice that forms from successive flows of ground water during freezing temperatures.

High Water Mark Signs Commemorate Record Flooding
by Ed Plumb

The National Weather Service has teamed up with the US Army Corps of Engineers (COE) to install high water mark signs in several Alaska communities. These small placards identify the water depth and date of the record flood for the community. The signs are being placed in highly visible locations in order to bring awareness of flooding to the local residents and visitors. The first sign was installed at Crooked Creek on the Kuskokwim River to observe the record breakup flood last spring on May 8, 2011. Signs were also hung on the fire hall and Laundromat in Eagle to commemorate the devastating Yukon River ice jam flood in May 2009. Additional signs will be placed in other communities in years to come.

High Water Mark sign on the fire hall in Eagle to commemorate the devastating Yukon River ice jam flood in May 2009

Spring Flooding on the Porcupine River
by Ed Plumb

The Porcupine River spilled way over its banks during May 2011, in fact, the river rose to one of the highest levels ever seen in recent times. A cold spring was immediately followed by a rapid warm-up, which led to sudden melting of the winter snowpack and flushed a large amount of water into the Porcupine River. This surge of water moved down the Porcupine from the headwaters in the Yukon Territory to the confluence with the Yukon River at Fort Yukon. Satellite imagery, aerial reports from pilots, as well as information from locals on the ground indicated that water spread more than a mile away from the main Porcupine River channel and into the surrounding lowlands.

Joe and Helen Matesi, cooperative and river observers for the NWS, barely escaped the floodwaters with their two dogs and cat as they loaded their boat and evacuated their home, which is located on a remote island near the mouth of the Coleen River. The Matesis navigated through turbulent water and dodged trees as they made their way upriver to higher ground. In addition to the high water on the Porcupine, massive amounts of logs and debris were picked up and carried downriver. Residents all along the Yukon River below the mouth of the Porcupine took advantage of thousands of cords of firewood that passed in front of their villages.

Local overbank flooding and high water is not uncommon along the Porcupine River during spring breakup as ice moves down the river and ice jams develop. The flooding in May 2011 was such a significant event because it occurred after the ice had flushed downriver. Therefore, the actual volume of water in the river was at or near record levels and flooding was widespread, rather than a local event caused by an ice jam.

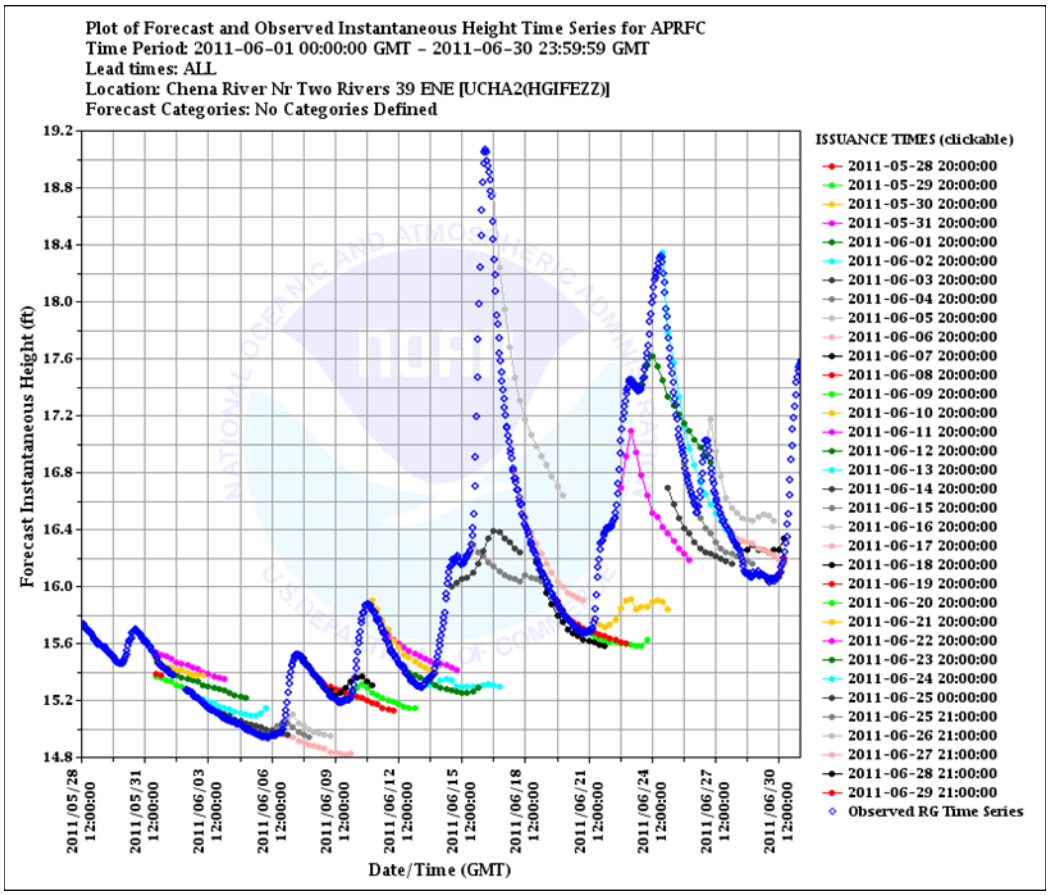
End of 2011
Open Water Season

The 2011 open water season is coming to a close, and we would like to thank you for your assistance in taking water level readings and ask that you stop taking readings when ice actually prevents you from making an accurate reading safely. We would appreciate any information you can provide on the condition of the river and the formation of river ice. Please complete the enclosed Freeze-up Form and return it to us. Your help contributes to a more complete record of freeze-up data for Alaska and is greatly appreciated.

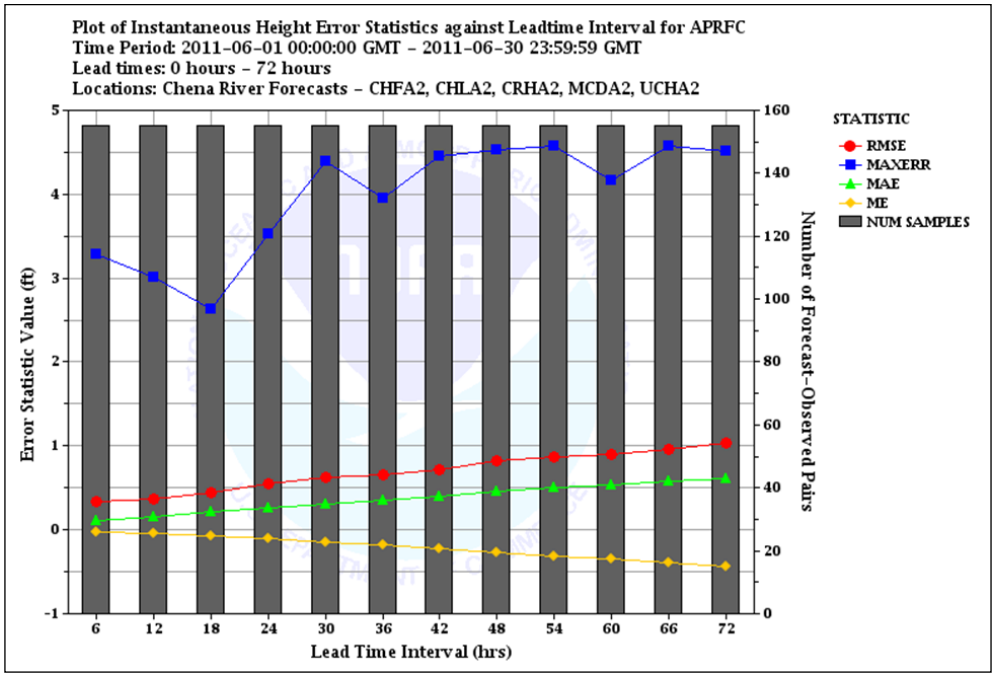
Forecast Verification at the APRFC
by David Streubel and Jim Coe

River observers, emergency managers, and routine river forecast users may wonder to what extent hydrologists at the APRFC evaluate their own forecasts. Staff hydrologists are happy to report that hydrologic forecast verification is being done all the time in one form or another. In recent years, verification has become more systematic and taken on greater emphasis as better tools were developed to objectively analyze our forecasts. All kinds of questions come up regarding hydrologic forecast verification ranging from: Why do it? What is a good hydro forecast? What verification metrics do you use? There are no easy answers, but we are incorporating new verification tools into our operation to better understand how our forecasts perform so we can improve.

A particular hydrologic forecast verification tool is the Interactive Verification Program developed to interface with an archive of our forecasts and observations. Below is a plot of water level forecasts for the Chena River above Two Rivers for the month of June, versus observations. By viewing the plot of how each one of our hydro forecasts compared with the observations one can get a quick picture of bias. From this plot it is evident that the forecasts underestimated increases in the Chena River water level during two convective precipitation events in June. We can look further at this location or numerous other locations to determine the statistical significance but more importantly operational implications that verification results provide. Actions can be taken to better understand the cause of the bias such as looking at the precipitation gauge data that went into our hydrologic forecast model, the parameterization of the hydrologic model, and other aspects of our operation to try identify causes of simulation error.



Another use for verification is to compile error statistics over various hydrologic forecast horizons to provide a measure of forecast uncertainty as a function of the how far in the future the forecasts were made. This could provide a quick estimate of uncertainty to forecast users, and indicate how much confidence to incorporate into future forecasts. These types of statistics, along with others, start to define a measure of skill in our forecasts. See example next page:



In the future, we will continue to look more objectively at our hydrologic forecast performance through the use of new verification tools. These tools should provide us a better understanding of forecast accuracy and skill at all our hydrologic forecast points. Verification will help in our internal decision making process for deriving modeling and re-calibration priorities, as well as understanding the limitations that we have. Stay tuned for more verification in future newsletters, and on the APRFC web page.

Welcome Dave Snider - Our New TV Meteorologist

Dave Snider, a 15-year broadcast veteran and a classically-trained meteorologist came to the Anchorage National Weather Service Forecast Office in early July from Springfield, Missouri. He filled the position of Lead Meteorologist for the Alaska Weather show after Jim Peronto accepted a position in Silver Spring, Maryland.

Dave is a graduate of Parks College of St. Louis University where he earned his degree in Meteorology.

Dave began working in broadcast meteorology in 1996 with KJCT-TV in Grand Junction, Colorado, as Chief Meteorologist, where he forecasted for eastern Utah and western Colorado. In 1997, he moved across the Continental Divide to the base of Pikes Peak when he joined KRDO-TV in Colorado Springs and faced the challenging weather of Colorado's Front Range. In 2002, Dave helped develop and shape a 24-hour weather show for News 14 Carolina in Raleigh, North Carolina. He covered the weather every 10 minutes and, in doing so, saw his fair share of thunderstorm outbreaks, tornadoes, tropical storms, hurricanes and winter weather nightmares (at least by Carolina standards). In 2005, Dave moved to Springfield, Missouri where he aggressively worked on social media for the KY3 (KYTV-NBC) weather center and continued to upgrade the look and presentations of the teams' broadcast.

Dave covered the EF-5 Joplin, MO tornado on Sunday, May 22, 2011 and reported live from Joplin during the week that followed. "Unless you saw it with your own eyes, no pictures or video could possibly convey the magnitude of destruction and pain I saw through our radar beam that night. I hope I never see that again", said Snider, "but I hope it leads us to be better prepared and more equipped in the future."

Dave and his wife, Mary Helen, have backpacked in the Colorado wilderness and in the Smoky Mountains. They enjoy bird-watching, skiing, fishing and exploring the back roads. The Sniders have two boys, Samuel and Benjamin and a faithful Labrador retriever companion, Jake.