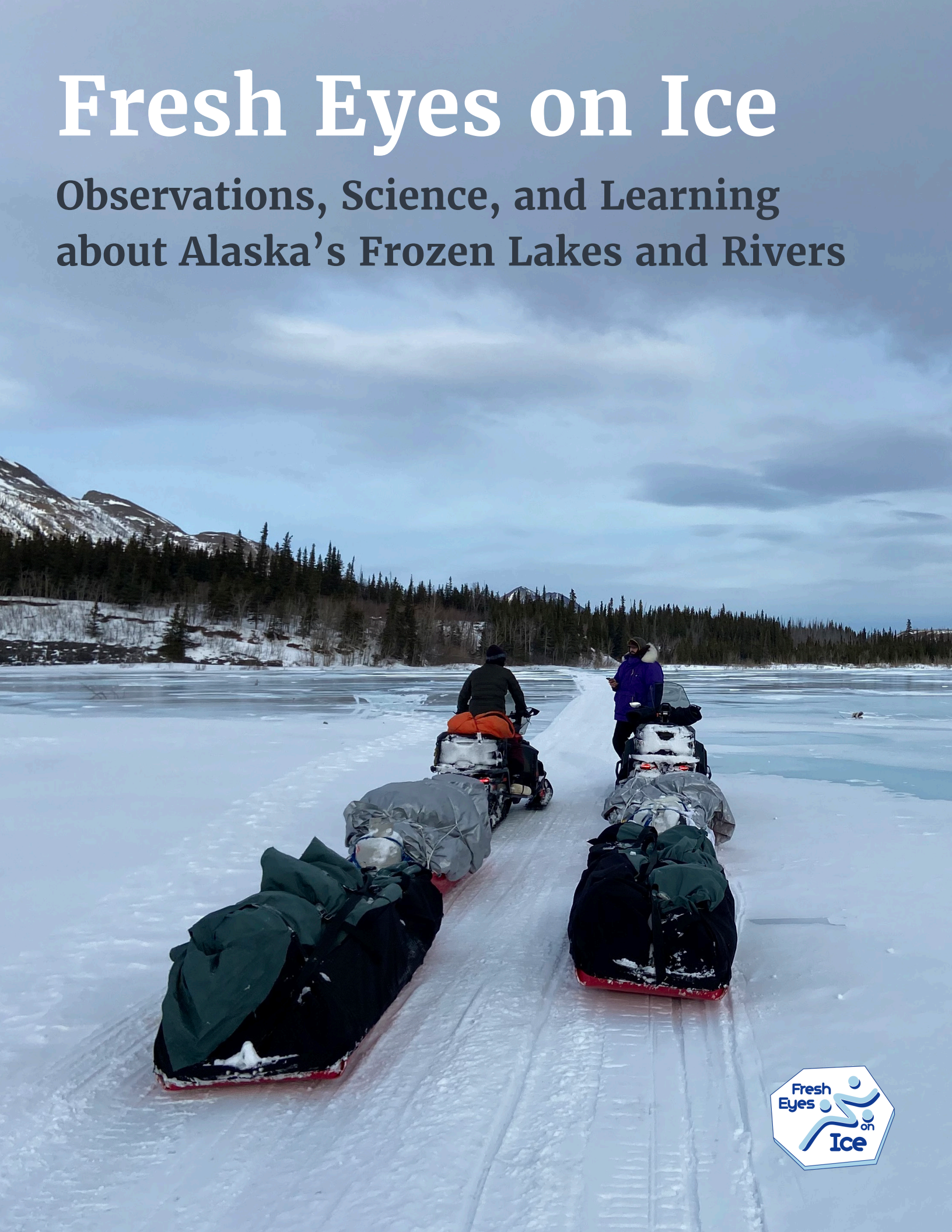
Fresh Eyes on Ice

Observations, Science, and Learning about Alaska's Frozen Lakes and Rivers



Seeing, Sharing, and Celebrating Alaska's Ice

About this Report

This report highlights the wonders, hazards, and recent changes seen in river and lake ice across Alaska. ***Fresh Eyes on Ice*** (***FEOI***) builds on river and lake ice observation programs of the past to sustain a new network of ice observers for the future.

Who We Are

Seeing ice in all its places, forms, and moments takes a community! The ***FEOI*** project is led by an interdisciplinary team of scientists and educators at the University of Alaska Fairbanks and includes K-12 students and educators; Indigenous Elders; community members; Tribal, state, and federal agency partners; and citizen scientists across Alaska and parts of Canada.

Learn more about our team at https://fresheyesonice.org or email questions and comments to fresheyesonice@gmail.com.


Tohru Saito

Front cover: ***FEOI*** scientists traverse overflow on the South Fork of the Kuskokwim River in 2022. Credit: Sarah Clement


Chris Arp

Table of Contents

Observer Safety

Like many things in nature, ice is never 100% safe! The consequences of falling through ice can range from scary, cold, and wet to much worse. Every year people get into ice accidents including falling into open water areas or getting stuck in overflow in remote locations. ***Fresh Eyes on Ice*** helps inform the public about ice hazards and provides data to make better decisions during winter travel and recreation. We also want our community monitoring teams to be as safe as possible when making observations and collecting data. Accordingly, we provide monitoring teams with tools and training to help make decisions on when it is safe to go out on the ice, as well as observation alternatives when conditions are not safe.

Please enjoy the natural beauty and wonders of ice, but also respect this magical platform of frozen water and the cold, often flowing, liquid water below.

Cite this Report

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Reading this Report

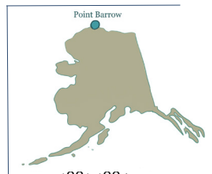
We report measurements using the internationally-recognized Metric system. Please refer to the conversion chart below when reading this publication.

Distance	1 kilometer (km) = 0.62 miles 1000 km = 621 miles
Length	1 meter (m) = 100 centimeters (cm) = 3.28 feet = 39.3 inches
Area	1 square kilometer (km^2) = 100 hectares = 0.39 square miles = 247 acres
Temperature	-40°C = -40°F | 0°C = 32°F | 100°C = 212°F

Drilling Down: Ice Through Time

Knowing how thick ice grows over the winter integrates climate, informs public safety, and helps predict break-up and ice-jam flooding. Observing ice thickness in Alaska has a long and varied history, from the first International Polar Year in 1881 to ***FEOI*** community monitoring teams in the 2020s.

1 1st International Polar Year (IPY) Research Stations



1881-1884

3 Cold Regions Research and Engineering Lab (CRREL)

CRREL monitored 26 ice thickness sites from 1961-1977 with help from Native villagers, lodgekeepers, teachers, and clergy

5 Circumarctic Lake Observation Network (CALON)

CALON collected data on 57 lakes on the North Slope between 2011 and 2019.

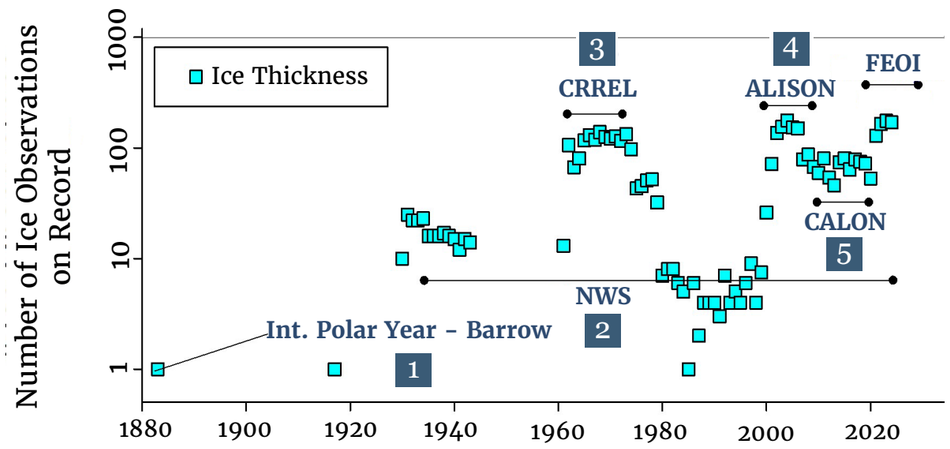
1880 1900 1920 1940 1960 1980 2000 2020

2 National Weather Service

Scientists with the National Weather Service have recorded monthly ice thickness data on lakes and rivers throughout Alaska with the help of rural community members since 1935. Data are primarily used to assist in forecasting break-up timing and ice-jam flooding, but serve many other purposes.

4 Alaska Lake Ice & Snow Observatory Network (ALISON)

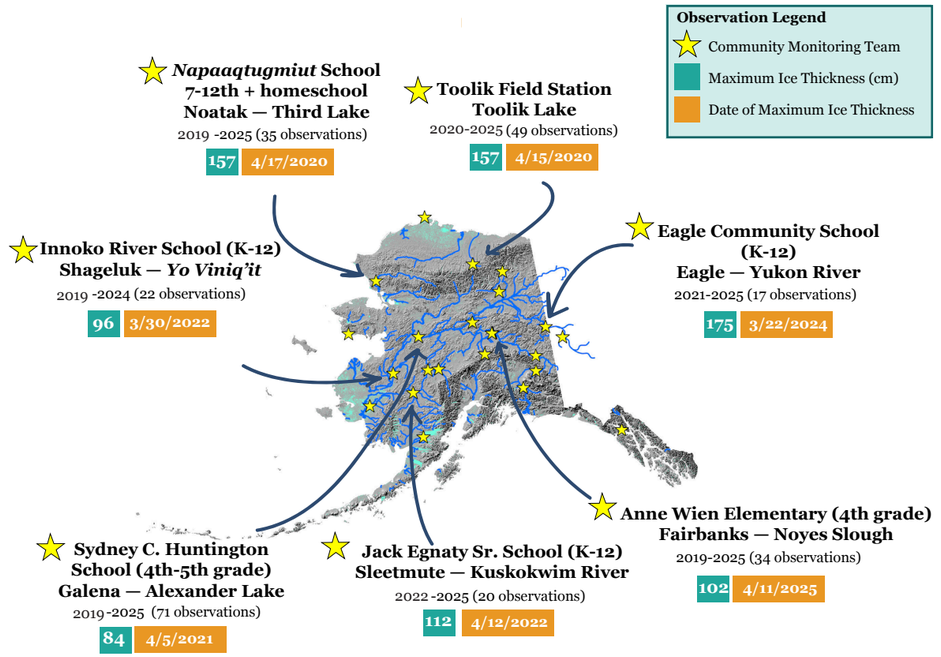
From 2001-2011, ALISON provided teachers and students learning opportunities in ice and snow physics, and resulted in valuable ice thickness data from 16 lakes around Alaska. ***FEOI*** adopted ALISON's ideas and now even works with some of the same teachers around the state!



▲ *Different river and lake ice scientific efforts in Alaska have contributed critical observations over the past century. Figure: Chris Arp*

Observing Takes a Community!

With the help of many observers (K-12 students, teachers, scientists, and community members), ***Fresh Eyes on Ice*** has expanded ice thickness and snow depth data collection around Alaska and beyond since 2019. Once adults determine the ice is safe, students use shovels, augers, tape measures, and snow probes to measure ice thickness and snow depth on a lake or river near their school. We enter data in the ***FEOI*** portal where students (and their families, communities, and the public) can see their results in graphs. We encourage other observations like photos, journaling, and special projects.



▲ ***FEOI*** *community monitoring teams across Alaska have been making ice observations since 2019. The teams shown here collected the most observations between 2019-2025.*

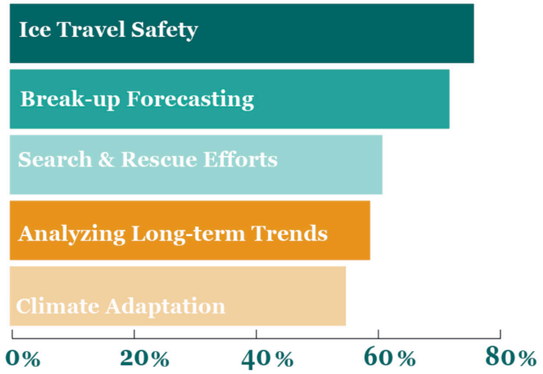
▼ *Sleetmute students head out to monitor ice conditions on the Kuskokwim River.*

Chris Arp

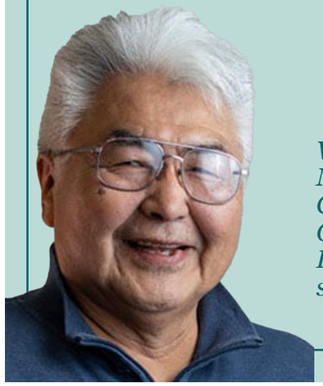
Why We Observe Ice

A priority of Fresh Eyes on Ice is to ensure that the data, science, and outcomes produced by the project meet the needs of communities across Alaska. Partners from University of Alaska Fairbanks (UAF), Tanana Chiefs Conference, National Weather Service Alaska-Pacific River Forecast Center and NASA GLOBE Observer teamed up to conduct a statewide priorities and needs assessment of ice concerns, local knowledge, research priorities, data product needs, and technological access issues across a diverse range of people.[1]

Top Uses of Ice Data Identified by Needs Assessment Survey Respondents



"The ice spoke and nobody listened. A few of us heard, but didn't know what we were hearing. There is room for everything in this, room for observations of the ice, room for different ways of thinking about ice, dealing with changes in ice, room for data collection as a researcher."



Wilson Justin, *Mentasta/ Chistochina October 2022, Fresh Eyes on Ice season kickoff*

Needs assessment results have guided the continued development of ***Fresh Eyes on Ice***, National Weather Service Alaska River Watch, and GLOBE Observer. We want river and lake ice observing in our state to be as useful as possible for community safety and science.

▾ *The Kuskokwim Ice Road is an essential winter travel corridor. The average length of the ice road is 200 miles, connecting communities near Bethel to upriver communities like Aniak and Sleetmute. Late or slow freeze-up conditions, along with coastal storms, often delayed or interrupted ice road construction in recent years. Overflow and large open-water zones are also concerning for ice road crews.*

Mark Leary

Meeting Ice Needs

Travel safety and flood forecasting were the top community-identified priorities for river ice data, so we focused on ensuring that the data and science coming out of the project directly meet these needs.

Ice Safety

With no roads or highways throughout most of rural Alaska, river ice serves as an essential travel corridor between villages in both summer and winter. In the winter, the condition, timing, and safety of the ice for travel is changing rapidly. ***Fresh Eyes on Ice*** has focused on studying overflow and open-water zones, two hazards that can make travel on the ice dangerous.

Chris Arp

▲ *Snowcat broken through the ice on the Tanana River near Fairbanks.*

Spring Flood Forecasting

Every spring, river break-up presents the risk of ice jam flooding for dozens of communities along the rivers of Alaska. ***FEOI*** community monitoring teams contribute ice thickness measurements to statewide monitoring efforts led by the National Weather Service Alaska-Pacific River Forecast Center to help make the flood predictions. ***Fresh Eyes on Ice*** has collected river photos taken by over 4,000 public participants through our website app, NASA's GLOBE Observer app, and social media channels that are shared directly with the National Weather Service as they prepare communities for flood warnings.

River Watch

▲ *Ice-jam flooding on the Yukon River in May 2023 impacted the Kokrine Hills Bible Camp.*

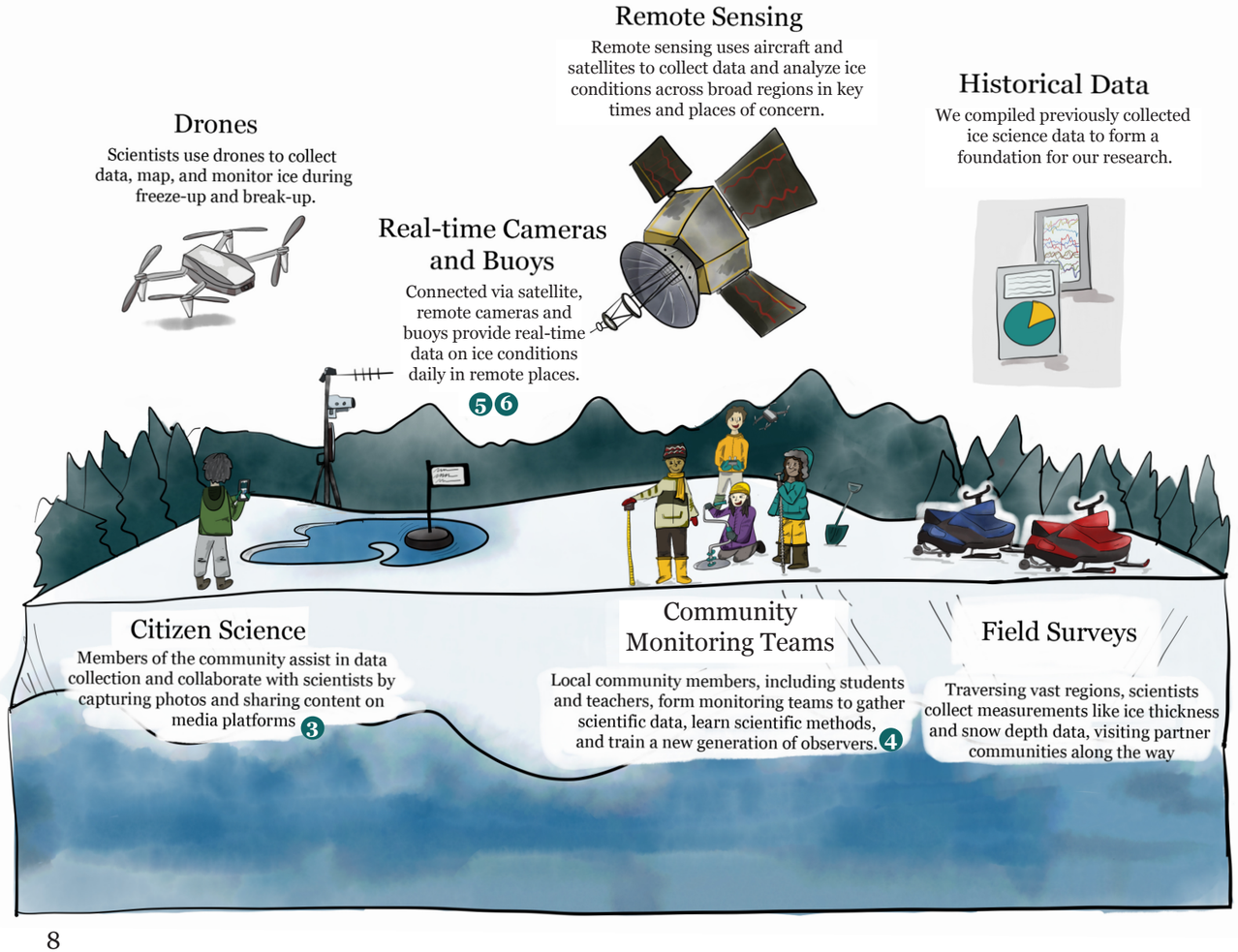
Making Decisions

We partnered with Steven Institute of Technology to combine remote sensing and citizen science photos in a river ice mapping dashboard that provides up-to-date information on ice conditions in rivers and lakes in the US and Canada. The tool integrates VIIRS (Visible Infrared Imaging Radiometer Suite) and Sentinel satellite imagery and our ***FEOI*** photo observations from our website and the NASA GLOBE Observer app to offer a daily look at current river ice concentrations. These maps aid operational users like the National Weather Service in getting a good view of ice conditions for predicting spring ice jam flooding.[2]

How We Observe Ice

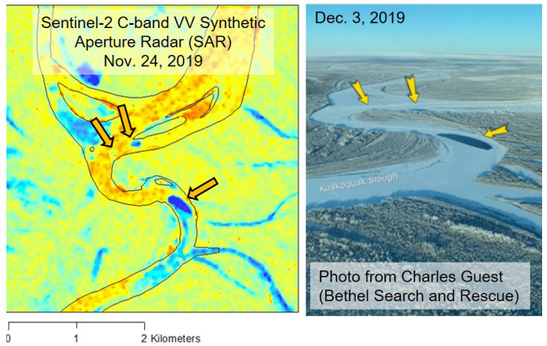
People living in cold places have long observed and recorded ice conditions on rivers and lakes. Records of freeze-up and break-up date back many centuries. Ice observing techniques have greatly expanded and continue to help document changes in many places around the world, including the abundant ice covered rivers and lakes of Alaska.

The ***FEOI*** project is working to support and sustain many types of observations of lake and river ice in Alaska to inform public safety, document responses to our changing climate, and promote science education and public engagement.



Satellites

Since the first Landsat satellite launch in 1972, the extent and frequency of ice observations has expanded. For observing ice at high latitudes (e.g., Alaska), synthetic aperture radar (SAR) imagery allows scientists to see through cloud cover and during dark winters (when optical satellites like Landsat cannot view the surface.

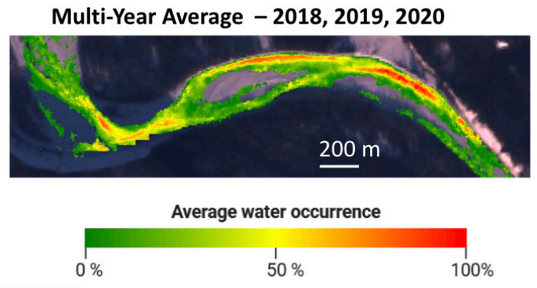


▲ *We used satellite radar and aircraft photos to detect persistent open-water areas (in blue) of the Kuskokwim River.*

Open-water zones present hazards to river travelers. ***FEOI*** scientists developed a new technique to detect these hazards using SAR. Developing the method was significantly aided by citizen scientists' photos. 7

▲ *Teshekpuk Lake freeze-up and break-up sequence from NASA's MODIS Aqua satellite.*

As the largest lake on Alaska's North Slope, Teshekpuk's size, latitude, and proximity to the Beaufort Sea coast make long (over nine months) seasonal ice-cover its dominant regime. Satellite observations show increasingly earlier break-ups and later freeze-ups over the last 49 years. 8



▲ *Composite derived from Sentinel-1 images for the Copper River displays open water and ice cover occurrence averaged over many winters.*

River ice responses to climate change profoundly impact people who travel on ice-covered rivers to access traditional lands and resources. To assist with river access and resource management, we mapped patterns of late-winter open-water areas using SAR. 9

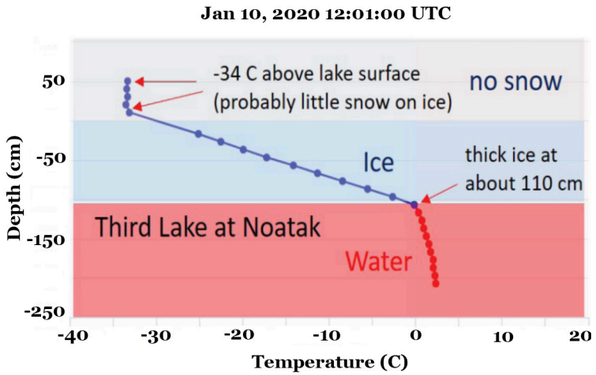
Cameras and Buoys

The term "ice phenology" describes the seasonality of ice cover, or how long the four states of ice cover (open water, freeze-up, ice cover, and break-up) occur in a given year. We use cameras that communicate with satellites to observe conditions in places where we can't always be physically present. The cameras took a photo a day to track ice phenology and broadcasted the photos live on the web.

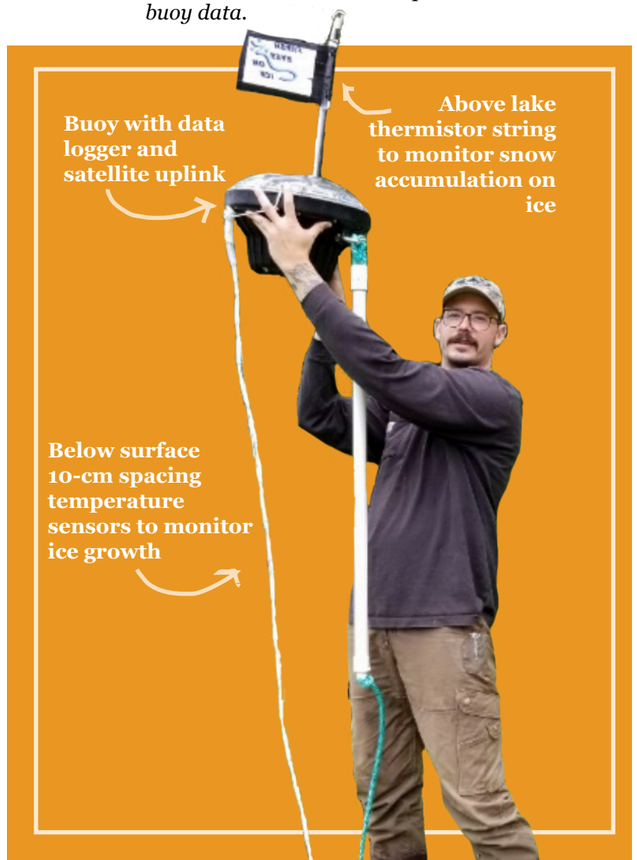
▲ *An example sequence of ice phenology photos from our river camera installed near Paimute on the Yukon River.*

▲ *Map of **FEOI** camera and buoy locations. Some buoys were co-located within our partner communities so that the community ice thickness measurements could be compared to the buoy data.*

Ice thickness buoys give us information about the temperature at different heights in the water column. They have strings of tiny temperature sensors (called thermistors) below, in, and above the ice, which create profiles we can use to determine ice thickness.



▲ *Example air-snow-ice buoy plots for January 10, 2020 on Third Lake at Noatak. This graph is shaded to show the depths of the unfrozen water (red), the ice (blue) and the air and snow (gray) more clearly.*



Drones

***Fresh Eyes on Ice* has been using Uncrewed Aircraft Systems (UAS),** commonly known as "drones," to monitor ice conditions from a different perspective than we can get from satellite sensors in space and from observers and cameras on the ground.

◀ ***FEOI** Remote Sensing scientist Dana Brown shows Venetie students the different perspectives on ice you can get from satellites, drones, and citizen science photos.*

Training Youth Drone Pilots

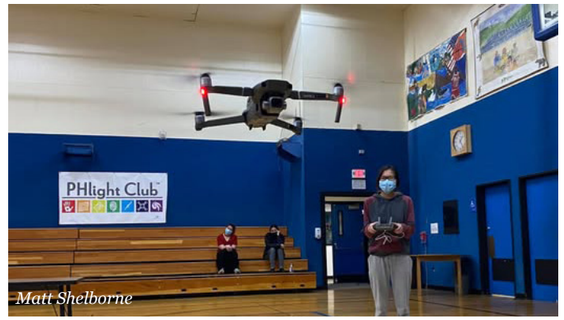
Build: In three-day workshops, students build their own drones and learn how to safely operate the Uncrewed Aircraft System during a mission.

Fly: Youth test their piloting skills through obstacle courses built from school gym equipment. Sometimes families and community members gather to watch and cheer at our *Drones on Ice* family STEM nights!

Observe: When weather permits, students apply their new skills outside, flying larger drones with photo capabilities, to collect images of river and lake ice conditions.

We use drones for ice research to monitor open-water zones in the ice and observe freeze-up and break-up processes. Through a partnership with Tanana Chiefs Conference, we expanded the team to include drone pilots in Tanana and Tok. With the Alaska Satellite Facility, we trained youth in our community monitoring teams to build and pilot drones for ice observing.

▲ *Shageluk students assemble their drones.*



▲ *A McGrath School student practices flying the school's **FEOI** drone, which they named the Aerial Knight 1.*

Meet the Pilots!

Bruce Ervin annually documents spring break-up processes and flooding along the Nabesna River, Chisana River, and the Tanana River near Tok, Northway, and Tanacross.

Andrew Marks flies drone missions to capture break up and freeze up of the Yukon River with the ***FEOI*** project in Tanana.

Submitting a photo of the ice conditions or an ice thickness measurement captures a moment in time that we will never get back. The older a photo or measurement gets, the more valuable it becomes to provide a baseline for detecting change. The data and photos are all permanently archived in the Arctic Data Center or the NASA GLOBE database for future generations. We also have used historical data dating back to 1962 to construct ice growth models, which we used to look at trends in ice thickness and how long ice could be used to travel across Alaska. [10]

Historical photo of carving ice in the Yukon River at Ruby, Alaska. Five feet eight inches thick, March 1, 1913. The date, location, and ice thickness record with this photo make it a valuable snapshot in time for science.

Historical Patterns

1) Maximum ice thickness during the winter has decreased through time across Alaska.

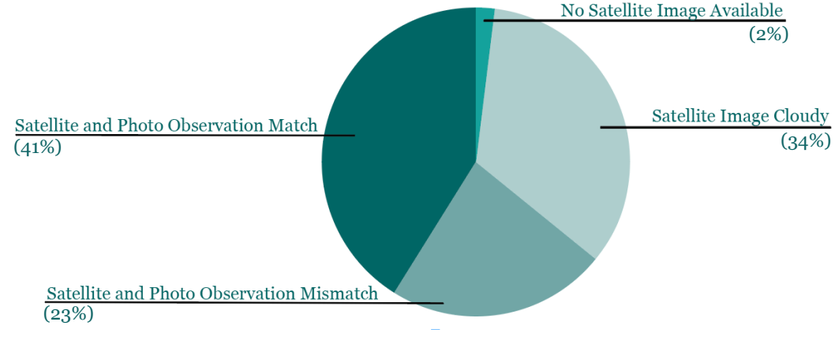
2) Maximum ice thickness between years varies more in rivers than in lakes.

3) The amount of time for safe ice travel on rivers is highly variable from year to year.

University of Alaska Fairbanks Archives

Does a Photo Matter?

Students from the UAF Climate Scholars program analyzed the value of the photos of ice conditions taken through the NASA GLOBE Observer app. They found that the photos submitted through the app provided imagery of the ice surface on days when sensors on satellites could not see through the clouds. They also found that 23% of the time, what the satellites could see from space didn't match the finer scale details that the photos showed on the land, particularly on rivers. [11]



▲ *Percentage of GLOBE Observer and Sentinel 2. Satellite image pairs accurately matching, inaccurately matching, or adding data unavailable by the satellite (n=80).*

Photo Observations

We use photos submitted by individual community members to help ground-truth satellite data, provide calibration data for ice models, and to share ice condition information across communities. From freeze-up in 2019 through break-up in 2025, public observers from locations throughout Alaska contributed 5,953 photos to our ***FEOI*** website photo portal or through NASA's GLOBE Observer app.

Katie Spellman

The most activity in photo submissions occurs during the break-up season, when sharing the photographic and video observations becomes critical for keeping communities up and down river informed of the coming conditions. The National Weather Service receives the photos from all our platforms in near real-time and uses them to help inform their forecasts and issue flood warnings. The photos, videos, and stories shared through our ***FEOI*** Facebook group also help keep communities up and down the rivers informed.

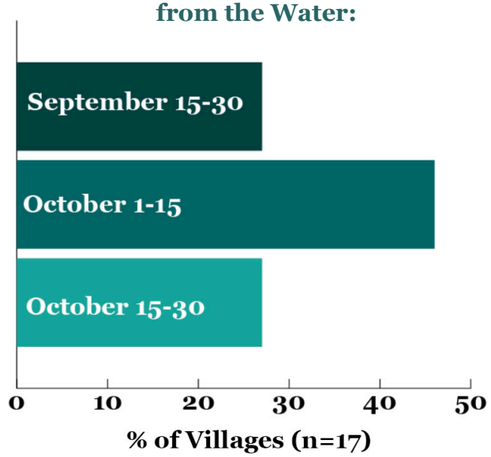
◀ *Dana Brown teaches youth in Venetie, Alaska how to use the GLOBE Observer app.*

Tanana Chiefs Conference Tribal Resources Stewardship Program conducted a local knowledge survey of Tribal council offices in 17 villages across their region as a part of ***Fresh Eyes on Ice***. They wanted to know the timing of when people remove their boats from the water between moose season and freeze-up, and what signs in the river people looked for to know that it is time to remove boats. October 1-15 was the general time frame that people in the majority of villages took boats out of the water. [12]

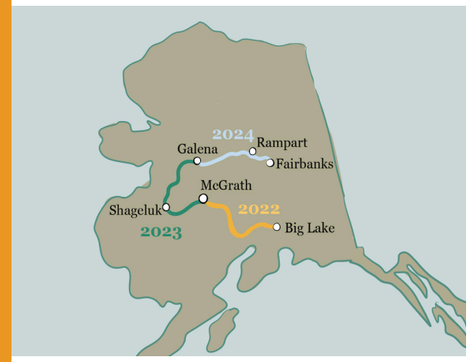
Important Indicators to Remove Boats from the Water Before Freeze-Up:

1. Visible ice floating down the river or ice forming on the banks
2. Water level dropping in the river
3. The end of moose hunting season

Dates Communities Remove Boats from the Water:



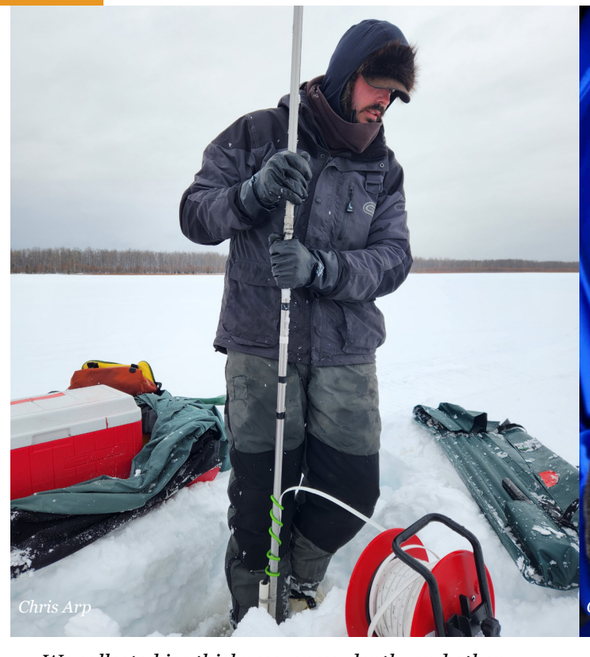
Fresh Eyes on Ice Traverse




Chris Arp

***FEOI* scientists completed a ~1,500 mile traverse of Interior Alaska by snow machine over three winters between 2022-2024**. Along the route, we collected ice thickness and snow depth data, as well as other measurements to help determine patterns of sediment concentration and the causes of hazardous open-water zones. [13] [14]

Another goal of our snow machine traverses was to combine ice science research with community engagement. We visited ***FEOI*** community monitoring teams in McGrath, Shageluk, Galena, and Rampart, where we had opportunities to collect and analyze ice data with students. We also hosted community nights for students to share their ice monitoring work and to hear stories about ice from local community members.

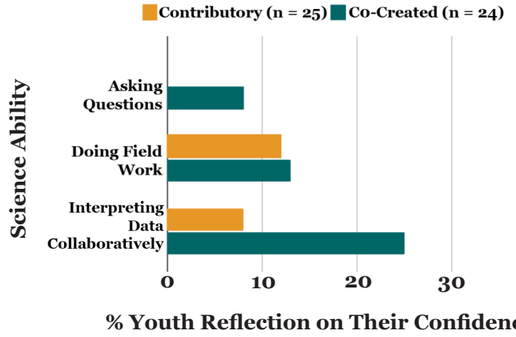

Chris Arp

▲ *We collected ice thickness, snow depth, and other measurements like water velocity at pre-determined coordinates. We also drilled ice cores to collect measures of sediment distribution throughout the ice.*


Chris Arp

▲ *An example of an ice core with sediment frozen into the ice. We cut ice cores into segments, melted the ice, filtered out the sediment, and measured the concentration of sediment in each segment to determine sediment distribution in the ice.*

Fresh Eyes on Ice* community monitoring teams with K-12 students, teachers, and community support scientists are the heart of this project (18-27)**. Teams monitored ice on a lake or river near their school, collecting data at least once per month during the ice-safe season. In some years, they collected measurements that formed the core of our project: ice thickness and snow depth. In other years, students and teachers co-created ice research projects with ***FEOI scientists to address topics the kids and community members thought were important.




J.R. Ancheta

When we compared the effects of these co-created projects with just collecting ***FEOI*** data, we found that co-created projects led to students developing greater confidence in their abilities to do science. We also found that participating in either type of program can spark students' interest in science! [15]

◀ *We interviewed K-12 students in **Fresh Eyes on Ice** and Winterberry, a similar youth-focused citizen science project studying berries. Youth who participated in the co-created model of either project reflected on their abilities to do science more often than youth who participated in contributory models.*

Elena Sparrow

Community monitoring teams gathered in Fairbanks at the end of the ice season each year to share their work in a student research symposium. Student representatives from each team shared their research to professional scientists and gave feedback to other student teams during poster sessions.


Katie Spellman

"It was neat to see the students positioned as experts to be able to share what they've learned… Those are the moments you hope for: professional scientists asking students questions so they can learn from the students and giving those students the opportunity to share what they know."

Beverly Chmielarcyzk, Bethel Regional High School Teacher, 2022

Investigating Ice Hazards

▲ *Snow machine stuck in overflow on the Chatanika River*

FEOI scientists studied lakes around Fairbanks to develop overflow detection methods using in situ sensors and satellite imagery. On lakes, snowfall triggers overflow events and can cause multiple snow-ice forming episodes in some winters. On rivers, overflow forms due to complex hydraulics, air temperature, and ice thickness that can vary from one meander to the next, making it more challenging to predict and thus more hazardous. [16]

When enough snow falls on black ice, its weight submerges and floods the surface to cause overflow. Often hidden under the snow surface for days to weeks, this wet layer is the bane of winter travelers and can be dangerous in remote places in very cold weather. Overflow causes some or all of the snow to melt and eventual re-freeze, forming snow ice. This less dense ice once again rises slightly above water level. Snow ice isn't as strong as black ice and also reduces sunlight penetration, which can impact aquatic habitat.

◀ ***FEOI*** *graduate student Cristina Ornelas retrieves an overflow sensor that was part of her research from Smith Lake on UAF's campus.*

◀ *Open-water zone on the Yukon River below Bishop Rock, downstream of Galena, from satellite imagery (L) and drone footage (R). The sharp bend in the river and the channel constriction formed by Bishop Rock likely help promote ice jams that contribute to keeping this spot on the river open year after year.*

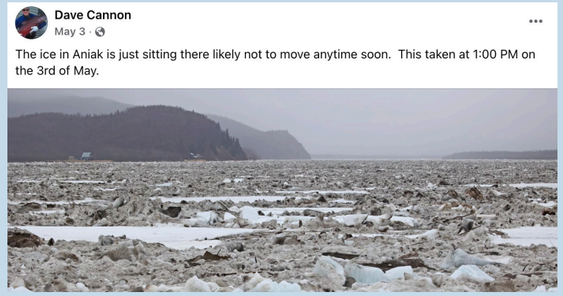
Where, when, and why do some spots in rivers stay open and ice-free long into cold Alaskan winters? Open-water zones are often indicated by dense mid-day fog, but when traveling on rivers in the dark, an open-water zone can be deadly. Scientists thought that zones of groundwater upwelling in riverbeds and stretches of river with higher water velocities caused open-water zones, yet our research suggests open-water zones form mainly downstream of ice jams during freeze-up. Ice jams commonly form at sharp meander bends or channel constrictions, which restricts downstream ice-pan transport and causes turbulence that helps water downstream remain unfrozen even when temperatures drop below -40 °C or °F. [14] [17]

▼ ***FEOI*** *graduate student Matt Scragg collects water depth and velocity data at one location of winter open-water zone formation.*

Monitoring Spring Break-Up

Spring break-up brings the promise of warmer days and the return of busy summer life, but it can also be a tense and uncertain season as communities watch to see what kind of break-up they will have. River break-ups can take two forms. Thermal break-ups have conditions where ice rots slowly and melts into smaller and smaller pieces. Dynamic ice break-ups happen when ice breaks quickly into large chunks because of rapid snow melt and rising water levels. Dynamic break-ups are more likely to lead to ice jams and flooding, posing risks for communities along riverbanks.

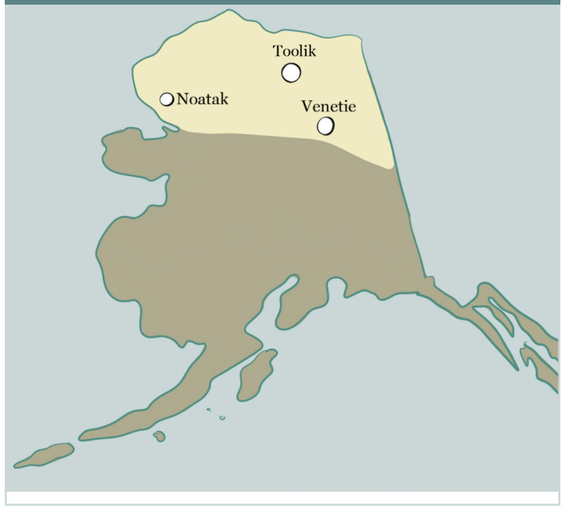
▲ ***FEOI*** *scientists installed a camera on the Kuskokwim River in Sleetmute in April 2022 after the National Weather Service suggested it would be a helpful place to locate a camera. Just a few weeks later, in May, the camera helped document and alert residents to flooding during spring break-up.*



The ***FEOI*** Facebook group has become a hub for communicating break-up information. Thousands of members have shared photos of ice, questions, and updates throughout the winter season. The Alaska-Pacific River Forecast Center uses the information for hazard forecasting and flood warnings in the River Watch program!

◀ *The NWS Alaska-Pacific River Forecast Center hosts the River Watch program each spring to encourage the public to report river ice conditions during break-up season. River Watch is a voluntary program for pilots and community residents to share observations from their normal flight routes and daily life to help the Alaska-Pacific River Forecast Center provide accurate flood forecasting and hazard information to Alaskan communities.*

Where We Monitor Ice



Lakes of Northern Alaska

Noatak

Noatak is one of our longest-running community observing teams! Students have been monitoring ice on Third Lake since 2019. We tested a new drone engineering challenge with the students in 2024 during one of our drone building workshops. We challenged students to build a model payload system for their mini drones to practice using drones to carry supplies or scientific instruments over lakes and rivers.


Brett Pietila

Venetie

The John Fredson School in Venetie was one of the first groups with whom we piloted our drone building workshop in 2021. At the time of the workshop, the ice on the Teedriinjik River was too thin to support students, so they used their new drone piloting skills to observe ice conditions!


Chris Arp

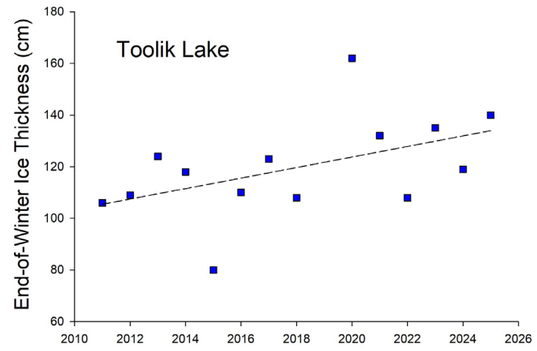

MaKade Sorensen

Toolik

Ice data collection began at Toolik Field Station in 2011 with the Circumarctic Lake Observation Network (CALON). Toolik Field Station continued monitoring Toolik Lake starting in 2019. Interestingly, this record shows increasing ice thickness over this period. When they're not monitoring the ice, staff like to play games like crokicurl, a Canadian game that mixes curling and the board game crokinole.


Toolik Field Station


Toolik Field Station



The end-of-winter ice thickness at Toolik Lake has shown an increasing trend since 2011, when CALON first started collecting ice thickness data.

Community Ice Monitoring at a Glance

Community Team	Site	Years Observed	Max Ice Thickness	Community Photos
Noatak Napaaqtugmiut School	Third Lake	2019-2025	157 cm (4/17/2020)	39
Venetie John Fredson School	Big Lake	2019-2022	130 cm (4/15/22)	77
Toolik Toolik Field Station	Toolik Lake	2019-2025	157 cm (4/15/2020)	2

Where We Monitor Ice

The Yukon River

With over 2,000 km (~1,240 miles) of river just in Alaska, the Yukon River is the longest and largest river in the state. Its major tributaries such as the Porcupine, Tanana, and Koyukuk rivers reach far into interior Alaska. Travel between villages in this region relies on the Yukon via boat in summer but over the ice all winter. We monitor ice on the Yukon River from Dawson City, Yukon, to the Innoko River where Shageluk sits. Here we highlight some of the notable events and contributions of our Yukon River community monitoring teams.

Shageluk

Students in Shageluk have measured ice on Yo Viniq'it, also known as "Sky Lake" or "Shageluk Lake," for both ***Fresh Eyes on Ice*** and the ALISON project. In 2024, the community was able to put in a fish fence for the first time since 2019 due to increasingly late freeze-up periods and freeze-thaw cycles that made the river unsafe for harvesting the last run of whitefish each season. They received permission from village Elders to also collect ice thickness data on the Innoko River near the fish fence.


Joyanne Hamilton

Galena

Fourth and fifth graders in Galena have been monitoring Alexander Lake with their teachers and US Fish & Wildlife Service biologists since the beginning of the project. After noticing that the water underneath Alexander Lake's ice smelled stinky, they tested differences between the ice and water quality on the Yukon River and the lake. They found that the river ice was slightly thicker than the lake ice, and that the river water tasted better than the lake water!


Sarah Clement

Rampart

Students in Rampart began monitoring ice thickness with ***Fresh Eyes on Ice*** in 2023. In 2024, we visited the community during their snow machine traverse from Galena to Fairbanks. The scientists facilitated several ice monitoring activities, including helping students learn about remote sensing of ice conditions by matching satellite scenes to on the ground photos.


Chris Arp

Eagle

Students at the Eagle Community School have monitored ice on the Yukon through several notable events in recent years, including the cancellation of the Yukon Quest dog mushing race between the towns of Circle and Eagle due to extreme jumbled ice conditions in 2023, as well as flooding in town during spring break-up later that year. Their work was recognized by NASA and they were asked to send student representatives for Alaska to the National Youth Science camp.


Kristy Robbins


Andrew Laviolette

*Ice road through Dawson City, Yukon, Canada. **Fresh Eyes on Ice** has begun working with the Robert Service School in Dawson City and hopes to continue building ice monitoring relationships with Yukon communities.*

Community Ice Monitoring at a Glance

Community Team	Site	Years Observed	Max Ice Thickness	Community Photos
Galena Sydney C. Huntington School	Alexander Lake	2019-2025	84 cm (4/5/2021)	221
Shageluk Innoko River School	Yo Viniq'it	2019-2025	96 cm (3/30/2022)	326
Rampart Rampart School	Yukon River	2023-2025	120 cm (4/8/2024)	10
Eagle Eagle Community School	Yukon River	2021-2025	175 cm (3/22/2024)	463

Where We Monitor Ice

The Kuskokwim River

Starting in the Alaska Range, the Kuskokwim River flows 1,100 km (~684 miles), passing many predominantly Native villages, before reaching the Bering Sea downstream of Bethel. The river provides salmon, moose, and wood to villages and is a critical travel route both in summer and winter. The Kuskokwim River ice road is one of the longest, well-traveled ice corridors in the United States and is maintained by the Native Village of Napaimute.

McGrath

Upon joining ***Fresh Eyes on Ice***, McGrath School built a science camp at their monitoring pond to keep students warm and engaged during ice observation outings. We had the opportunity to visit McGrath students several times on our snow machine traverses and again for a drone building workshop!

Chris Arp

Napaskiak

We located one of our cameras on the Kuskokwim River near Kwethluk in 2019. In 2020, Napaskiak resident Earl Samuelson saw the camera was falling into the river due to an eroding riverbank. Earl and his grandchildren rescued the camera and set it up in a new location near Napaskiak, helping us to collect photos for another four years!

Earl Samuelson

Sleetmute

Ice jams cause hazardous flooding in villages along the Kuskokwim in many years with thick ice, deep snow, and fast late warm-ups. Students at the Jack Egnaty Sr. School began monitoring ice on the river in 2022. They used an ***FEOI*** drone to take pictures and video of a break-up flooding event in their community that spring, helping emergency managers and raising awareness of these hazards.

Chris Arp

Bethel

Students at Bethel Regional High School tested the variation in ice thicknesses near beaver lodges around Bethel over two winters. They also surveyed members of their community to understand how changes in river ice conditions had impacted subsistence lifestyle practices (such as travel and hunting) in recent years.

Beverly Chmielarczyk

Chris Arp

◂ ***FEOI*** *graduate student Sarah Clement encounters rough trails and open water on the Iditarod Trail traveling to McGrath in 2022 as part of our 1,500 mile, three-year ice science research and community engagement traverse.*

Community Ice Monitoring at a Glance

Community Team	Site	Years Observed	Max Ice Thickness	Community Photos
McGrath McGrath School	Shooting Range Pond	2020-2024	89 cm (3/7/22)	41
Sleetmute Jack Egnaty Senior School	Kuskokwim River	2021-2025	112 cm (4/12/2022)	219
Bethel Bethel Regional Senior High	Brown's Slough	2020-2023	105 cm (3/31/22)	75
Nikolai Top of the Kuskokwim School	Salmonberry Lake	2024-2025	74 cm (3/14/25)	3

Where We Monitor Ice

Tanana River

As a major tributary of the Yukon, the Tanana (translated from Koyukon Athabaskan to “trail river”) River has long connected people to the surrounding lands through Interior Alaska to its headwaters in the eastern Alaska Range. River boats once regularly navigated freeze-up and break-up, the latter of which has been monitored by the Nenana Ice Classic since 1917. Records from Nenana Ice Classic tripod tips on Tanana River ice show the latest break-ups happened in 1964 and 2013 (May 20) and the earliest happened in 2019 (April 14).

Fairbanks

UAF undergraduates Susan Glade and Maggie House measured snow depth, ice thickness, and water depth at Cripple Creek in 2022 after the failure of a diversion structure. Their findings of water flow and bed scouring under two meters of ice contradicted engineering assumptions that the instability was due to bedfast ice. Their work influenced environmental restoration efforts and new partnerships to promote the return of salmon in the area. [18]

Fourth graders at Anne Wien Elementary School have collected data on Noyes Slough since the beginning of ***Fresh Eyes on Ice***. In addition to regular ice thickness and snow depth measurements, students have investigated where to find the cleanest layer of snow in the snowpack and compared the strength of black ice, snow ice, and “dirty” ice containing sediment.


Christina Buffington


J. R. Ancheta

Nenana

Students in Nenana measured ice thickness at the Nenana Airport’s float pond, complementing one of Alaska’s longest-running ice records, the nearby Nenana Ice Classic. They shared their data with the Federal Aviation Administration to help monitor conditions for aviation safety.


Sarah Clement

Tok

Students in Tok monitor ice on Jan Lake in partnership with staff from the Tetlin National Wildlife Refuge and local UAF assistant professor of language and culture Bruce Ervin. As a part of their monitoring work, the students conducted interviews with Elders about the history of ice in their community.


Robert Kelso


Dana Brown

◂ *Dana Brown conducted drone surveys on the Tanana River near Rosie Creek in Fairbanks between 2020-2022. She documented these superchunks of pancake ice flowing downriver during freeze-up in November 2021.*

Community Ice Monitoring at a Glance

Community Team	Site	Years Observed	Max Ice Thickness	Community Photos
Fairbanks Anne Wien Elementary UAF/West Valley High Fairbanks Community	Noyes Slough Cripple Creek	2019-2025	102 cm (4/11/2025)	1,809
Tok Tok Pathways School	Jan Lake	2020-2023	102 cm (4/10/21)	319
Nenana Nenana City School	Airplane Float Pond	2020-2021	69 cm (2/28/21)	87

Where We Monitor Ice

Copper River Basin

Superstar citizen scientist Barbara Cellarius has taken hundreds of photos of ice throughout the Copper River Valley during the ***Fresh Eyes on Ice*** project. [9]

Barbara Cellarius
Silver Springs Loop, Copper Center
March 8, 2025

Glennallen

Upstream Learning Homeschool students monitored Pippin Lake and Willow Creek near Glennallen for several winters. In 2021-2022, students compared historical temperature and precipitation data on the creek to understand why ice conditions seemed to deviate from normal that year.

Mark Proch

Jack Lake (Wrangell St. Elias)

The Rego family runs a remote lodge in Wrangell St. Elias National Park & Preserve. They wanted to get their kids involved in hands-on, locally relevant science, so they called us up! The Rego family has monitored ice on Jack Lake for two winters. They also host an annual Raptor Migration and Science weekend each spring which includes ice science activities for all attendees.

Helena Buurman

Community Ice Monitoring at a Glance

Community Team	Site	Years Observed	Max Ice Thickness	Community Photos
Wrangell St. Elias Rego Family	Jack Lake	2023-2025	134 cm (4/2/24)	27
Glennallen Upstream Learning	Kenny Lake	2020-2022	75 cm (2/22/21)	671

Where We Monitor Ice

Coastal Alaska

Alaska's vast, diverse coastlines host some of the most rapidly changing freshwater ice due to storms, shrinking sea ice, and warming oceans. Many coastal lakes that once reliably froze each winter now have ice in some years but not others, or freeze and thaw multiple times each winter, making winter travel and subsistence uncertain. In these conditions, community and citizen science photo observations are often the best means to document current conditions.

Nome

Students in Nome monitored ice on a pond behind their school in 2023-2024, and presented their data at the ***Fresh Eyes on Ice*** student research symposium that spring!

Jessica Smyke

Gustavus

The Vanselow family monitored the tidally-influenced Salmon River in Gustavus between 2021-2022. They noted that the river only froze during cold snaps.

Phoebe Vanselow

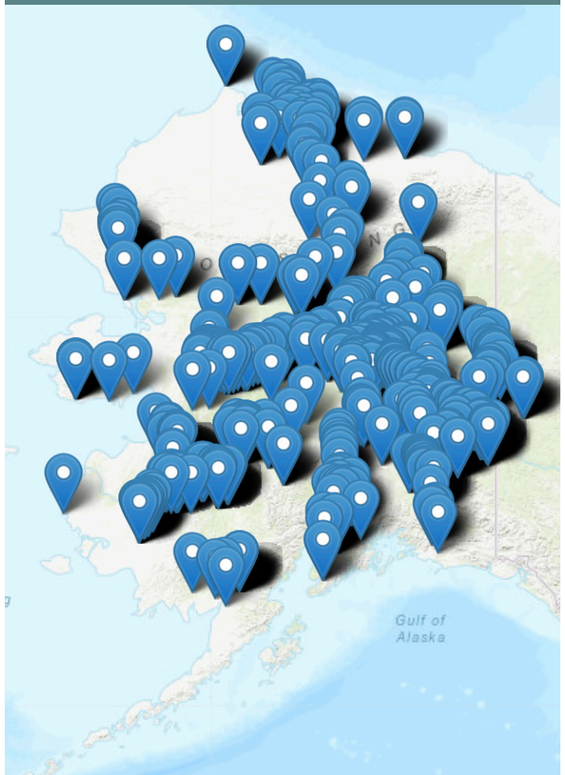
Igiugig

Bill Kane

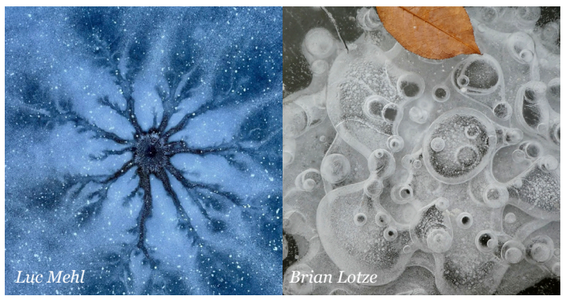
Community Ice Monitoring at a Glance

Community Team	Site	Community Photos
Nome Anvil City Science Academy	ACSA Pond	8
Gustavus Vanselow Family	Salmon River	24
Igiugig Igiugig School	Lake Iliamna, Kvichak River	16

Where Citizen Scientists Monitor Ice



▲ *The **FEOI** photo portal displays the locations of submitted photos. The image above shows every photo that has been submitted to the portal, including historical photos.*



▲ *People share photos of different ice conditions such as ice spiders (L) or methane bubbles (R) to our **FEOI** Facebook group.*

▲ *Submit your own photos to our **FEOI** photo portal!*

Top: Freeze-up on the Yukon River at Nulato on October 22, 2021. Middle: Little Gerstle River near Delta Junction on February 25, 2023. Bottom: Break-up on the Yukon River near Circle on May 5, 2024

Photo Observations

Citizen scientists submit photo observations of freeze-up, mid-winter ice, break-up, and interesting features or patterns in the ice. We have received thousands of photos of river and lake ice conditions through our website portal, the NASA GLOBE Observer app, and Facebook since ***Fresh Eyes on Ice*** began in 2019!

Become an Ice Observer!

Share Your Ice Observations

Submit observations to ***Fresh Eyes on Ice,*** GLOBE Observer, and/or SIKU. All observations are helpful, but repeat observations from the same place over the course of the season are particularly useful! Learn more and access each platform at https://fresheyesonice.org/submit-observations.

FEOI Portal
Fresh Eyes on Ice online photo portal

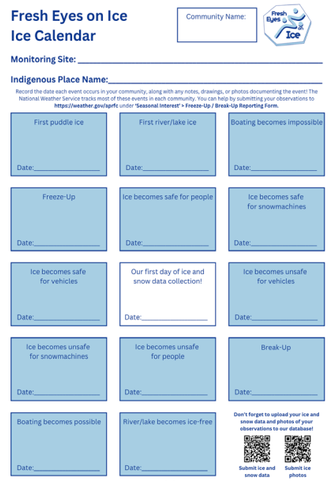
GLOBE Observer
NASA GLOBE Observer mobile app

Facebook
Fresh Eyes on Ice Facebook group

SIKU
Indigenous Knowledge Network app

Record Ice Events

Track ice events in your community and share your data with the National Weather Service! Download the calendar at https://fresheyesonice.org/community-monitoring-teams/.



Use Ice Data

Access ***FEOI*** data from https://fresheyesonice.org/view-data/.

Learn about Ice

We host a variety of ice resources on our ***FEOI*** website, including information about safety, science, and local knowledge. Access lesson plans, videos, stories, and other resources at https://fresheyesonice.org/all-about-ice/.

Contributors


Sarah Clement

Many thanks to all of our team members, community monitoring teams, partners, and citizen scientists!

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Vanselow Family (Gustavus)
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Alaska Satellite Facility
Alaska State Parks
Arctic & Earth STEM Integrating GLOBE and NASA assets
Bethel Search & Rescue
NASA GLOBE
National Weather Service
Native Village of Napaimute
National Park Service
SIKU - Arctic Eider Society
Tanana Chiefs Conference
U.S. Geological Survey
U.S. Fish & Wildlife Service

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Back photo: ***FEOI*** scientists in Rampart Canyon on the Yukon River during the 2024 traverse. Credit: Chris Arp

Partner

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