Kuskokwim_River_above_Kwethluk 2019-11-04 20:01:10 UTC
60.85811, -161.36394 14.4V -7.5°C P

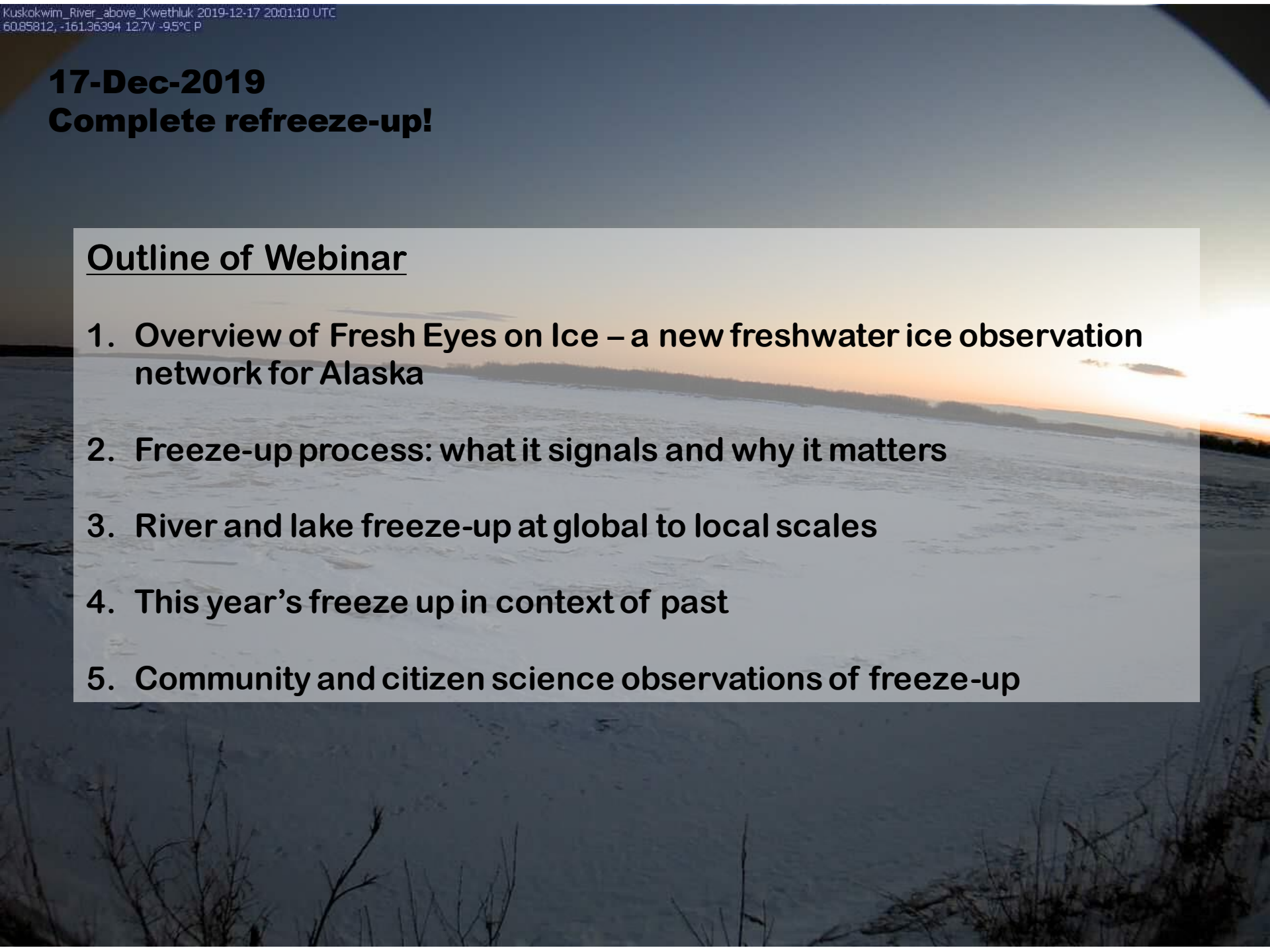
Observing Alaska Lake and River Freeze-up through Fresh Eyes on Ice

Chris Arp
Hydrologist

Dana Brown
Geographer

Laura Oxtoby
Ecologist & Educator

Katie Spellman
Ecologist & Educator



17-Dec-2019
Complete refreeze-up!

Outline of Webinar

1. Overview of Fresh Eyes on Ice – a new freshwater ice observation network for Alaska
2. Freeze-up process: what it signals and why it matters
3. River and lake freeze-up at global to local scales
4. This year's freeze up in context of past
5. Community and citizen science observations of freeze-up

Connecting Arctic Communities through a Revitalized and Modernized Freshwater Ice Observation Network

Investigators

Chris Arp
Dana Brown
Laura Oxtoby
Katie Spellman

Team Members

Karin Bodony
Allen Bondurant
Sarah Clement
Melanie Engram
Tohru Saito
Theresa Villano
Peter Webley

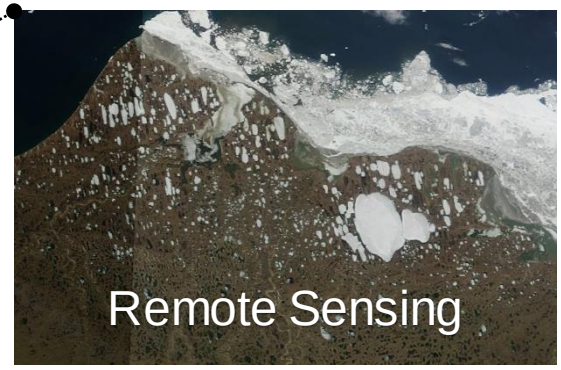
NNA/AON
#1836523
(2019 – 2024)

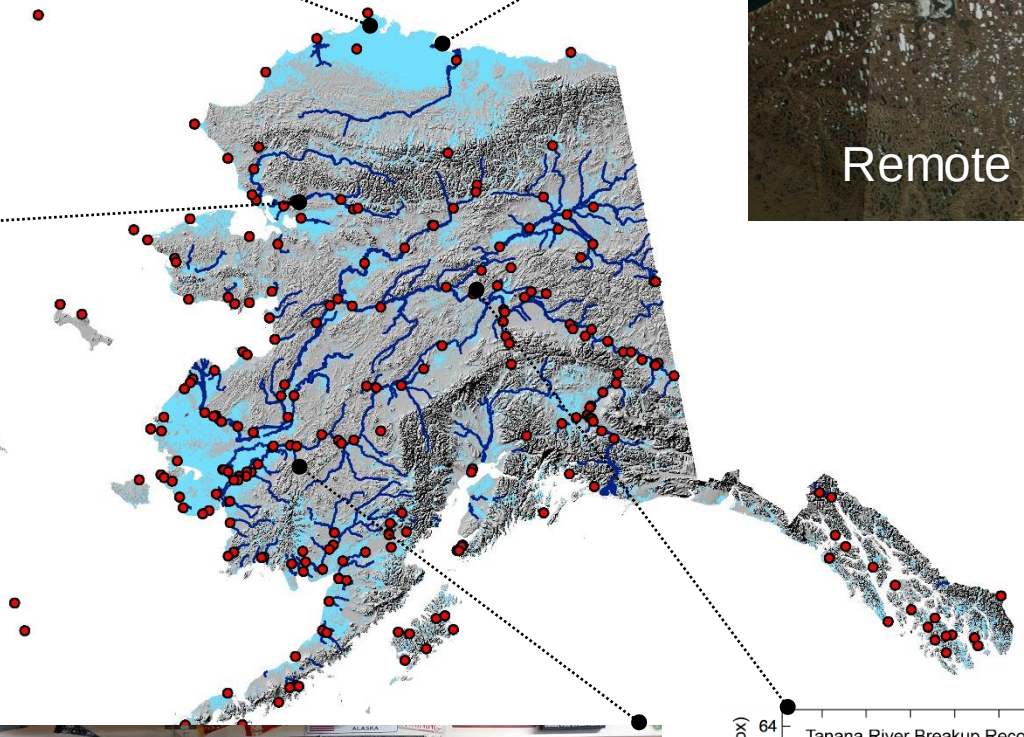
Collaborators

Alaska DNR (Parks and ADF&G)
Bethel Search & Rescue
USFWS, NPS, and BLM
River Watch Program (NOAA)
... and many Alaska communities & schools

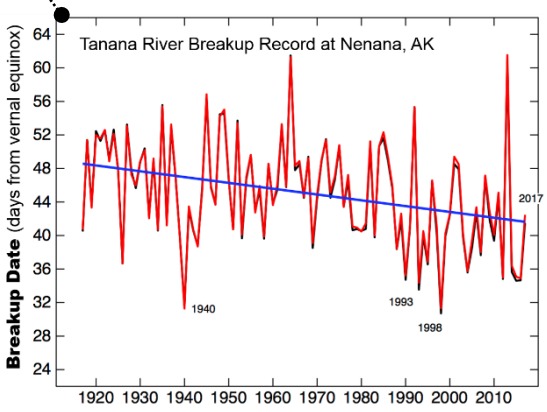
http://freshеyesonice.org/

Connecting a Landscape of Water and People through Observations

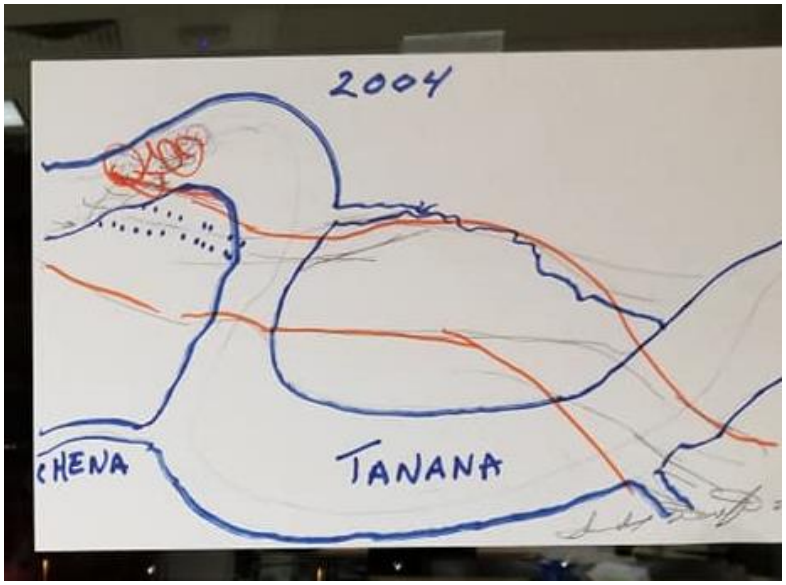




Archiving &
Analysis of
Historic Data

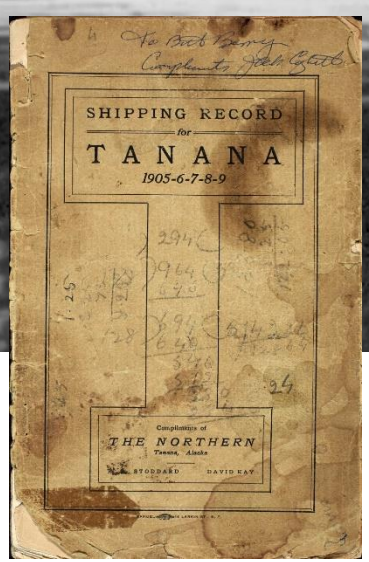


Learning from our Elders



Elder Sam Demientieff (Holy Cross/Fairbanks) sharing knowledge of changing ice and much more

Learning from the past



Observing the present

Shaping the future.

Community Based Monitoring Teams

2019-20

Noatak

Shageluk

Fairbanks

Venetie

Bethel

Galena

New this year: Kenny Lake, Northway, Tok, Anderson, McGrath, Nenana, Arctic Village, maybe others!

Getting youth outdoors observing their environment

Developing STEM skills & confidence

Collaborating with community members, educators and scientists to create a dataset for community safety, planning, science, and learning

Sharing freeze-up & break-up observations across the state

Fresh Eyes on Ice

Public group · 119 members

+ Invite

Amanda B Young
October 12 at 3:06 PM ·

Over the past three days Toolik Lake has gone from being mostly open to mostly covered with ice!

5 Seen by 50

Like Comment Share

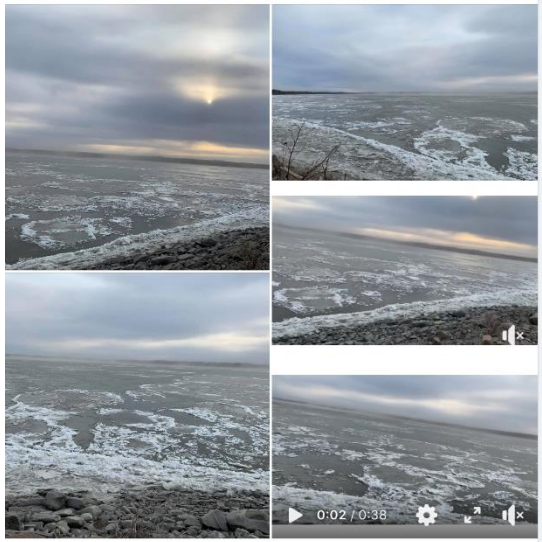
Christopher Douglas Arp
Admin
· October 11 at 3:16 PM ·

Pan-ice moving down Colville River yesterday past expanding shorefast ice. Looks like air temps should be consistently below freezing this week in northern-most Alaska!

Karin Lehmkuhl Bodony and 3 others Seen by 57

Thinh Tran
October 16 at 4:39 PM ·

Pancake-ice is moving and forming thicker in the Yukon at Galena Friday afternoon 10/16.



5 1 Comment Seen by 40

Like Comment Share

Parker Thompson is in **Allakaket, Alaska**.
May 11 ·

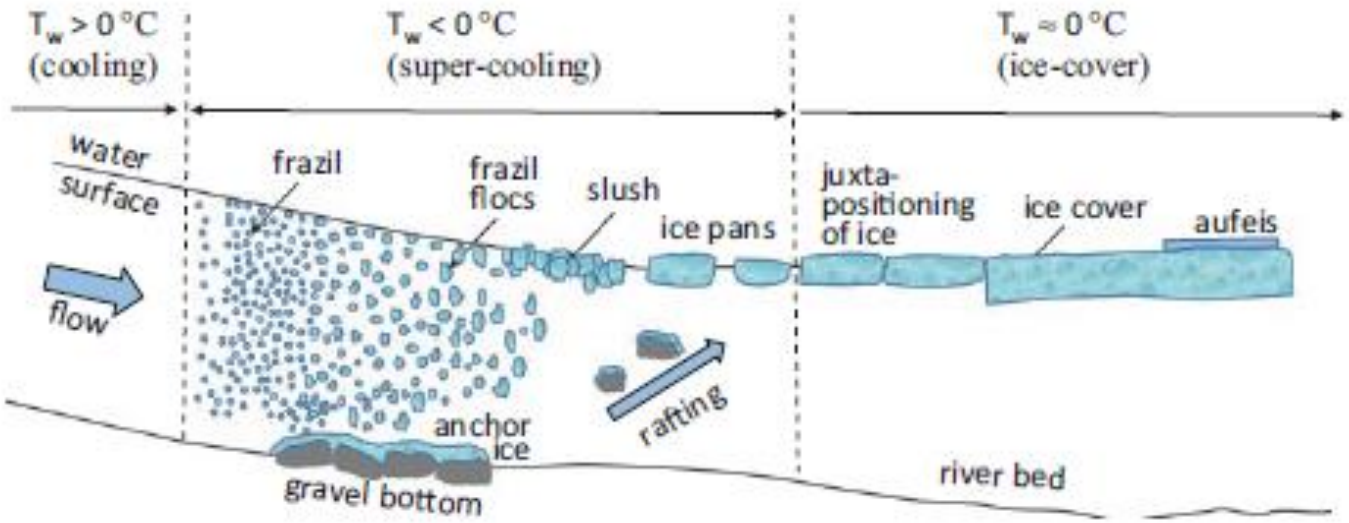
Happy Monday from the Koyukuk River. There is still a lot of ice smashed up against the bank that looks solid, but (I discovered) is not. The bulk of the ice in the middle has made its way downstream. Very calm this morning, with minimal breeze, 45 degrees in the shade. Photos and video shot at 7:30 am. Water is maybe 6-7 feet below the bank.

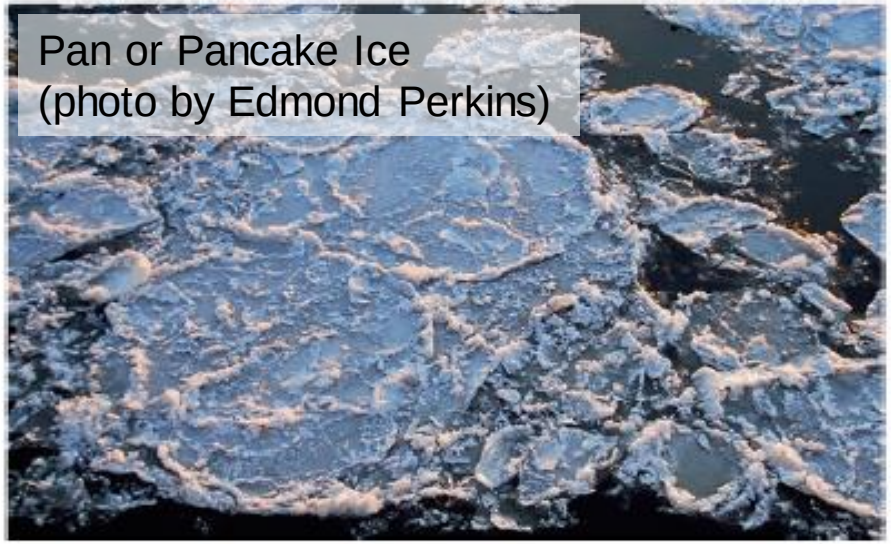

Kuskokwim_River_above_Kwethluk 2020-01-30 20:01:11 UTC
60.85811, -161.36394 12.4V -33.5°C P
Kuskokwim River above Kwethluk
30-Jan-2020
Freeze-up process:
what it signals and why it matters

Ice Types & Freeze-up on Lakes

Teshekpuk Lake - April 2016

Profile of Freeze-up in a River





Pan or Pancake Ice
(photo by Edmond Perkins)

From Lindenschmidt 2020 in *River Ice Processes and Ice Flood Forecasting*

Historical Trends in Lake and River Ice Cover in the Northern Hemisphere

Magnuson et al. 2000 *Science*

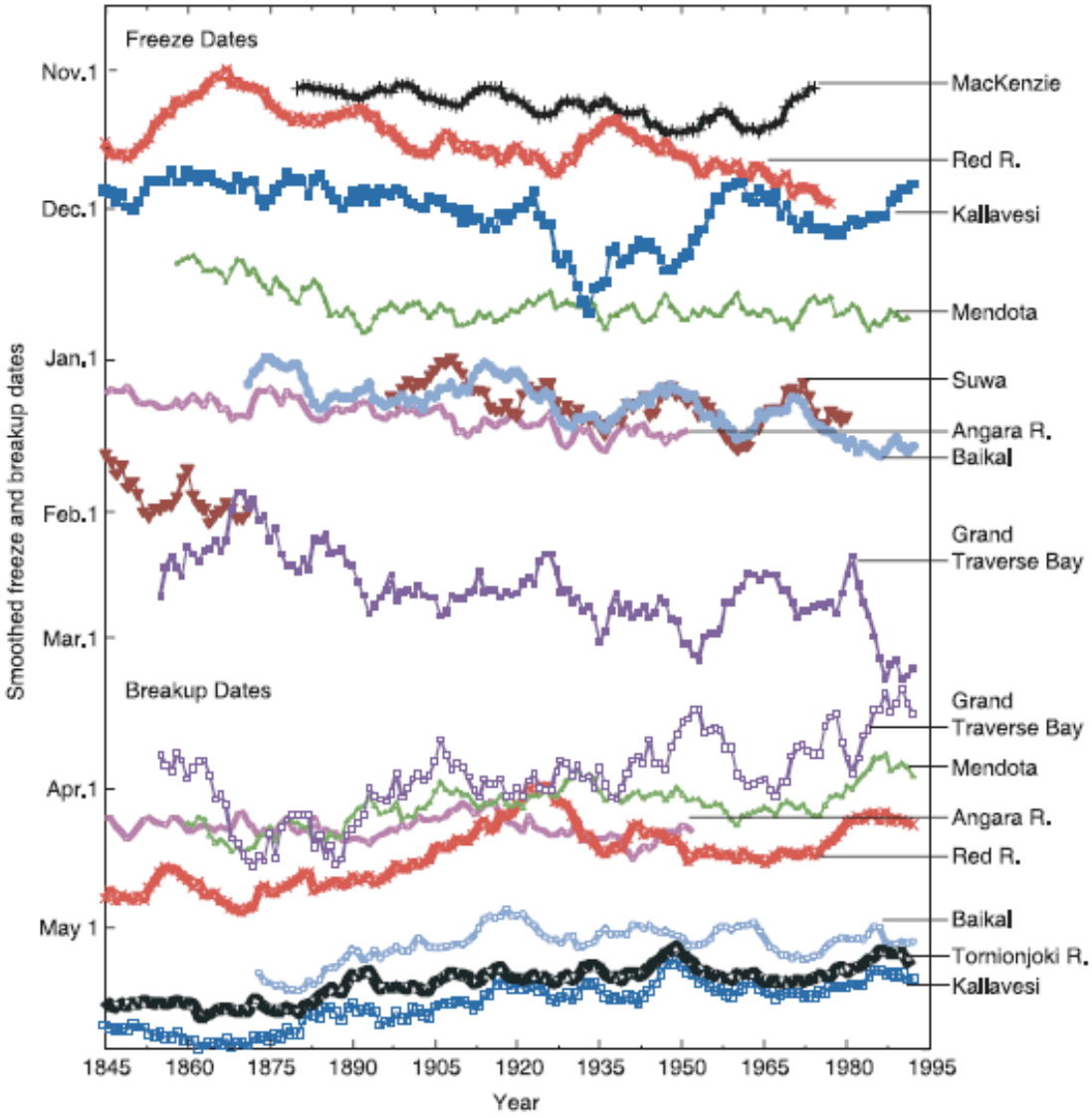


Fig. 1. Time series of freeze and breakup dates from selected Northern Hemisphere lakes and rivers (1846 to 1995). Data were smoothed with a 10-year moving average. Locations and related information are in Table 1.

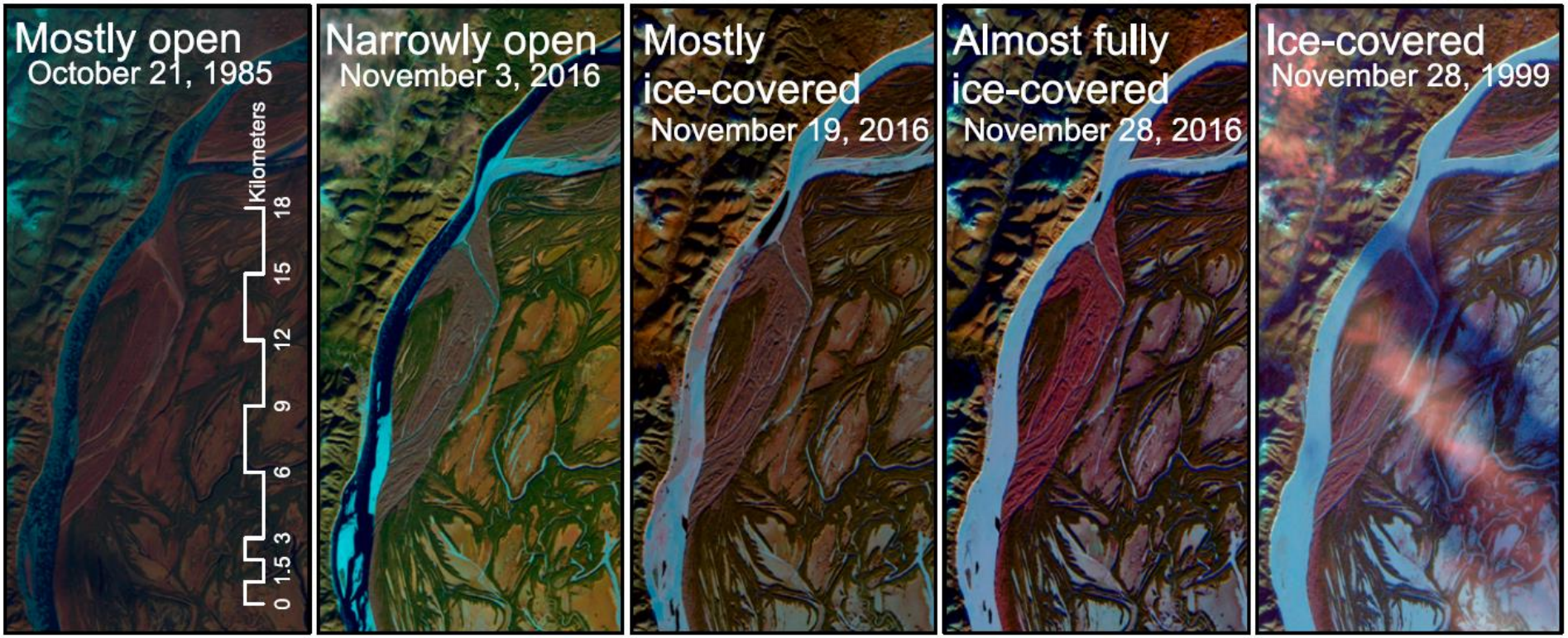
Calendar date of freezing and thawing recorded by people before direct scientific observation programs of ice (and climate in many areas)

Recorded as first day water body totally ice covered

6 day earlier freeze-up / 100 yrs translates to 1.2ºC increase air temperature / 100 yrs

Freeze-up can be a long process! How do we decide which day it happened on and does the rest of the freeze period matter?

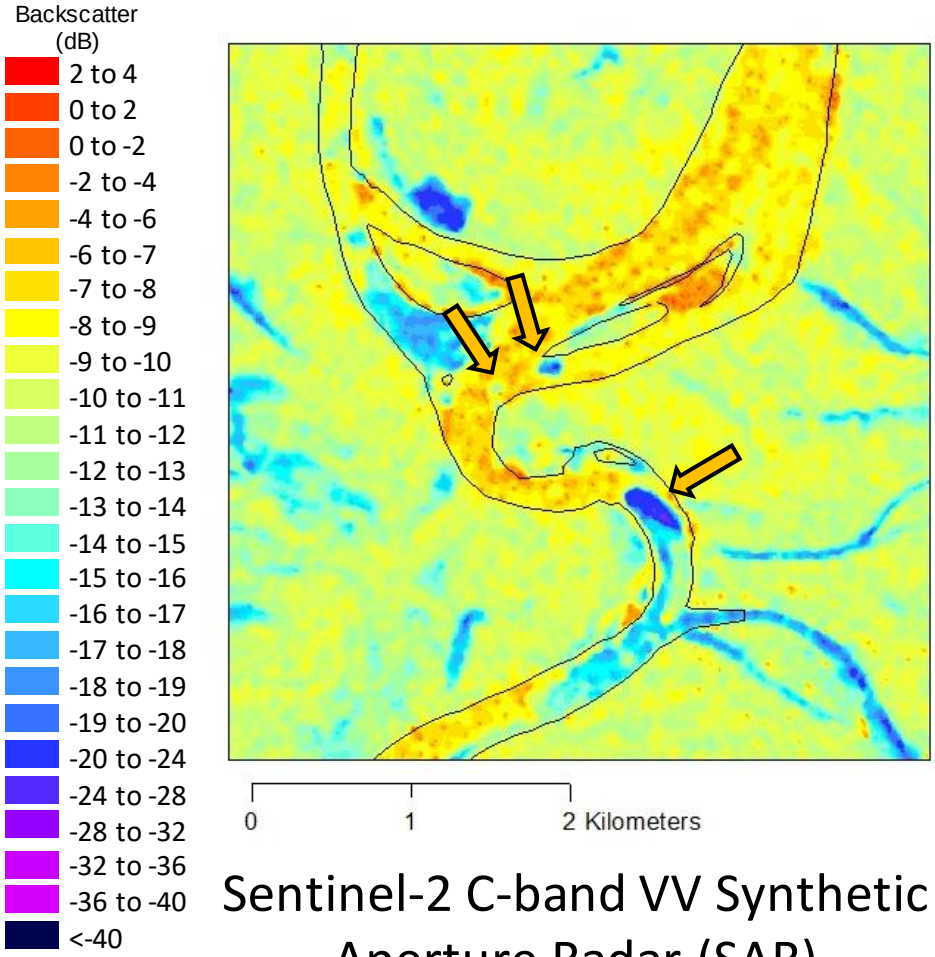
Examples of Freeze-up Sequence from Yukon River near Grayling (Landsat)



From Brown et al. 2018 & NWS Alaska Pacific River Forecast Center

Common View of Alaska from Optical Satellites (e.g. Landsat) in Winter makes Remote Sensing of Freeze-up Challenging!

Example of Detecting Open-water areas on Kuskokwim River using Satellite Radar & Aircraft Photos



Sentinel-2 C-band VV Synthetic Aperture Radar (SAR)

Engram et al. in progress

Satellite radar can image in dark & through clouds, but hard to interpret without ground-truth data!

Freeze-up timing and state in relation to how people use rivers

Kuskokwim River freeze-up causes complications for Bethel barge service

By
Greg Kim, KYUK - Bethel
-
November 7, 2019

Bethel Boat Harbor on Nov. 13, 2014. (Photo by Dean Swope)

…[barge] company's issues are due to the unpredictable freezing, thawing, and refreezing of the ice. …late freeze up this year (2019), some barge companies are trying to squeeze in some final trips.

Other river uses dependent on freeze-up sequence:

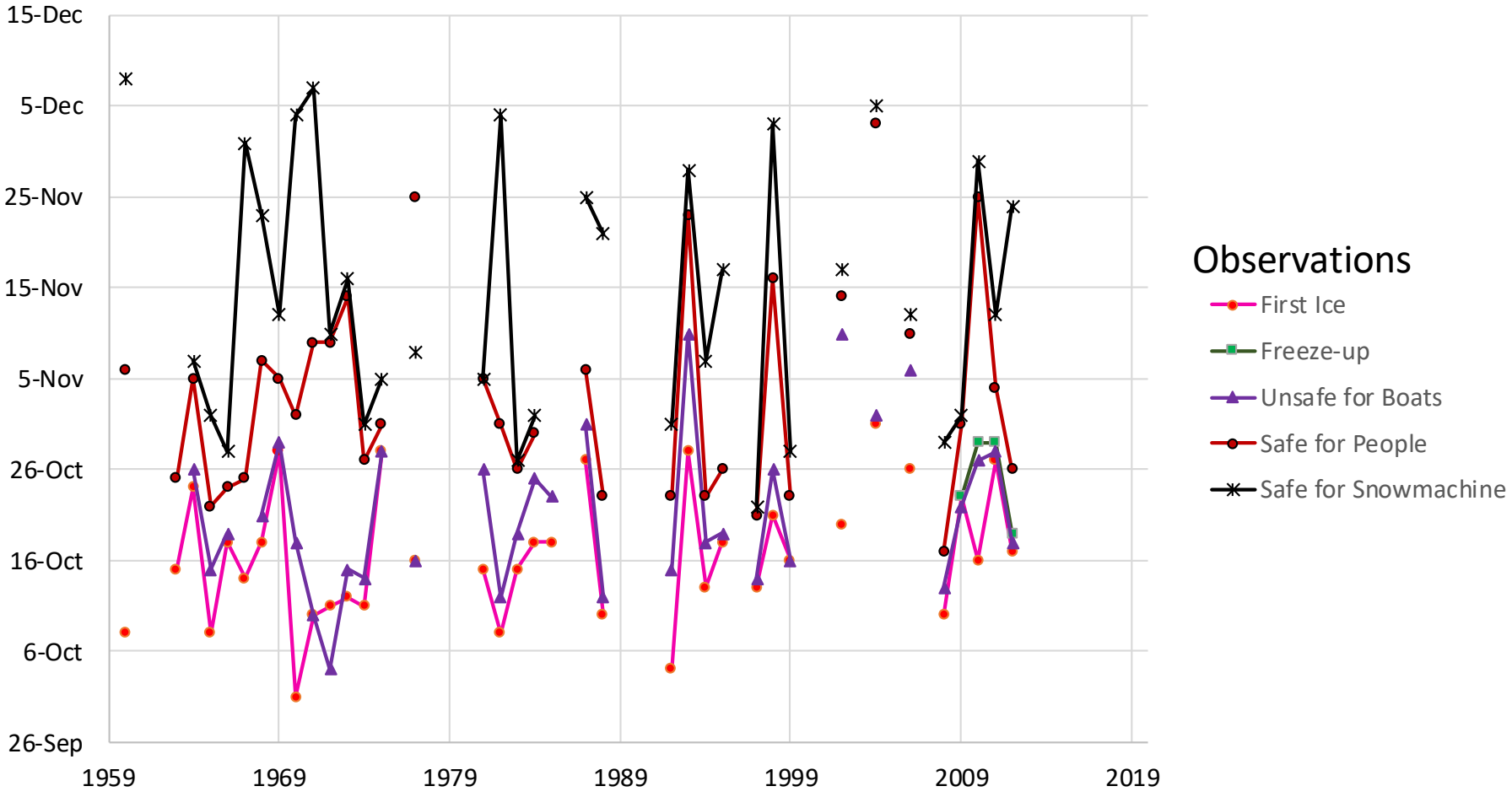
1. Ice-fishing / gillnetting
2. Hunting & trapping
3. Inter-village travel
4. Ice road construction
5. Others ?

River use during early winter probably highly dependent on river and region, level of caution / comfort, and level of knowledge of ice and the river

Freeze Up Data

Alaska-Pacific RFC
River Forecast Center

Kuskokwim River at Bethel



To Bob Berry
Compliments Jack Chute

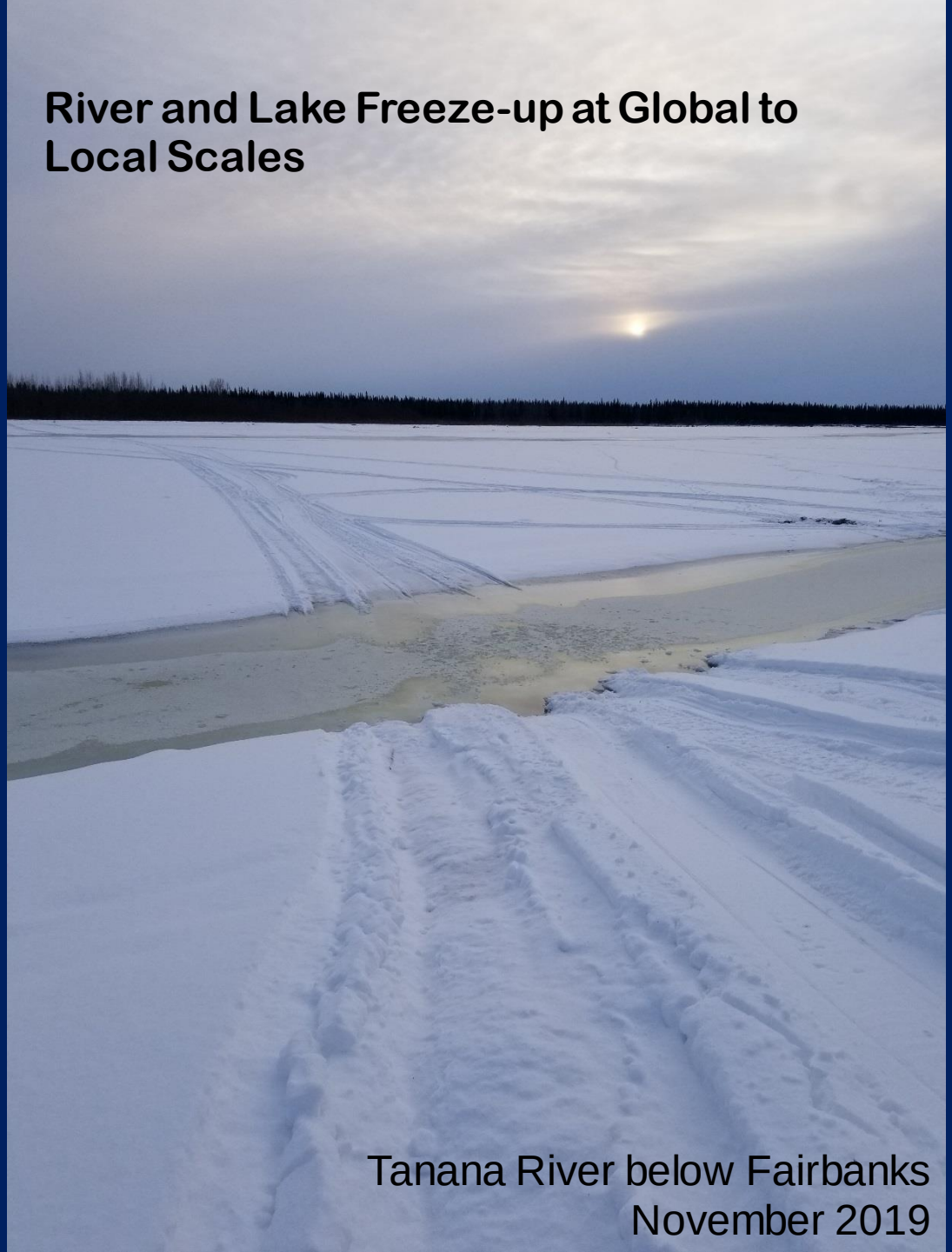
SHIPPING RECORD
for
TANANA
1905-6-7-8-9

SAMUEL 16 LARKIN ST., S. F.

DATES OF OPENING AND CLOSING OF YUKON RIVER, AT TANANA, ALASKA.

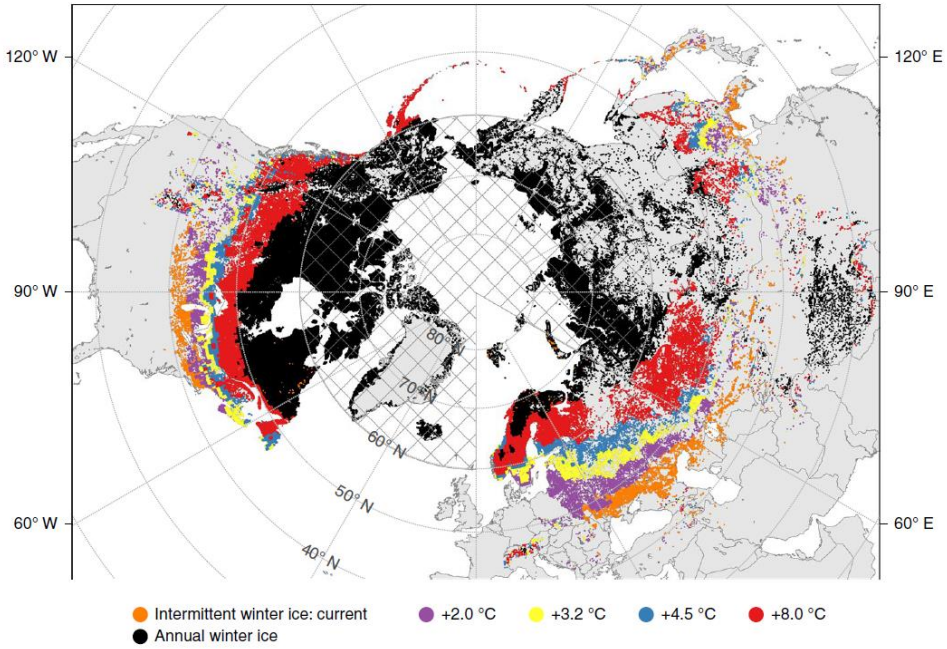
Year.	Opened.	Closed.
1900	May 8th	Oct. 30th
1901	May 24th	Nov. 3rd
1902	May 13th	Nov. 7th
1903	May 22nd	Oct. 21st
1904	May 7th	Nov. 4th
1905	May 12th	Oct. 26th
1906	May 8th	Nov. 9th
1907—Ice moved	May 6th	
1907—Ice went out	May 9th	Oct. 27th
1908—Ice moved	May 11th	
1908—Ice went out	May 16th	Oct. 27th
1909—Ice went out	May 15th	Nov. 3rd

River and Lake Freeze-up at Global to Local Scales



Tanana River below Fairbanks
November 2019

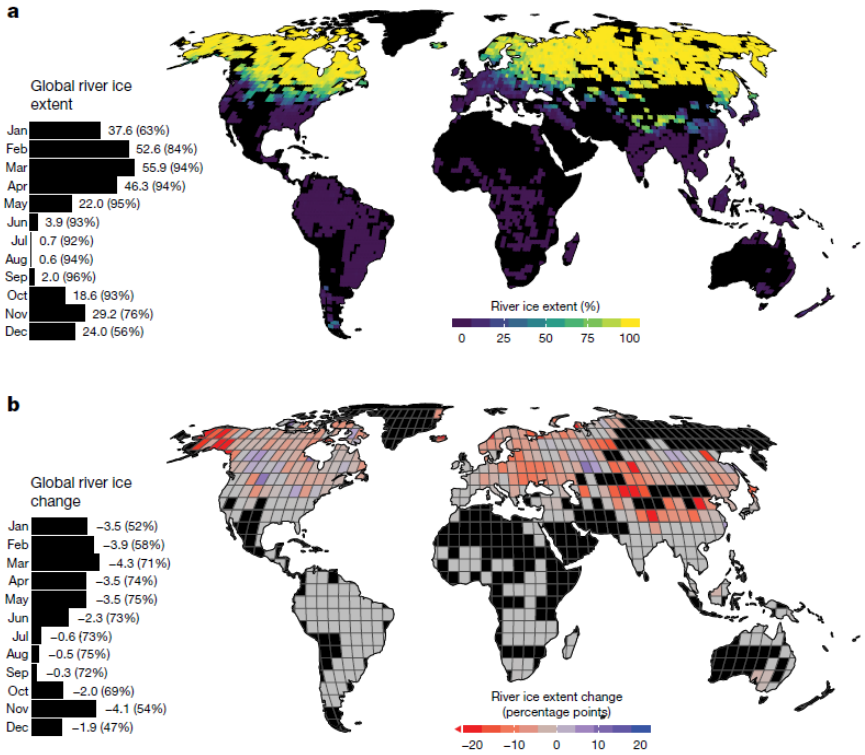
Widespread loss of lake ice around the Northern Hemisphere in a warming world



Sharma et al. 2019 *Nature Climate Change*

Shift from lakes with reliable ice every winter to ice in some years, but not others … based on statistical models and projections of climate change

The past and future of global river ice



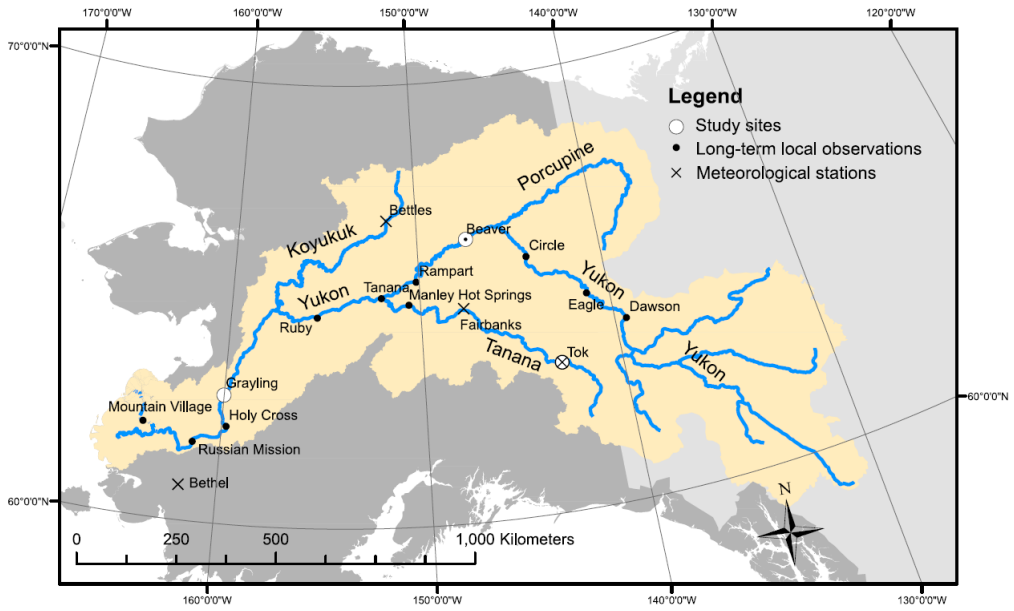
River ice cover duration declined from 1984 to 2019 based on satellite data and projected to decline 17 day / year by end of 2100

Yang et al. 2020 *Science*

Trends in freeze-up date based on local observations

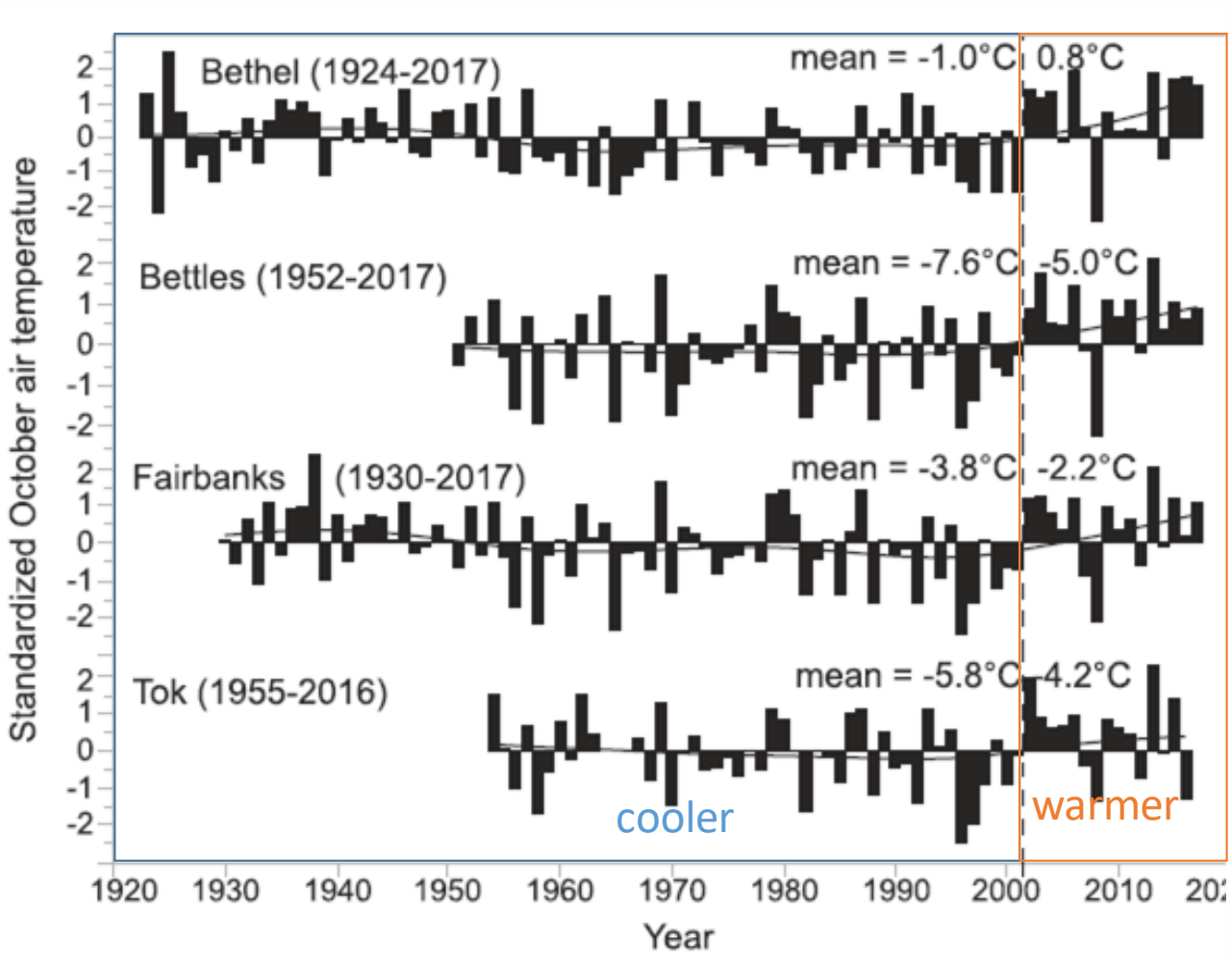
Trend towards later freeze-up

Site	Range of years	*n*
Tanana River at Manley Hot Springs	1911–2011	39
Yukon River at Beaver	1940–82	30
Yukon River at Circle	1901–2009	27
Yukon River at Eagle	1968–2012	38
Yukon River at Holy Cross	1901–81	42
Yukon River at Mountain Village‡	1937–2001	33
Yukon River at Rampart	1901–81	26
Yukon River at Ruby‡	1911–2011	46
Yukon River at Russian Mission	1928–2000	36
Yukon River at Tanana	1901–99	49



Brown et al. 2018
Weather, Climate, and Society
Changing river ice seasonality and impacts on interior Alaska communities

Changes in October air temperature



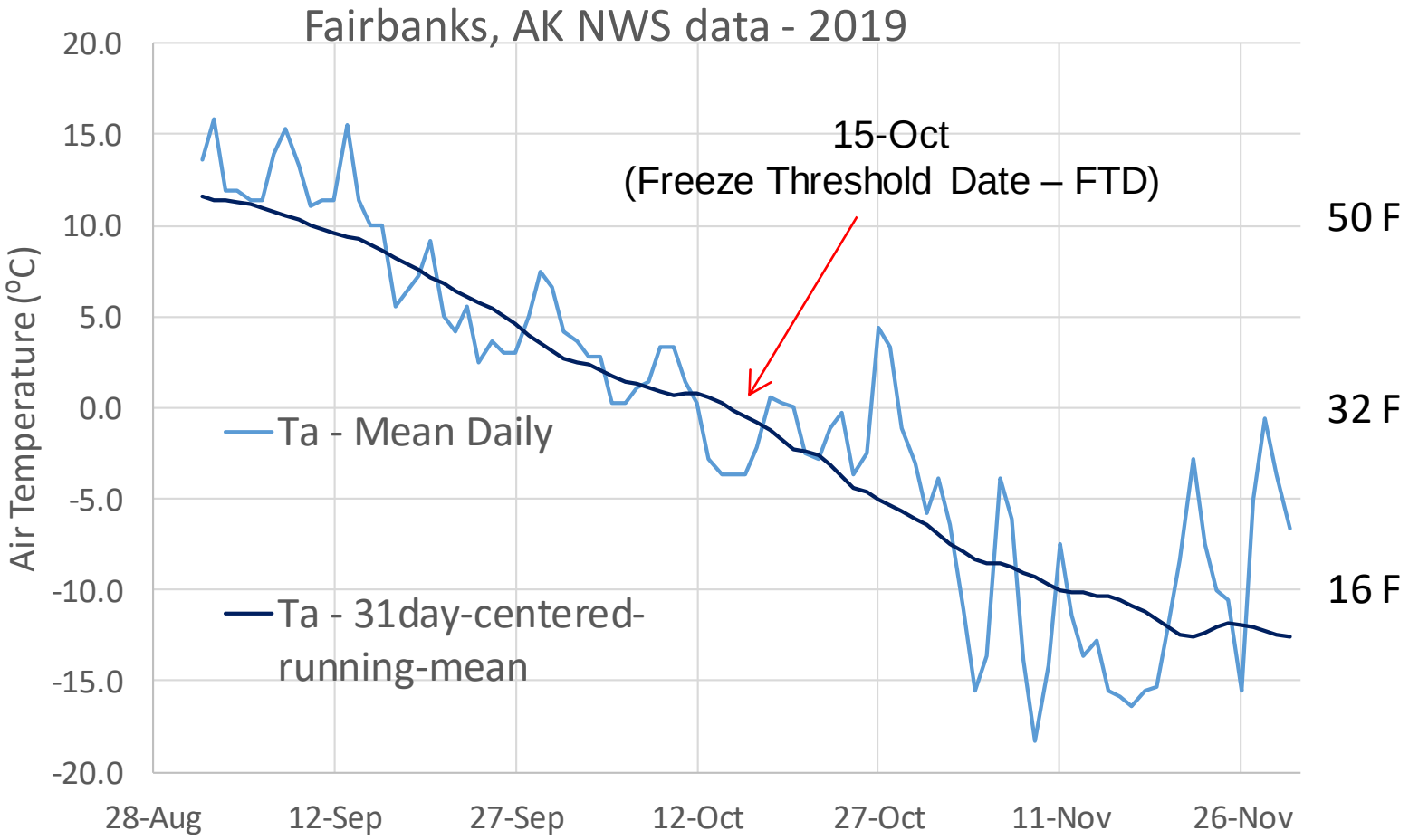
Brown et al. 2018
Weather, Climate, and Society
Changing river ice seasonality and impacts on interior Alaska communities


Colville_River_at_Ocean_Point 2020-10-07 20:01:18 UTC
70.07149, -151.38371 12.6V -2.5°C PL
Colville River above Nuiqsut
7-Oct-2020
2020 Freeze-up in Context

NATIONAL WEATHER SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

THE ALASKA CLIMATE RESEARCH CENTER

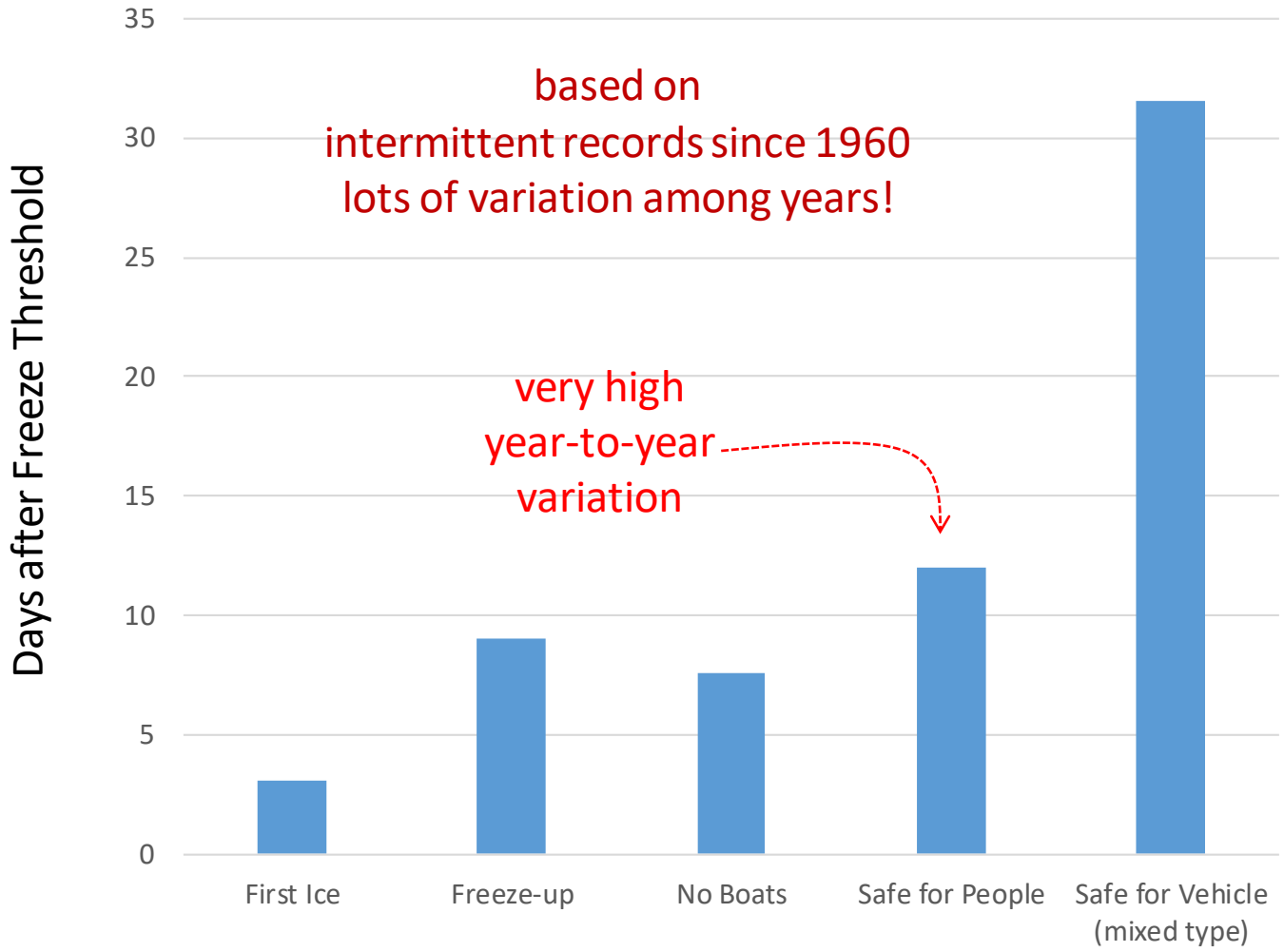
http://akclimate.org/

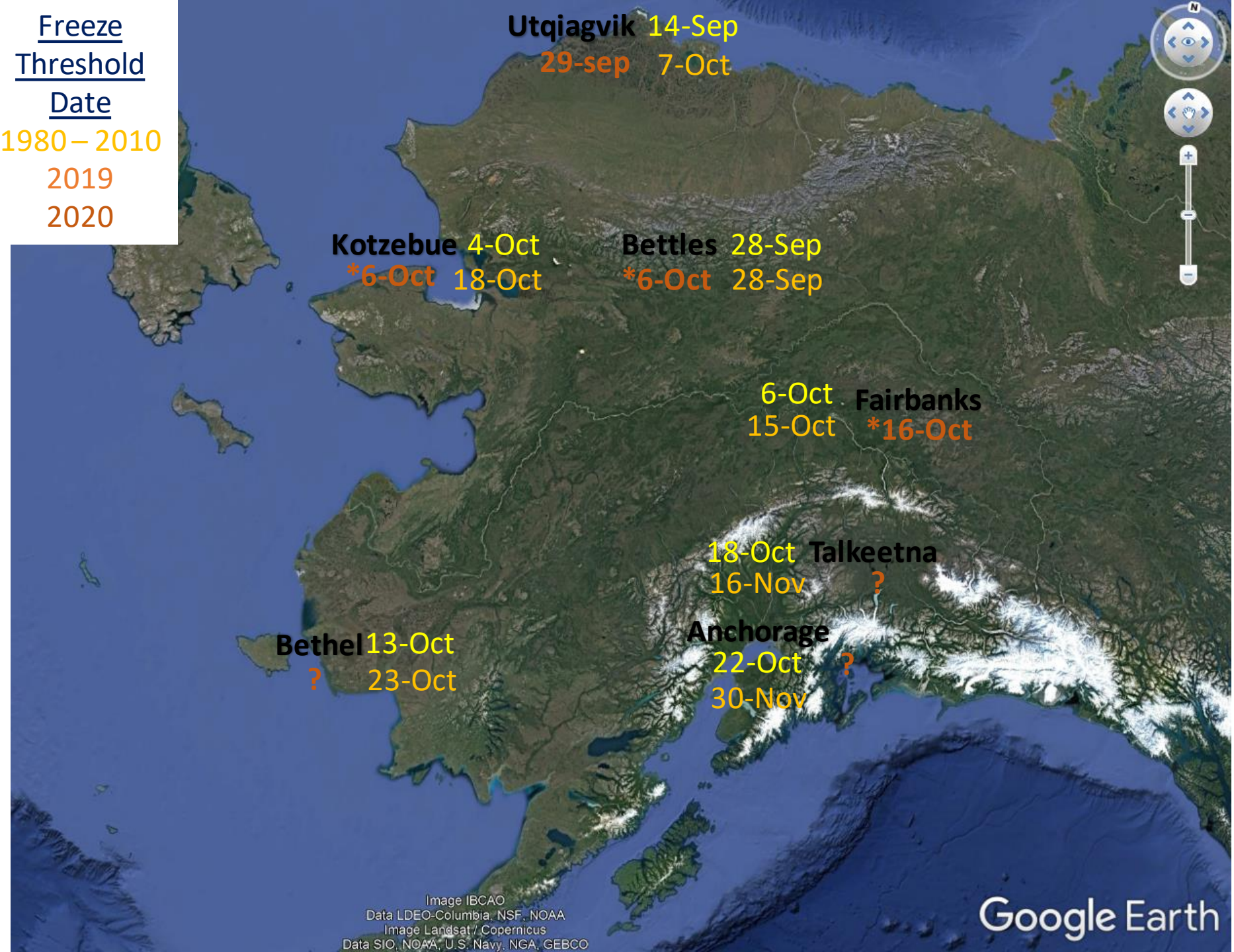


Reference Period (1980-2010) Last Year (2019) This Year (2020)*

What does Freezing Threshold Date mean for ice and people using it?

Example from NWS Alaska River Forecast Center data on Kuskokwim River in Bethel




Freeze Threshold Date
1980 – 2010
2019
2020
Utqiagvik 14-Sep
29-sep 7-Oct
Kotzebue 4-Oct
*6-Oct 18-Oct
Bettles 28-Sep
*6-Oct 28-Sep
6-Oct
15-Oct
Fairbanks
*16-Oct
18-Oct Talkeetna
16-Nov ?
Anchorage
22-Oct ?
30-Nov
Bethel 13-Oct
? 23-Oct
Image IBCAO
Data LDEO-Columbia, NSF, NOAA
Image Landsat / Copernicus
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google Earth

REAL-TIME DATA

http://fresheyesonice.org/realtime-data/

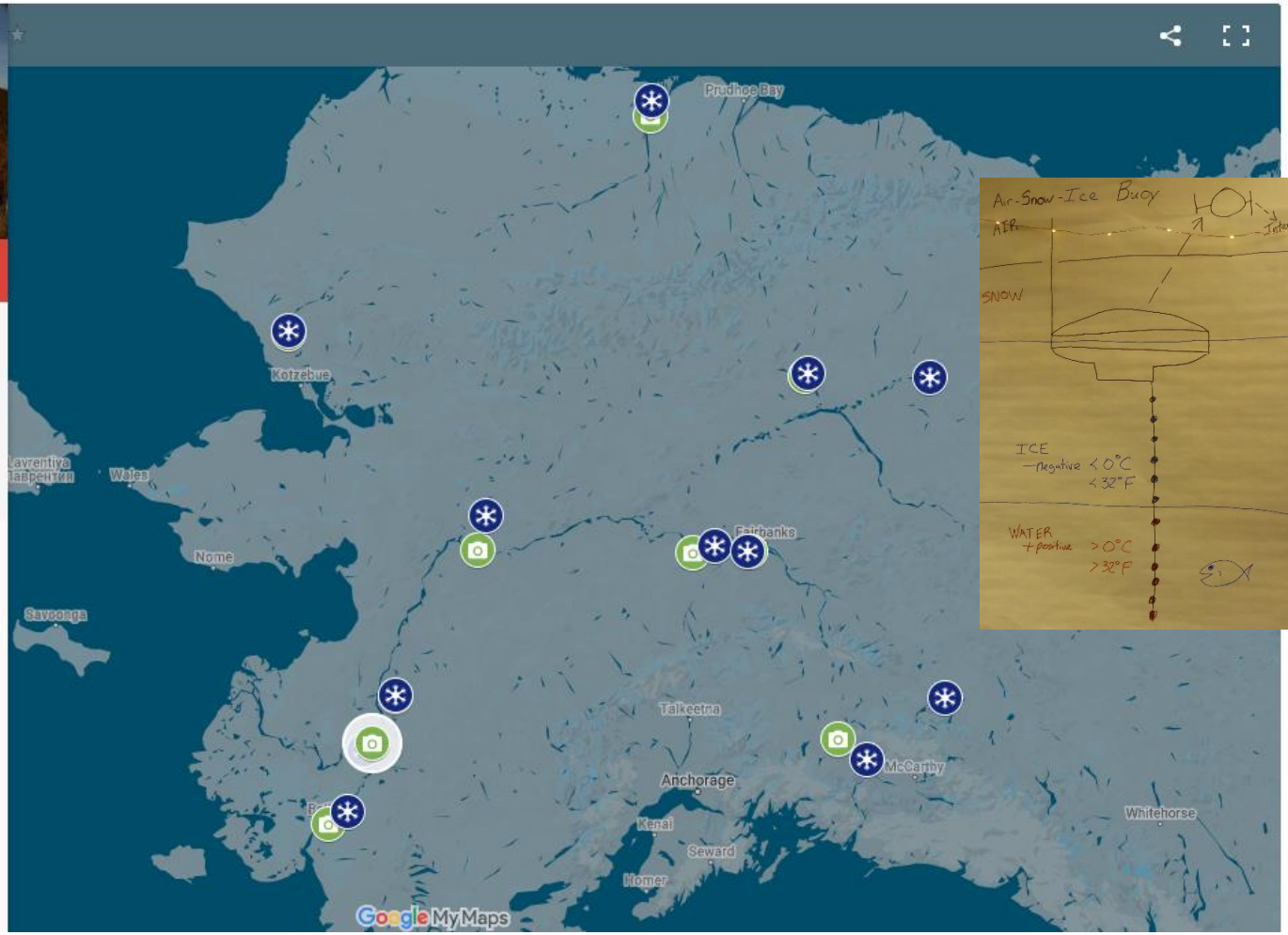
River Ice Cameras Views (updated daily)

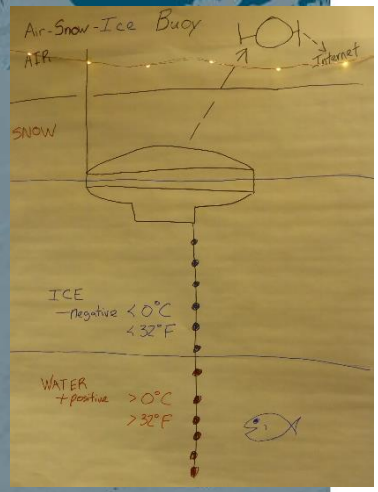
Ice Thickness & Air-Water-Snow Temperature Data (time-series & monthly summaries)

Yukon River at Paimute

name
Yukon River at Paimute

description
http://fresheyesonice.org/realtime-data/river-ice-camera/#a1504



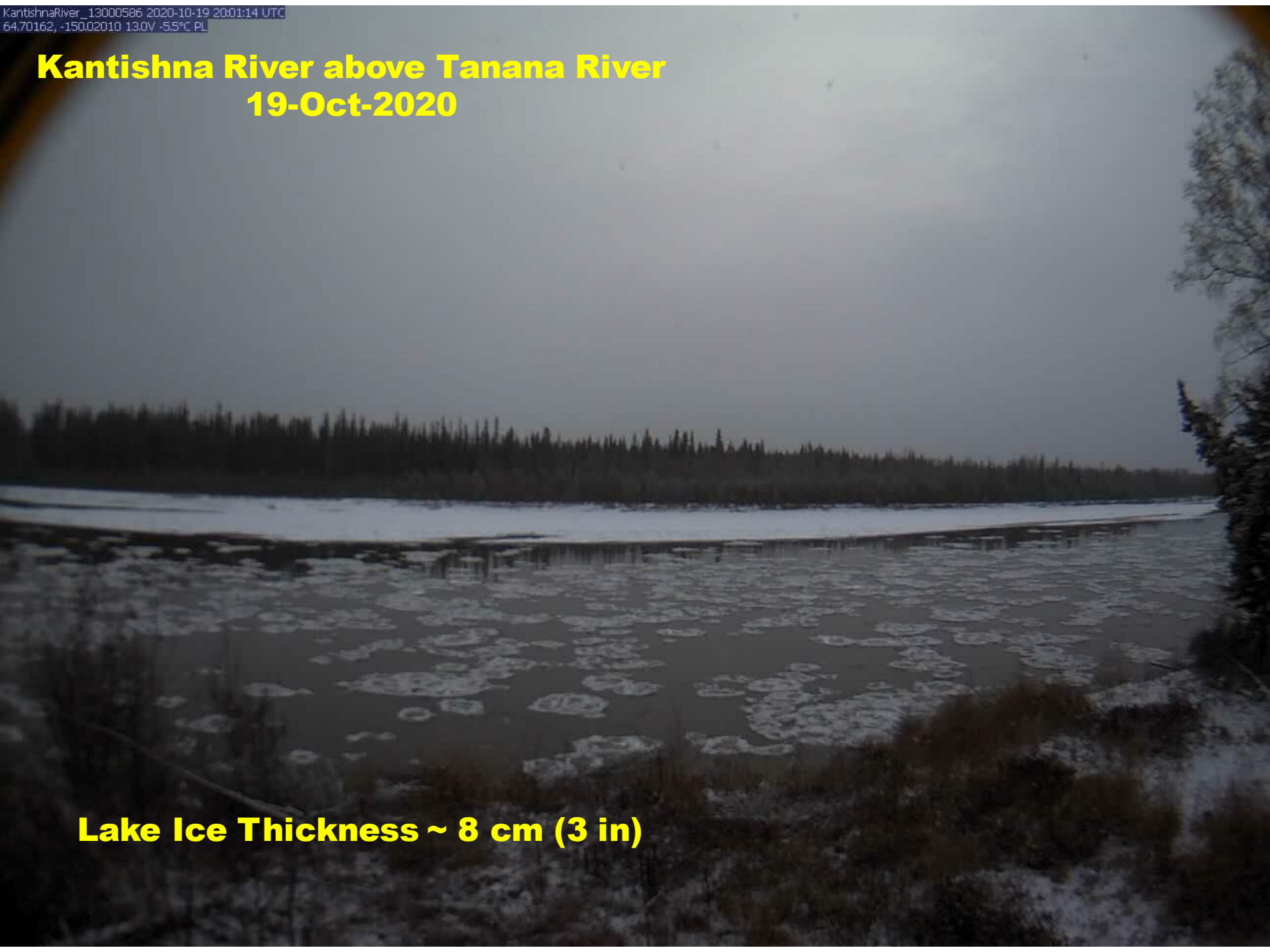



Colville_River_at_Ocean_Point 2020-10-18 20:01:17 UTC
70.07146, -151.38371 12.3V -9.0°C PL
Colville River above Nuiqsut
18-Oct-2020
Lake Ice Thickness ~ 20 cm (7 in)


Noatak_River_below_Noatak 2020-10-19 20:01:10 UTC
67.51710, -163.01585 12.3V -1.0°C P
Noatak River below Noatak
19-Oct-2020
Lake Ice Thickness ~ 8 cm (3 in)


YukonRiver_at_Paimute_13000603 2020-10-17 20:01:18 UTC
61.96329, -160.31508 13.5V 10°C PL
Yukon River below Holy Cross
15-Oct-2020
Lake Ice Thickness ~ no ice


Kuskokwim_River_above_Napaskiak 2020-10-17 20:01:09 UTC
60.71916, -161.73460 13.3V 2.5°C P
Kuskokwim River above Napaskiak
17-Oct-2020
Lake Ice Thickness ~ no ice


KantishnaRiver_13000586 2020-10-19 20:01:14 UTC
64.70162, -150.02010 13.0V -5.5°C PL
Kantishna River above Tanana River
19-Oct-2020
Lake Ice Thickness ~ 8 cm (3 in)

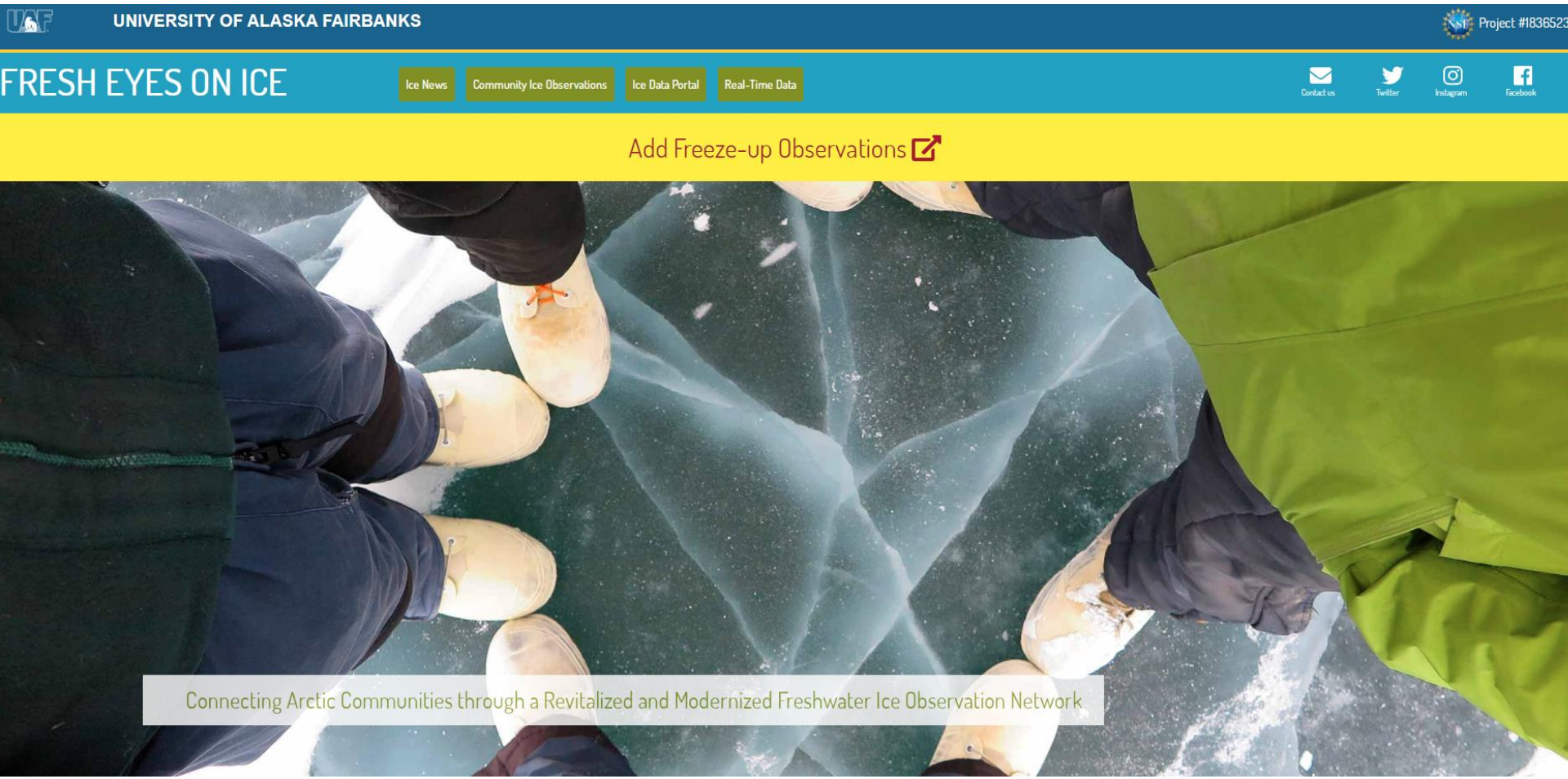

Copper_River_Below_Tazlina 2020-10-19 20:01:15 UTC
62.02458, -145.37383 12.9V -6.5°C PL
Copper River above Copper Center
19-Oct-2020
Lake Ice Thickness – no ice

Your observations matter

How can you contribute this freeze-up season?

Ways to report observations:

- Fresh Eyes on Ice Photo Portal
- NWS River Watch Form
- LEO Post
- Fresh Eyes on Ice Facebook



freshEyesonice.org

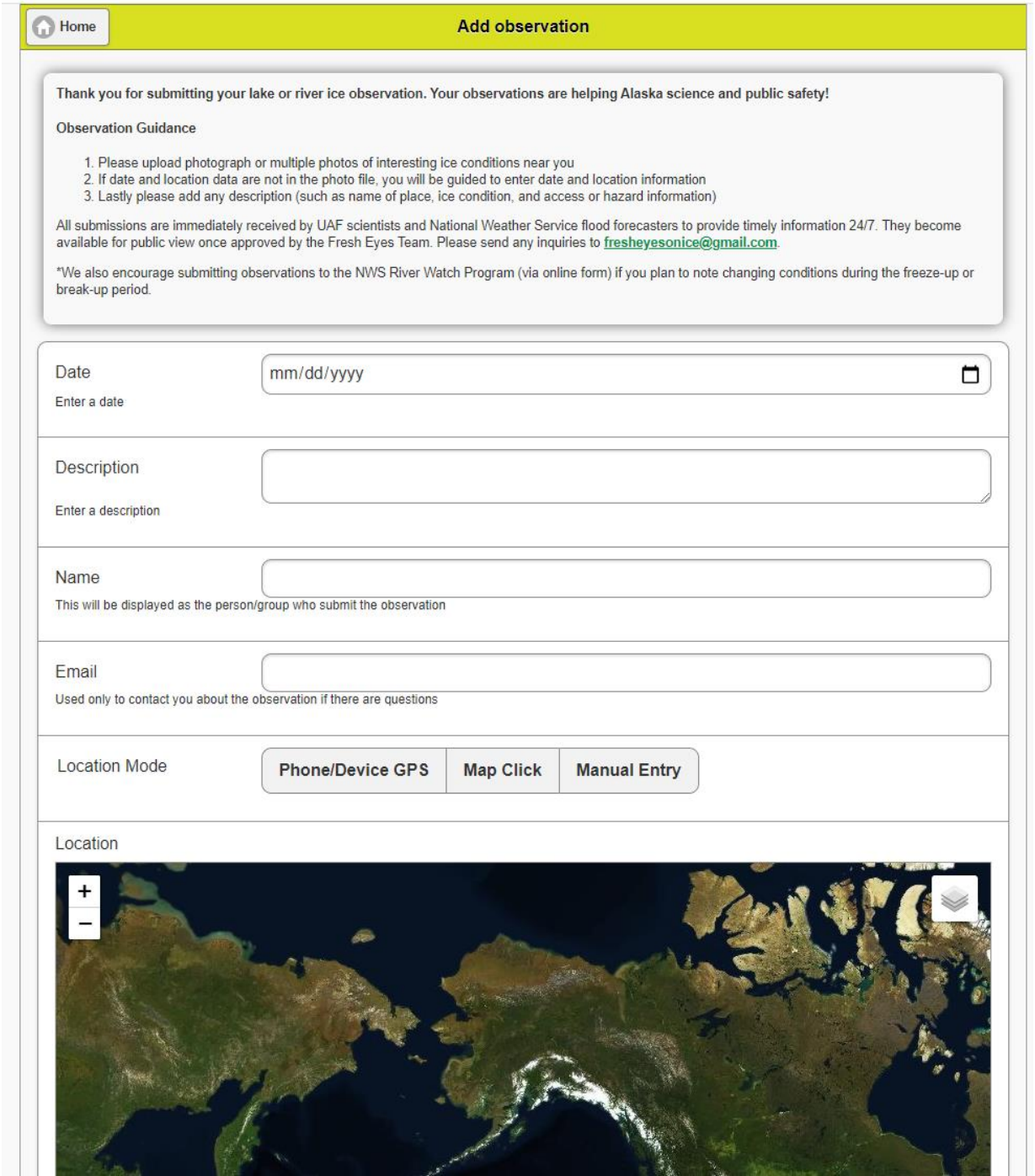
Ways to report freeze-up observations

1

UAF Fresh Eyes on Ice

Photo Observation Portal

Fresheyesonice.org



Latitude

In decimal degrees - please convert from other formats using https://www.fcc.gov/media/radio/dms-decimal

Longitude

In decimal degrees - please convert from other formats using https://www.fcc.gov/media/radio/dms-decimal

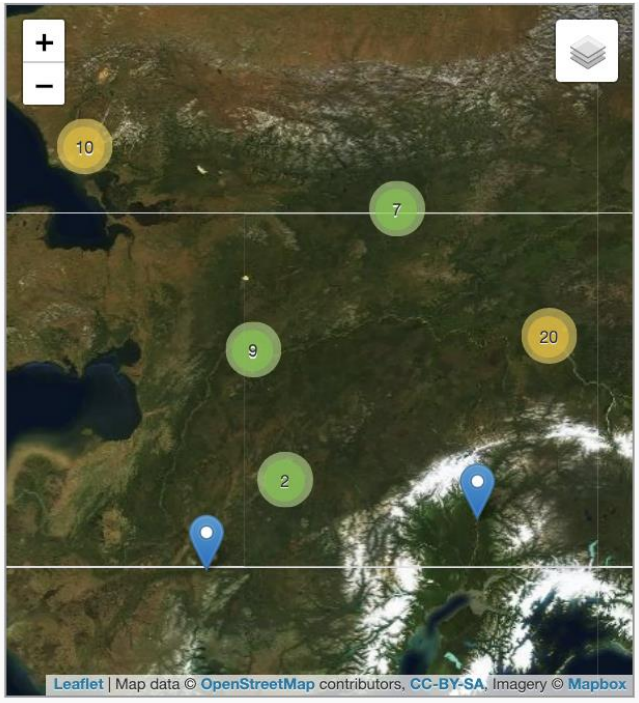
Photos

No Image Photo Choose File No file chosen

No Image Photo Choose File No file chosen

Add Photos

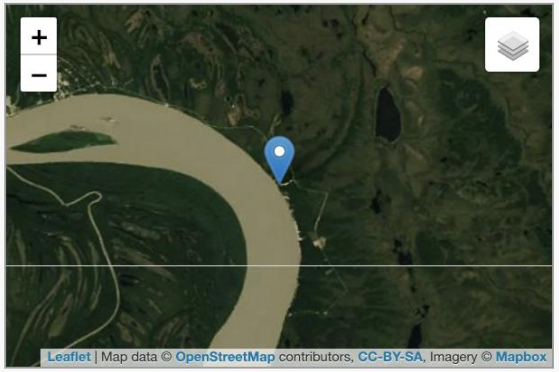
Back **Submit**



Home

Observation at 2020-04-26 by Karin Bodony

Observation at 2020-04-26 by Karin Bodony



Date	2020-04-26
Description	Yukon River just above Galena (Beaver Creek mouth). Ice has lifted eliminating surface ponding. Small moat forming on edges. Outflow from Beaver Creek has remained fairly steady this week.
Name	Karin Bodony
Location Mode	Map Click
Latitude	64.718796
Longitude	-156.75075

Photo

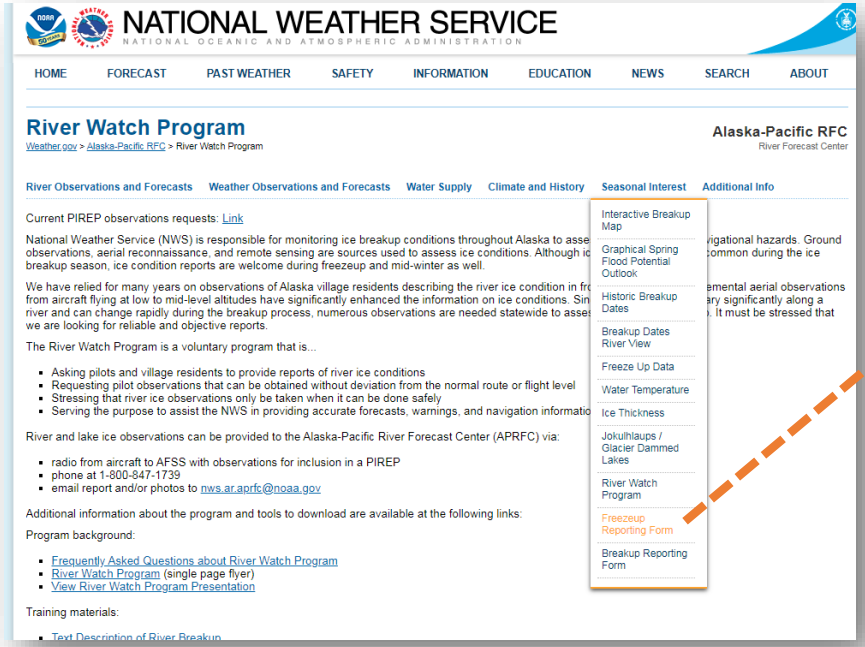
- **Photo Latitude:** N/A
- **Photo Longitude:** N/A
- **Photo DateTime:** N/A
- **Photo Google Maps:** N/A

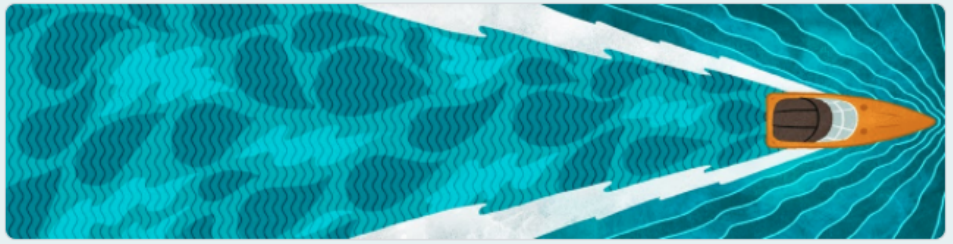
Ways to report
freeze-up observations

2

NWS River Watch

https://www.weather.gov/aprfc/RiverWatchProgram





Freeze-up Form for Alaska Rivers

We at the Alaska-Pacific River Forecast Center request your assistance in obtaining information on freeze-up on rivers and lakes in your area. We would appreciate it if you would answer the questions below that are applicable to your area, to the best of your knowledge. If you have any comments concerning the freeze-up, please put them in remarks. Your help contributes to a more complete record of ice data for Alaska and is greatly appreciated.

River and location???

Your answer

Date of first ice?

Date

mm/dd/yyyy

Date boating became impossible?

Date

mm/dd/yyyy

Date of freeze-up?

Date

Freeze Up Data

Alaska-Pacific RFC
River Forecast Center

River/Location: Black River at Chalkyitsik (8)

Select a River/Location from the dropdown menu. The number in parenthesis indicated the number of records available for that site.

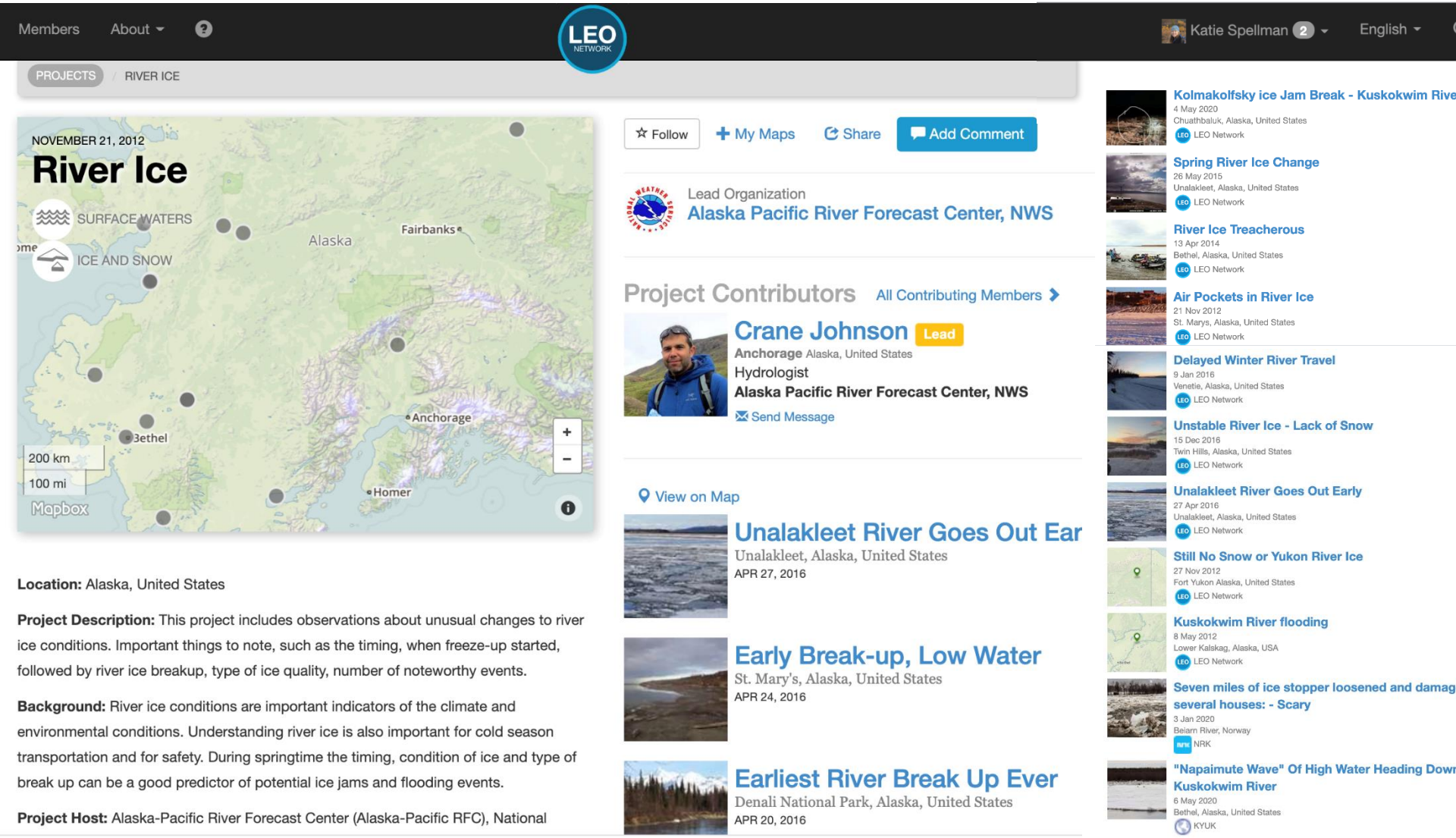
Year	River/Location	First Ice	Freeze Up	Unsafe for Boats	Safe for People	Safe for Vehicle	Type of Vehicle	Remarks
2010	Black River at Chalkyitsik	2010-09-26	2010-10-10	2010-10-05	2010-10-12	2010-10-18	snowmachine	
2009	Black River at Chalkyitsik	2009-10-01	2009-10-12	2009-10-08	2009-10-11	2009-11-08	snowmachine	Freezeup form completed 11-08.
1982	Black River at Chalkyitsik	1982-10-12	null	1982-10-08	1982-10-14	1982-10-14	snowmachine	
1978	Black River at Chalkyitsik	1978-10-03	null	1978-10-04	1978-10-10	1978-10-18	snowmachine	
1977	Black River at Chalkyitsik	1977-10-11	null	null	1977-10-13	1977-10-18	snowmachine	
1975	Black River at Chalkyitsik	1975-10-09	null	null	null	null		
1974	Black River at Chalkyitsik	1974-10-02	null	null	1974-10-07	1974-10-12	snowmachine	
1972	Black River at Chalkyitsik	1972-09-30	null	null	1972-10-15	1972-10-30		

Ways to report freeze-up observations

3

LEO Network Post

https://www.leonetwork.org/



Location: Alaska, United States

Project Description: This project includes observations about unusual changes to river ice conditions. Important things to note, such as the timing, when freeze-up started, followed by river ice breakup, type of ice quality, number of noteworthy events.

Background: River ice conditions are important indicators of the climate and environmental conditions. Understanding river ice is also important for cold season transportation and for safety. During springtime the timing, condition of ice and type of break up can be a good predictor of potential ice jams and flooding events.

Project Host: Alaska-Pacific River Forecast Center (Alaska-Pacific RFC), National

Ways to report freeze-up observations

4

Join Fresh Eyes on Ice Facebook group

Fresh Eyes on Ice

Public group · 119 members

+ Invite

Amanda B Young
October 12 at 3:06 PM ·

Over the past three days Toolik Lake has gone from being mostly open to mostly covered with ice!

5 Seen by 50

Like Comment Share

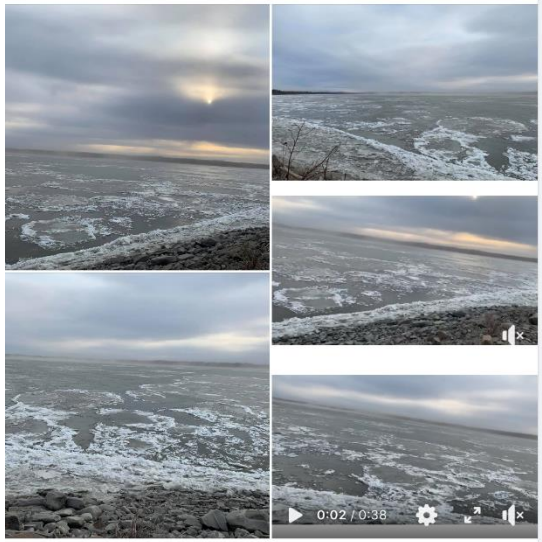
Christopher Douglas Arp
Admin
· October 11 at 3:16 PM ·

Pan-ice moving down Colville River yesterday past expanding shorefast ice. Looks like air temps should be consistently below freezing this week in northern-most Alaska!

Karin Lehmkuhl Bodony and 3 others Seen by 57

Thinh Tran
October 16 at 4:39 PM ·

Pancake-ice is moving and forming thicker in the Yukon at Galena Friday afternoon 10/16.



5 1 Comment Seen by 40

Like Comment Share

Parker Thompson is in **Allakaket, Alaska**.
May 11 ·

Happy Monday from the Koyukuk River. There is still a lot of ice smashed up against the bank that looks solid, but (I discovered) is not. The bulk of the ice in the middle has made its way downstream. Very calm this morning, with minimal breeze, 45 degrees in the shade. Photos and video shot at 7:30 am. Water is maybe 6-7 feet below the bank.

Thank you!

Chris Arp
UAF Water and Environmental Research Center
cdarp@alaska.edu

Katie Spellman
UAF International Arctic Research Center
klspellman@alaska.edu

More Detailed Information on Current Ice and Weather in the Context of Historic Conditions around Alaska
(for serious ice / weather nerds!)

NATIONAL WEATHER SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

HOME | FORECAST | PAST WEATHER | SAFETY | INFORMATION | EDUCATION | NEWS | SEARCH | ABOUT

Go
View Location Examples
Your local forecast office is
Fairbanks, AK

Hurricane Delta Likely to Approach Gulf Coast Friday; Mainly Tranquil Weather Elsewhere

Hurricane Delta will move northward across the Gulf of Mexico and will likely approach the Louisiana coastline by late Friday with dangerous winds, life-threatening storm surge, heavy rainfall, and flooding. The remainder of the country will experience mainly tranquil conditions, although some showers and thunderstorms are expected from the Great Lakes into the Northeast through Thursday. Read More >

En Español | Share

Current conditions at
Fairbanks, Fairbanks International Airport (PAFA)
Lat: 64.8°N Lon: 147.88°W Elev: 433ft.

Patches Fog
42°F
6°C

Humidity	85%
Wind Speed	NE 7 mph
Barometer	29.81 in (1009.9 mb)
Dewpoint	38°F (3°C)
Visibility	10.00 mi
Wind Chill	38°F (3°C)
Last update	7 Oct 11:53 am AKDT

More Information:
Local Forecast Office
More Local Wx
3 Day History
Mobile Weather
Hourly Weather Forecast

Extended Forecast for
Westgate AK

This Afternoon	Tonight	Thursday	Thursday Night	Friday	Friday Night	Saturday	Saturday Night	Sunday
Areas Fog	Mostly Cloudy	Mostly Sunny	Partly Cloudy	Mostly Sunny	Partly Cloudy	Mostly Sunny then Slight Chance Rain	Slight Chance Rain/Snow then Chance Snow	Chance Rain/Snow then Chance Rain
High: 49 °F	Low: 33 °F	High: 50 °F	Low: 31 °F	High: 48 °F	Low: 30 °F	High: 44 °F	Low: 28 °F	High: 42 °F

Detailed Forecast

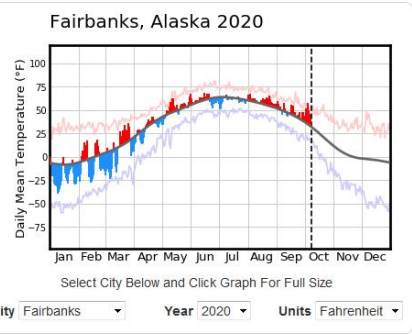
This Afternoon	Areas of fog before 1pm. Otherwise, mostly sunny, with a high near 49. East wind 5 to 10 mph.
Tonight	Mostly cloudy, with a low around 33. Northeast wind 5 to 10 mph.
Thursday	Mostly sunny, with a high near 50. East wind around 5 mph.

Topographic
Click Map For Forecast

THE ALASKA CLIMATE RESEARCH CENTER

Home | Climate | Weather | Products | Tourist's Information | Contact | About | Search

...u may still visit our archived old website here.



Select City Below and Click Graph For Full Size

City Fairbanks Year 2020 Units Fahrenheit

UAF Campus

Time stamp	Temp.	Press.	Rel. Hum.	Wind speed	Wind Dir
10/7/2020, 12:30:00 PM	6.2°C 43.1°F	983.9hPa 29.1inHg	85.7%	1.6m/s 3.7mph	31.4° NE

...ews

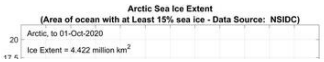
...K wildfire information and smoke forecasts

The Alaska wildfire activity almost ceased with the onset of more rainy weather in July. The UAF smoke page provides information on current fires as well as smoke forecasts.

Read more

...rctic Sea Ice Extent: October 1, 2020

October 1, 2020: Over the past week the sea ice has increased from the ...value last week by 6.87% from the level on 9/24/2020 of 4.118 M km² to 4.422 M km².

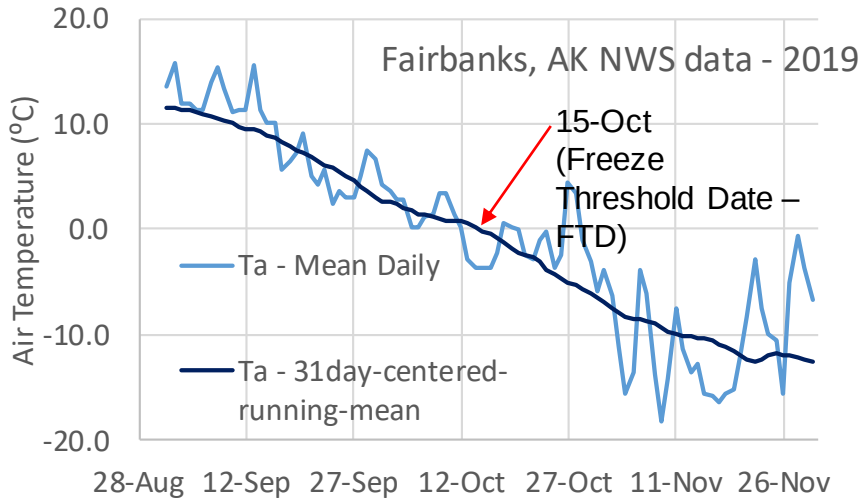


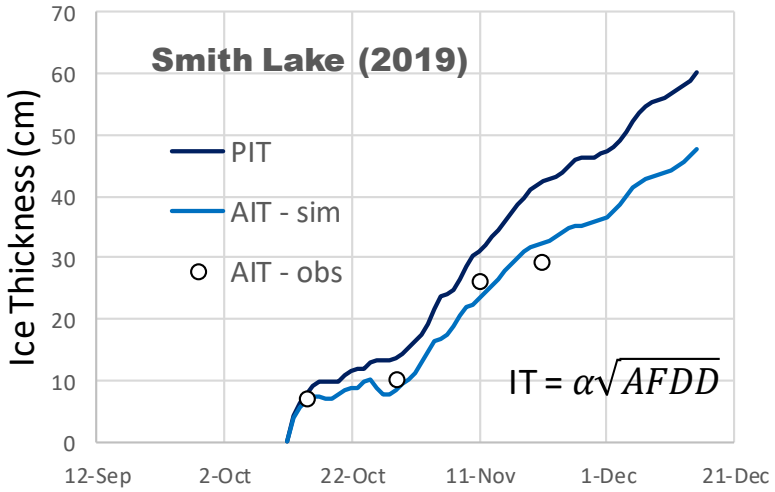
Spotlight on Climate

Annual Summary Report 2019
2019 Alaska Climate Summary
Statewide 2019 Year in Review

- New temperature records were set: 2019 was the warmest year in Alaska since 1949, with a mean temperature of 37.4 °F, breaking the previous record set ... departures ...
- The Panha ... the most significant drought conditions observed over Southeast Alaska in ...

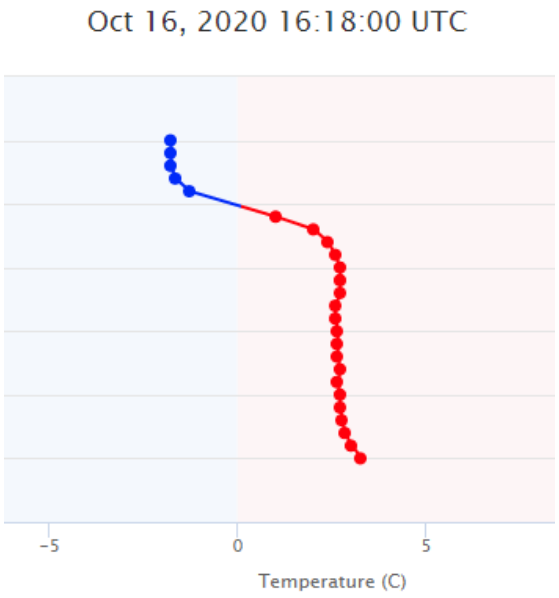
http://akclimate.org/





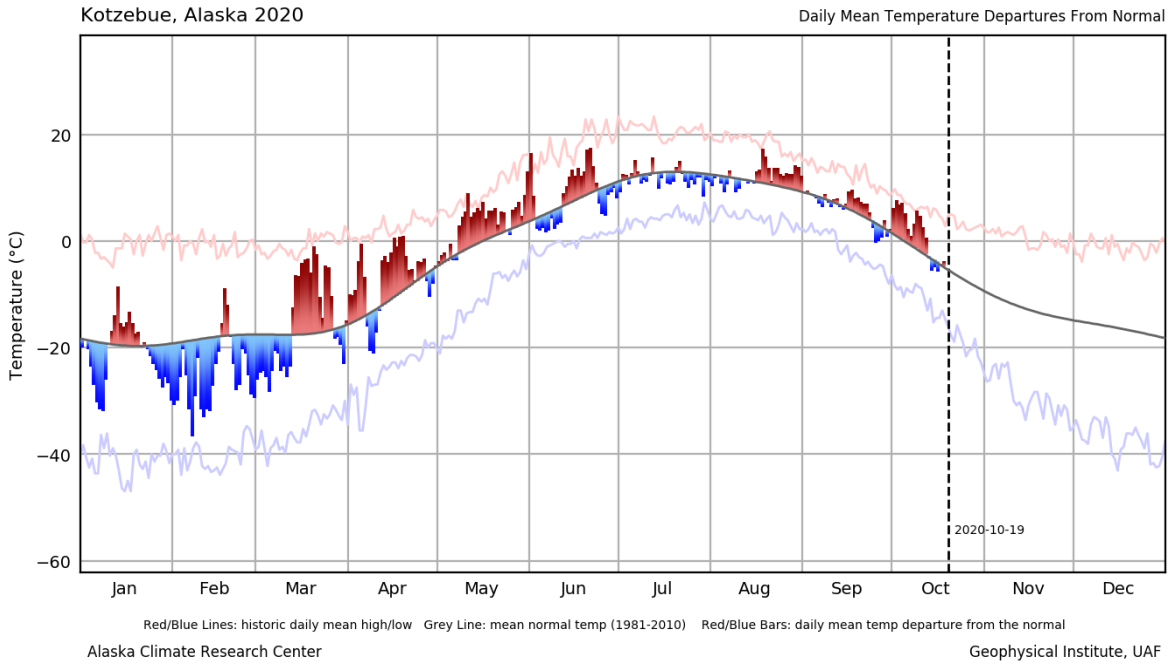
Western Alaska Real-time River Cameras & Lake Buoys

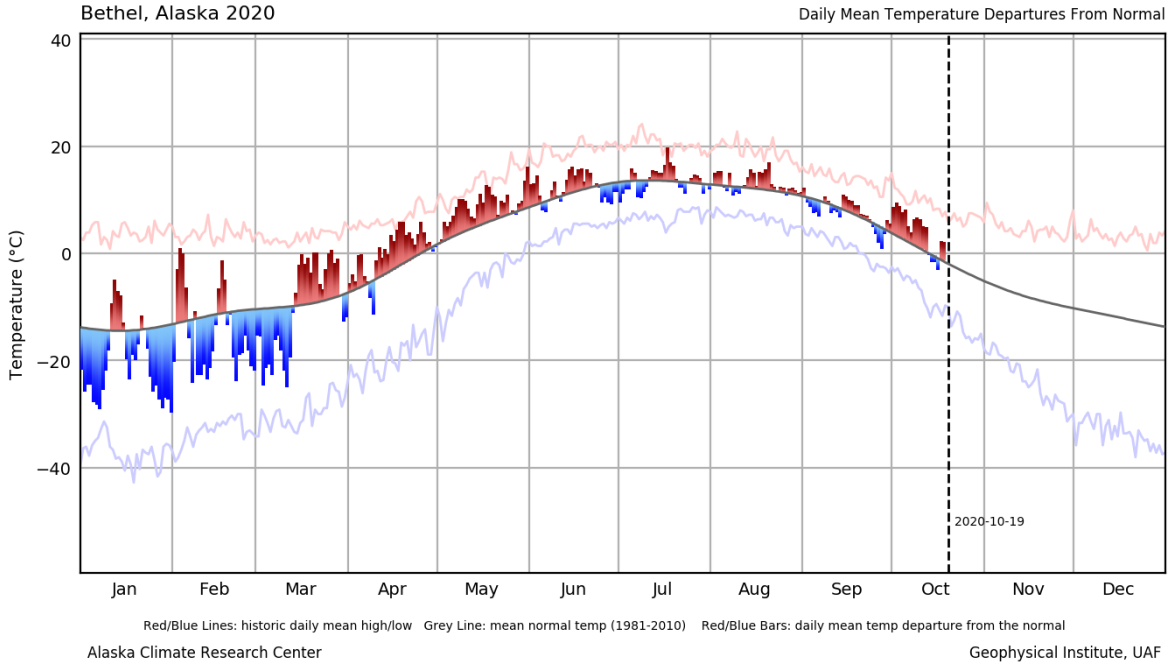
Air-to-water profile Little Paimute Lake



Nearest Town / Village	Ice Thick-ness (cm)	Snow Depth (cm)	Air Temp (°C)	Water Temp (°C)
Shageluk	0	0	0.3	3.9
Holy Cross	0	0	0.2	4.1
Akiak	0	0	0.3	4.9

Updated on 18-Oct-2020





Western Alaska

Kotzebue

Period	FTD	PIT (cm / in)
1980-2010	4-Oct	17 / 7
2019	18-Oct	10 / 4
2020	6-Oct ?	17 / 7

Outlook

Ice cover on small ponds, lakes, and streams; some ice flows on rivers coming out of mountains

Bethel

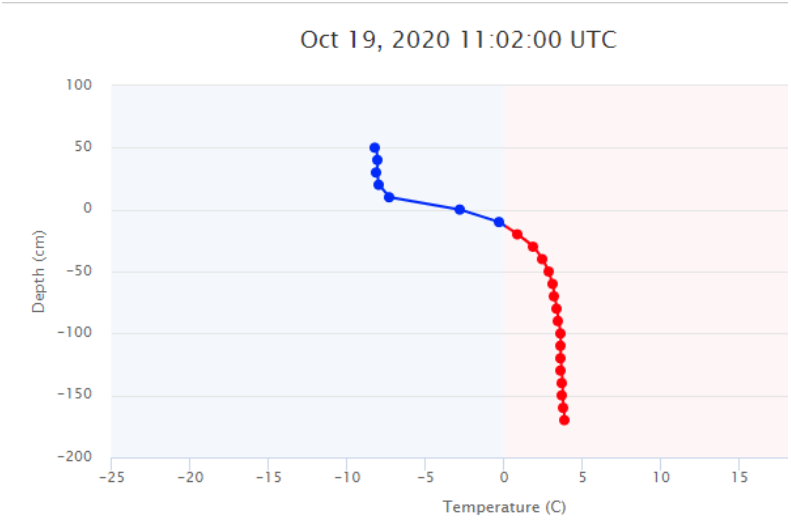
Period	FTD	PIT (cm / in)
1980-2010	13-Oct	10 / 4
2019	23-Oct	8 / 3
2020	24-Oct ?	7 / 3

Outlook

possible thin ice on small waterbodies from recent cold, little to no new ice formation on rivers in next week

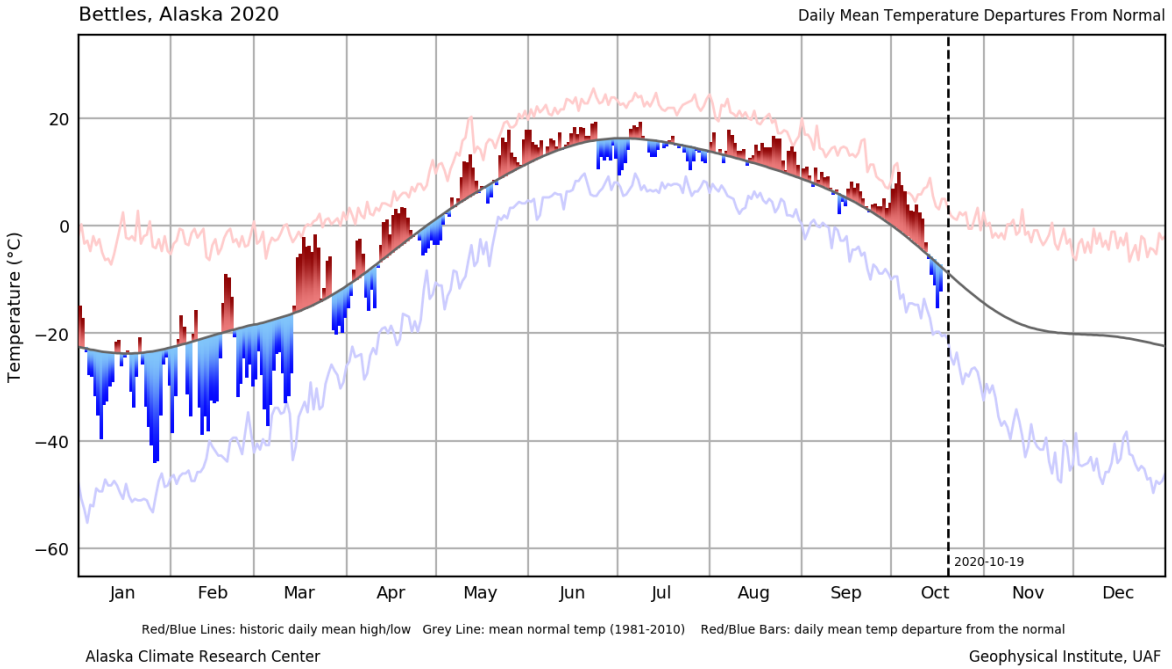
Interior Alaska Real-time River Cameras & Lake Buoys

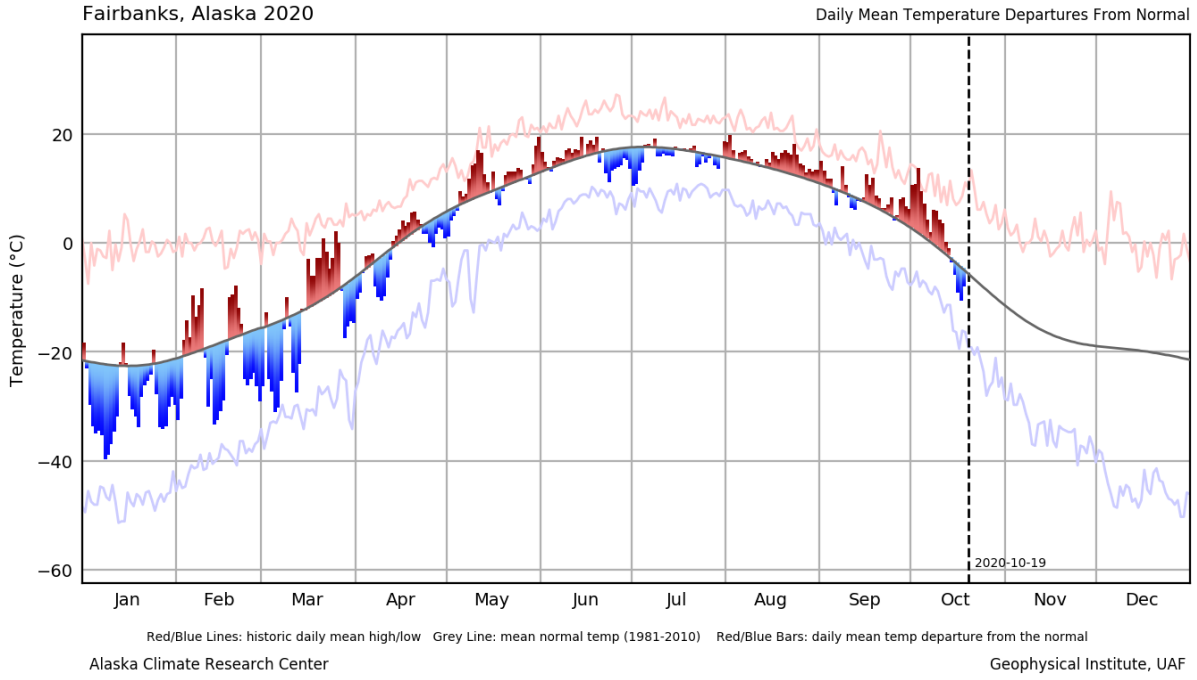
Air-to-water profile Sam Charley Oxbow



Nearest Town / Village	Ice Thick-ness (cm)	Snow Depth (cm)	Air Temp (°C)	Water Temp (°C)
Huslia	8	0	-2.0	4.3
Fairbanks	12	0	-3.2	3.8
Nenana	5	0	-3.2	3.8

Updated on 18-Oct-2020





Interior Alaska

Bettles

Period	FTD	PIT (cm / in)
1980-2010	28-Sep	25 / 10
2019	28-Sep	22 / 9
2020	6-Oct ?	22 / 9

Outlook

thickening ice on most ponds and lakes; ice flows leading to intermittent ice covered stream and middle sized rivers

Fairbanks

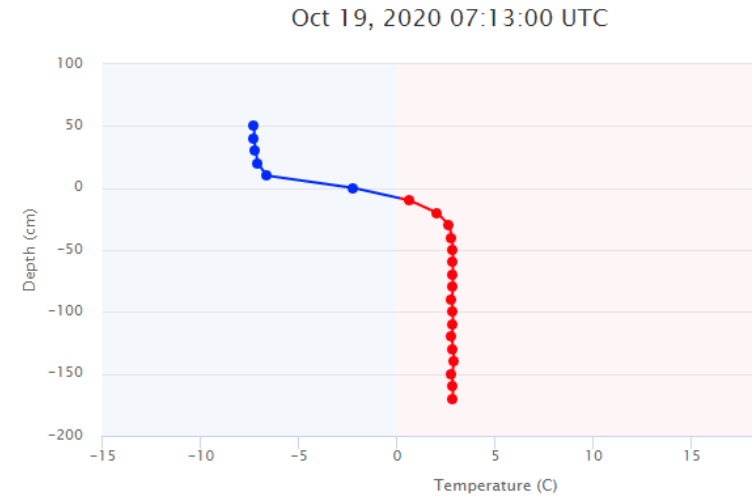
Period	FTD	PIT (cm / in)
1980-2010	6-Oct	17 / 7
2019	15-Oct	10 / 4
2020	16-Oct ?	17 / 7

Outlook

thickening ice on most ponds and shallow lakes; ice flows leading to intermittent ice covered stream and middle sized rivers

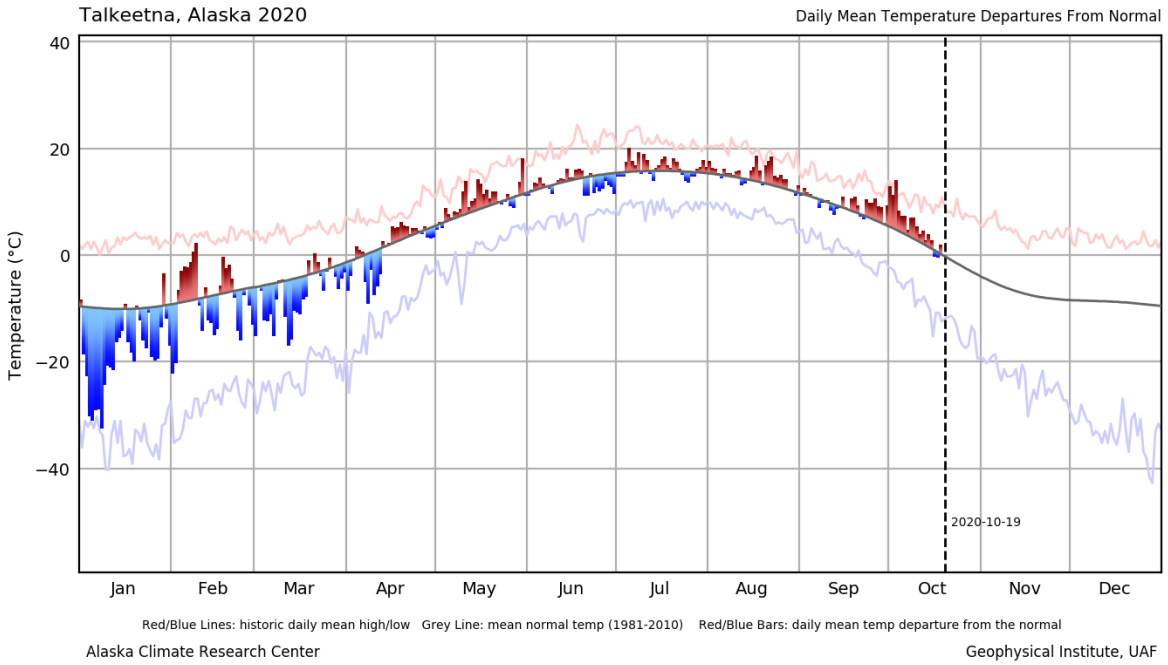
Eastern Alaska Real-time River Cameras & Lake Buoys

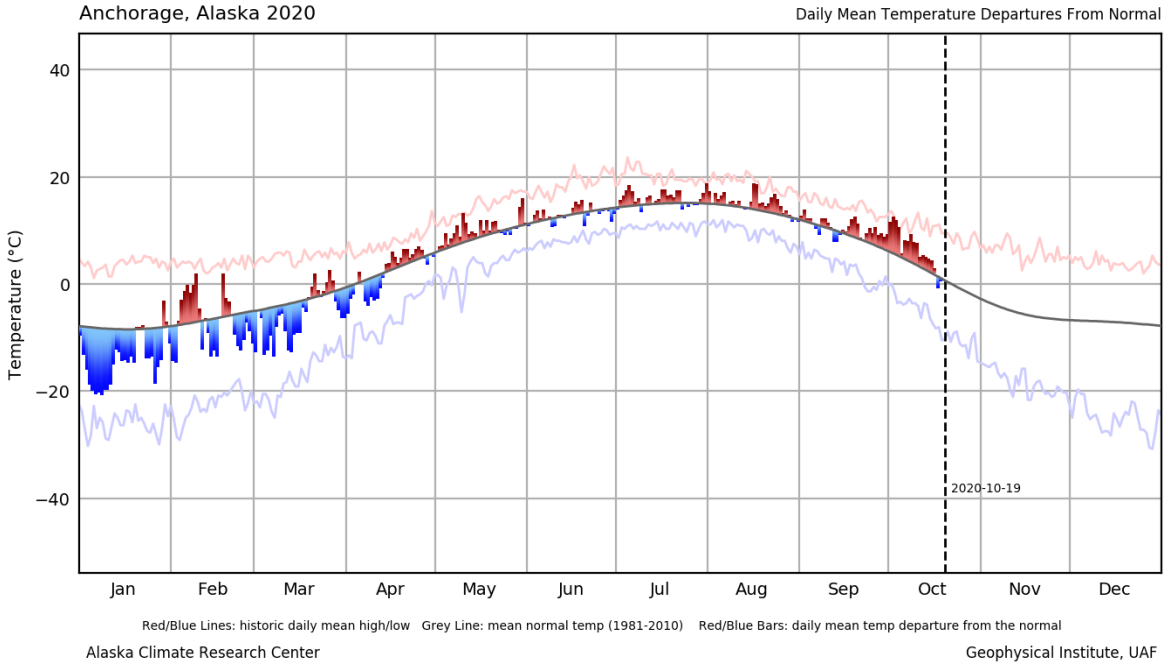
Air-to-water profile Cheshnina Lake



Nearest Town / Village	Ice Thick-ness (cm)	Snow Depth (cm)	Air Temp (°C)	Water Temp (°C)
Kenny Lake	0	0	-1.3	4.2
Northway	0	0	-3.1	4.4
Venetie	12	0	-4.8	1.3
Ft. Yukon	10	0	-7.1	1.0

Updated on 18-Oct-2020





SouthCentral Alaska

Talkeetna

Period	FTD	PIT (cm / in)
1980-2010	18-Oct	7 / 3
2019	16-Nov	3 / 1
2020	?	2 / 0

Outlook

thin ice formed or forming on small waterbodies and ice flows on rivers coming out of higher elevations

Anchorage

Period	FTD	PIT (cm / in)
1980-2010	22-Oct	5 / 2
2019	30-Nov	0
2020	?	2 / 0

Outlook

possible thin ice cover on small ponds and stream from recent cold, otherwise no ice formation on larger waterbodies in near week(s)