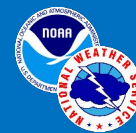


2023 Alaska Breakup:
Breakup with a spotlight on remote sensing tools

NWS Alaska Region Briefing
Alaska Pacific River Forecast Center

2023 Spring Breakup in Review



NWS Alaska Region

Overview of Flood Categories

2

Catastrophic
Floods

3

Major
Floods

10

Moderate
Floods

14

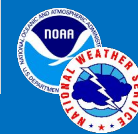
Minor Floods

2023 was a historic breakup year



Aerial view of flooding of Crooked Creek on the Kuskokwim River on May 14th.

2023 Spring Breakup in Review



NWS Alaska Region

Summary NWS Watch / Warning / Advisory Products

15

Watches were issued

09

Advisories were issued

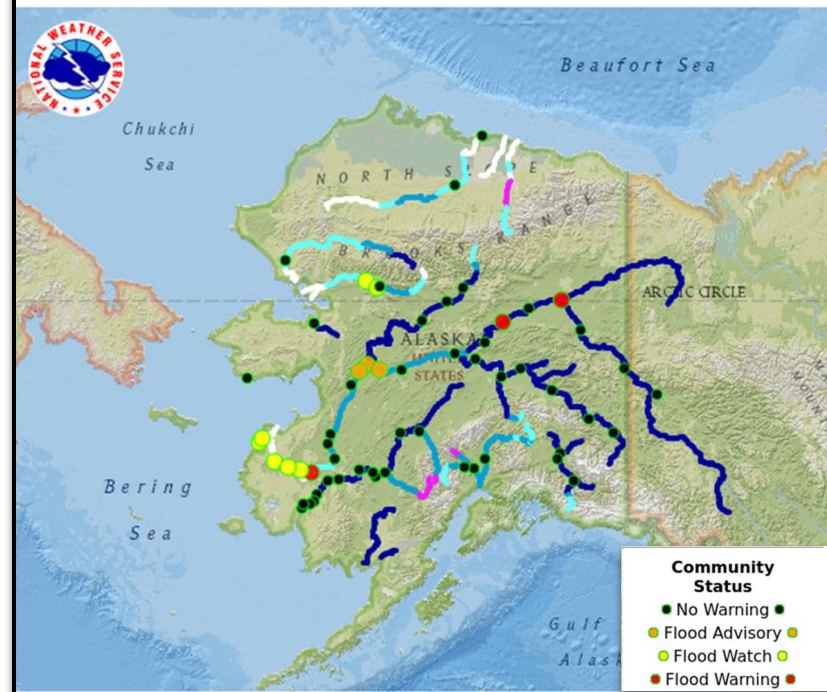
17

Warnings were issued

108

Product updates

APRFC Breakup Map - 23 May 2023 6:50:10 AM AKDT



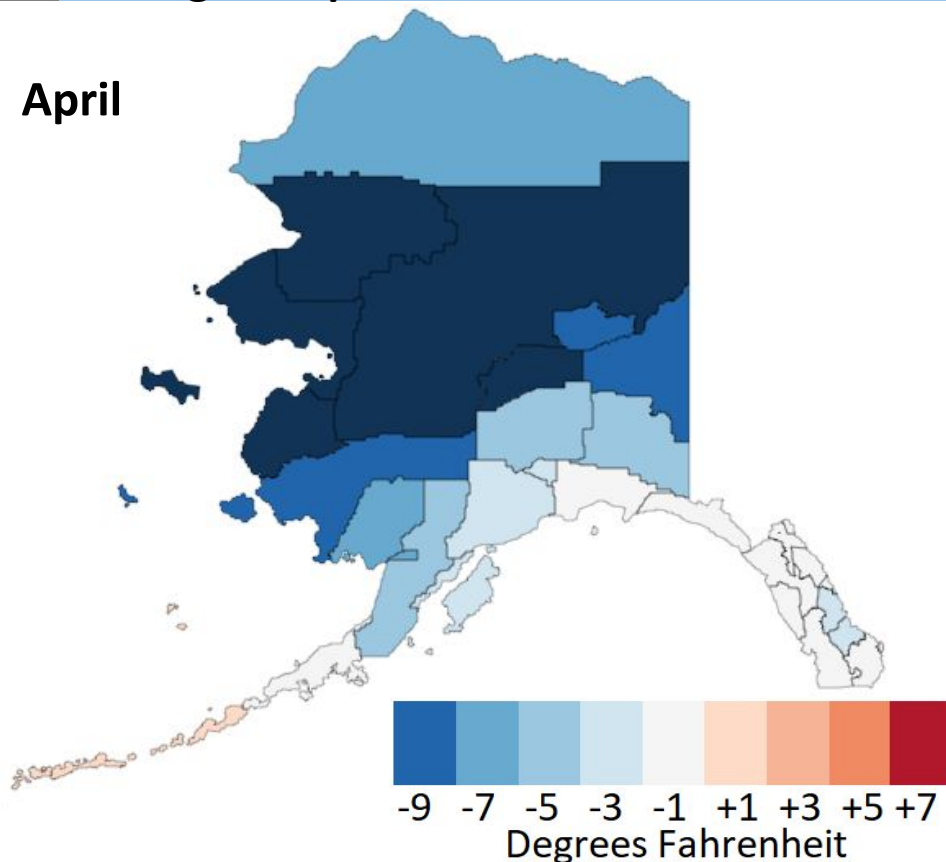
2023 Spring Breakup in Review

Average Temperature Difference from 1925-2000

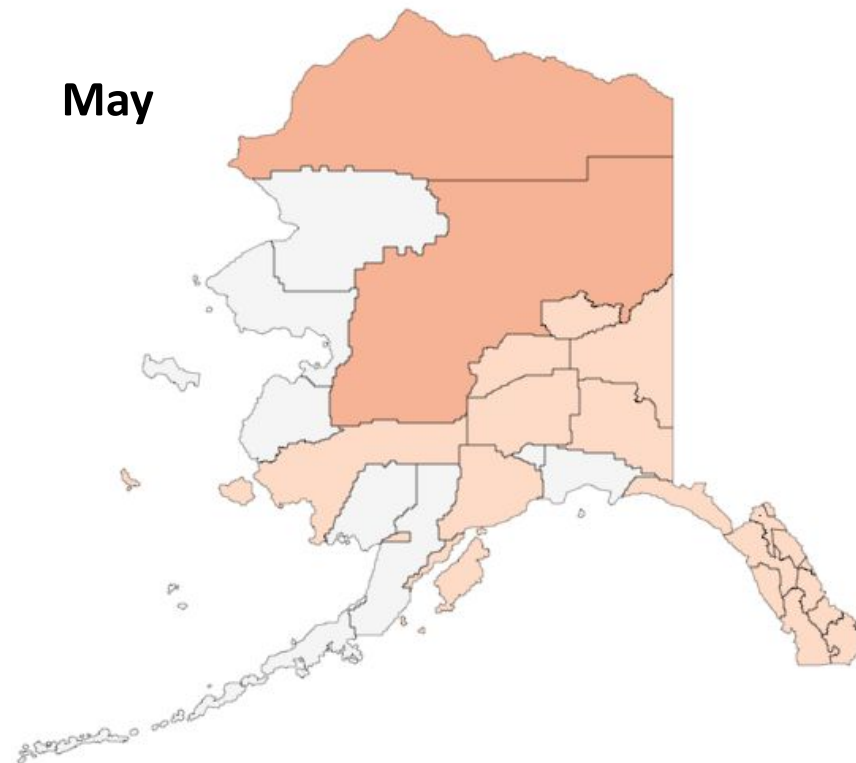


NWS Alaska Region

April

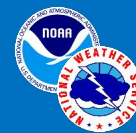


May

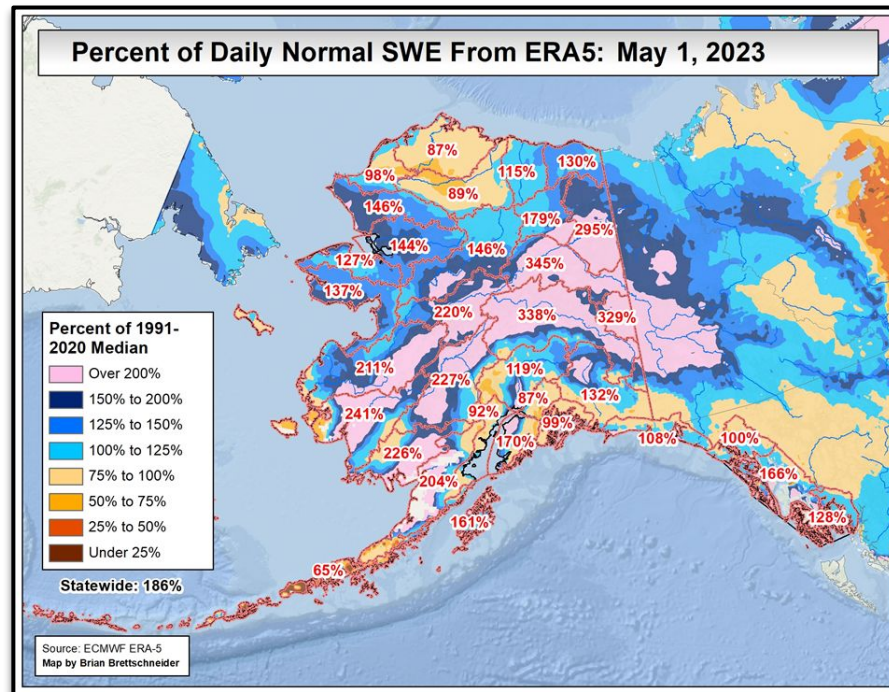
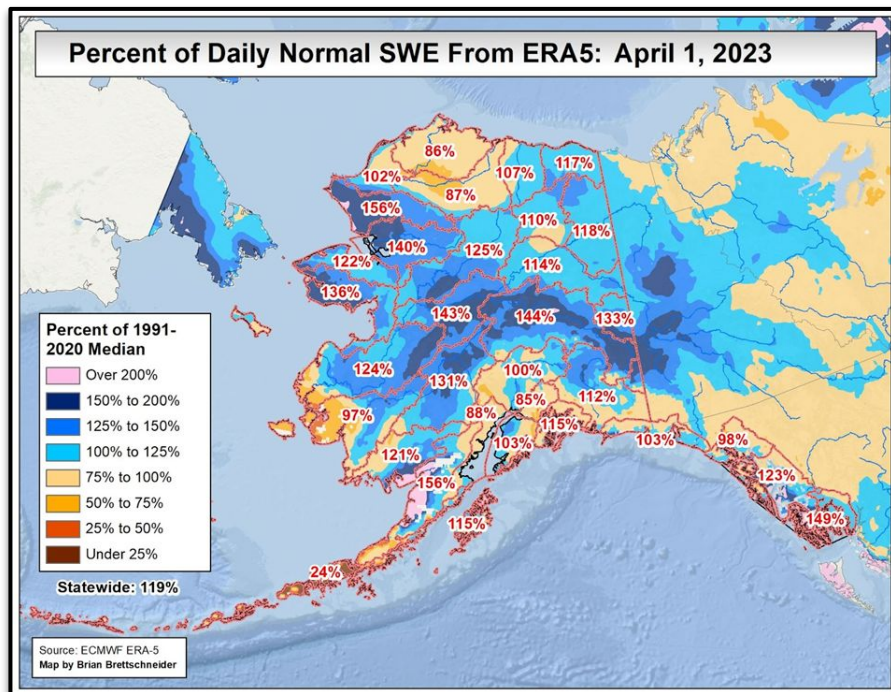


2023 Spring Breakup in Review

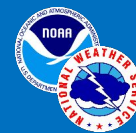
Above average late season snowpack



NWS Alaska Region



2023 Spring Breakup in Review

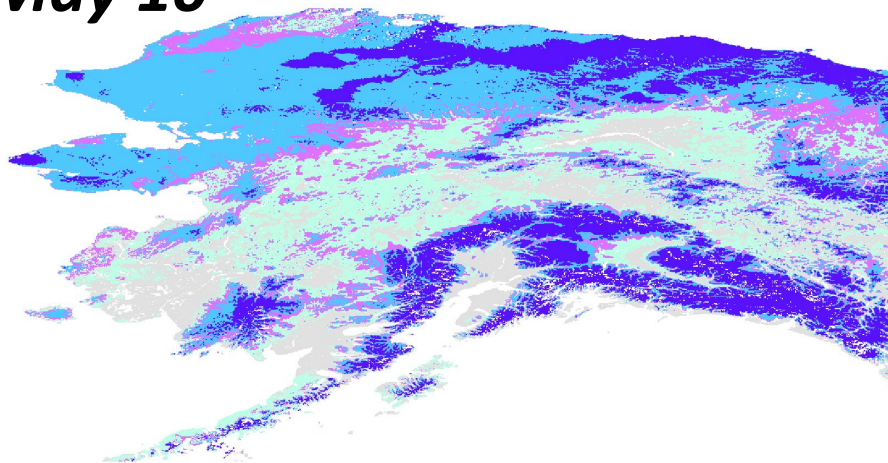


NWS Alaska Region

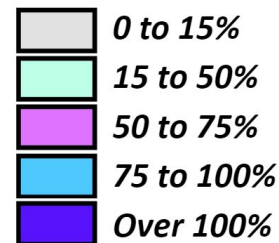
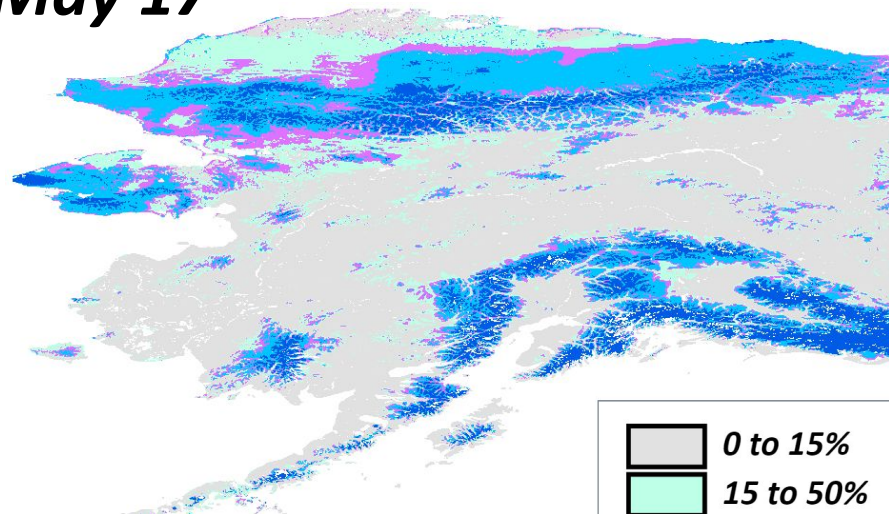
Slow snow melting until mid May

NASA LIS Snow Water Equivalent: Percentage of Snow Remaining (April 10th)

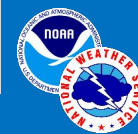
May 10th



May 17th



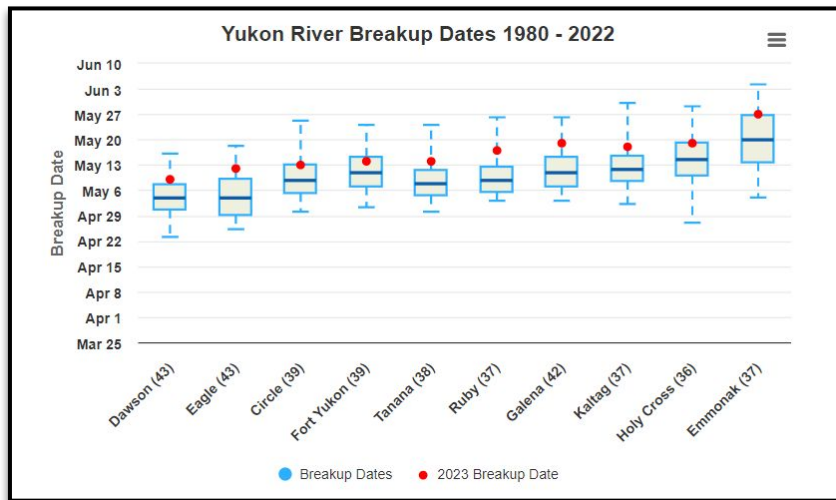
2023 Spring Breakup in Review



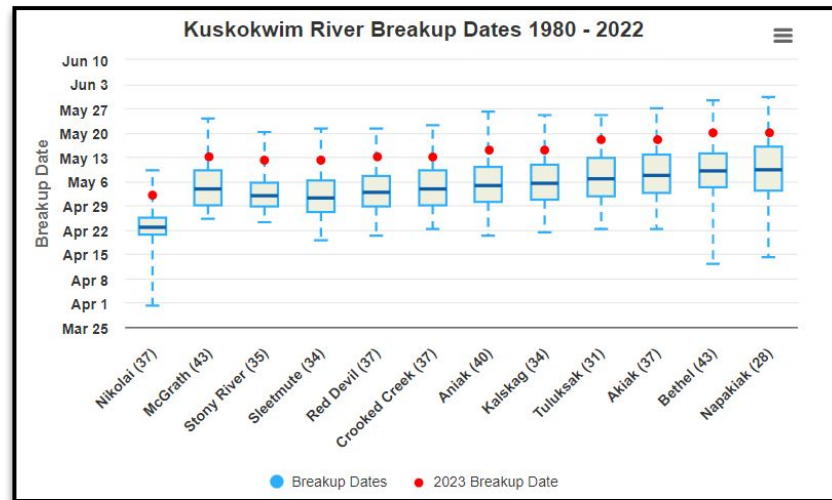
NWS Alaska Region

Breakup was later than normal

**Yukon River breakup
approximately 6 days late**



**Kuskokwim River breakup
approximately 10 days late**



2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events

May
08

Riverwatch officially deployed

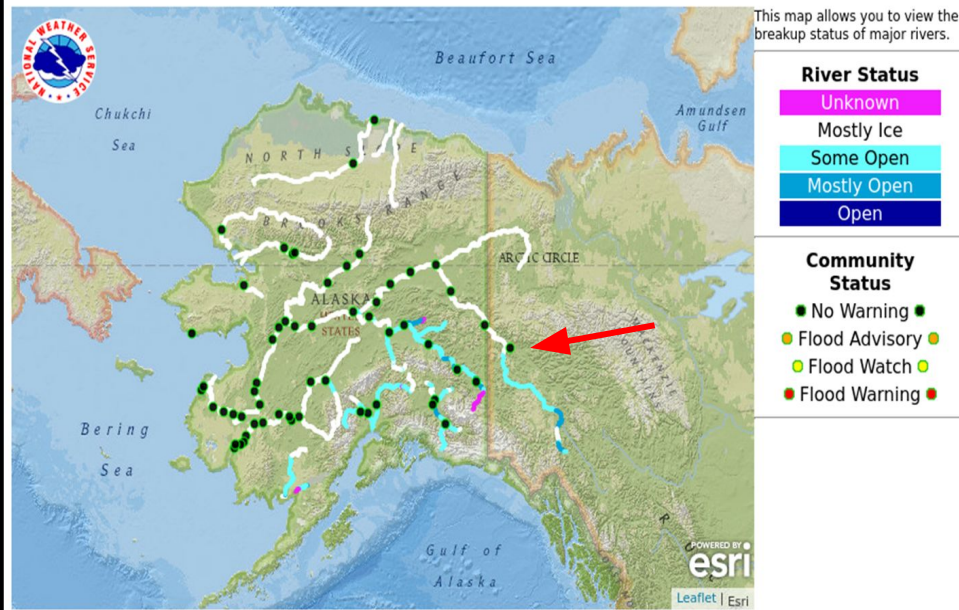
Upper Yukon Riverwatch team deployed, marking the start of breakup in Alaska. Breakup front located upstream of Dawson, Canada

May
09

Breakup in Dawson, Canada

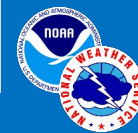
Yukon River breakup begins. Multiple ice jams form, major flooding observed across Canadian border.

APRFC Breakup Map - 9 May 2023 8:04:19 AM AKDT



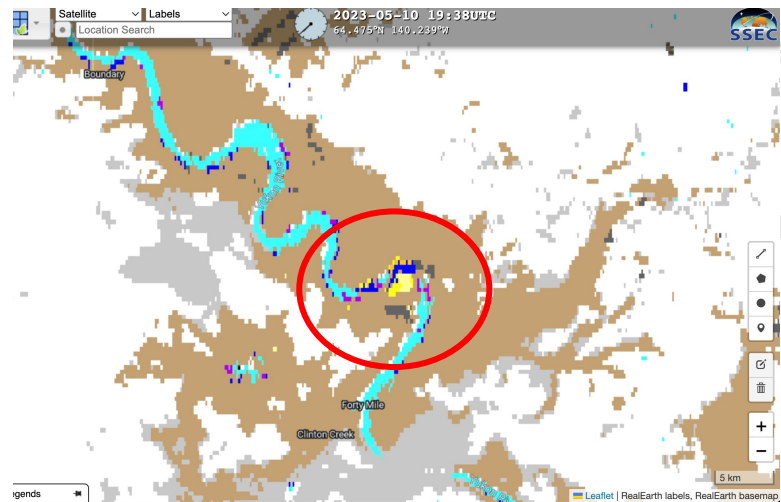
APRFC Breakup map highlighting location of Dawson, Canada (red arrow) along the Yukon River on May 9th.

2023 Spring Breakup in Review



NWS Alaska Region

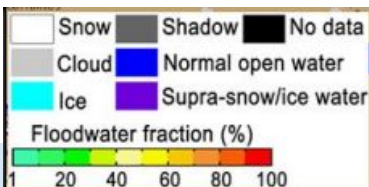
Timeline of Events



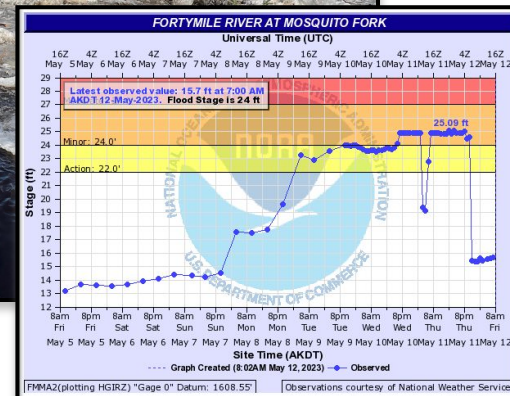
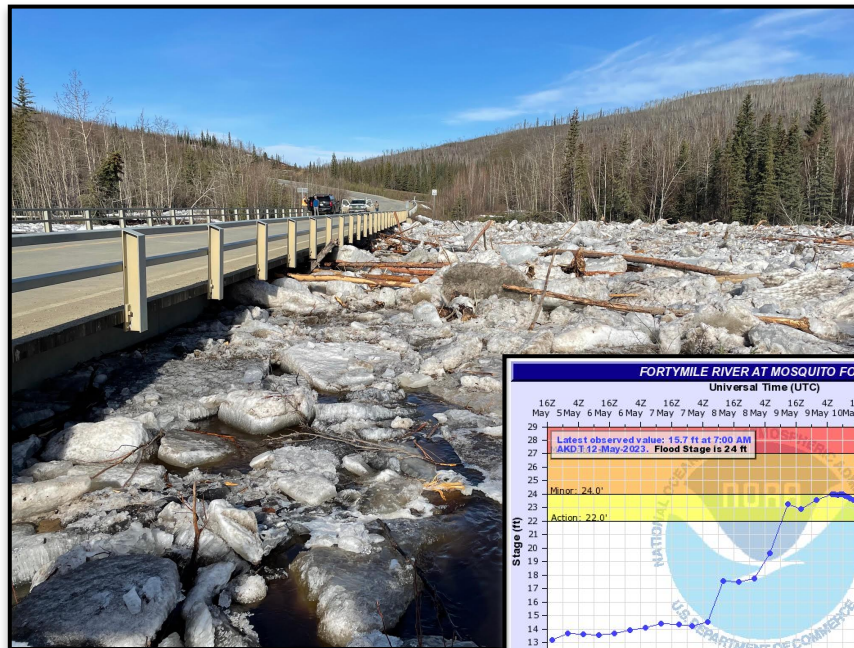
May
09-11

Ice jams on Forty Mile River

Two ice jams form on the Forty Mile River, flooding Clinton Creek Rd and Taylor Highway

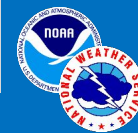


907-266-5160



Taylor Highway bridge at Mosquito Fork of the Fortymile River, looking at the upstream side of the bridge at 9 am on May 11th.

2023 Spring Breakup in Review



NWS Alaska Region

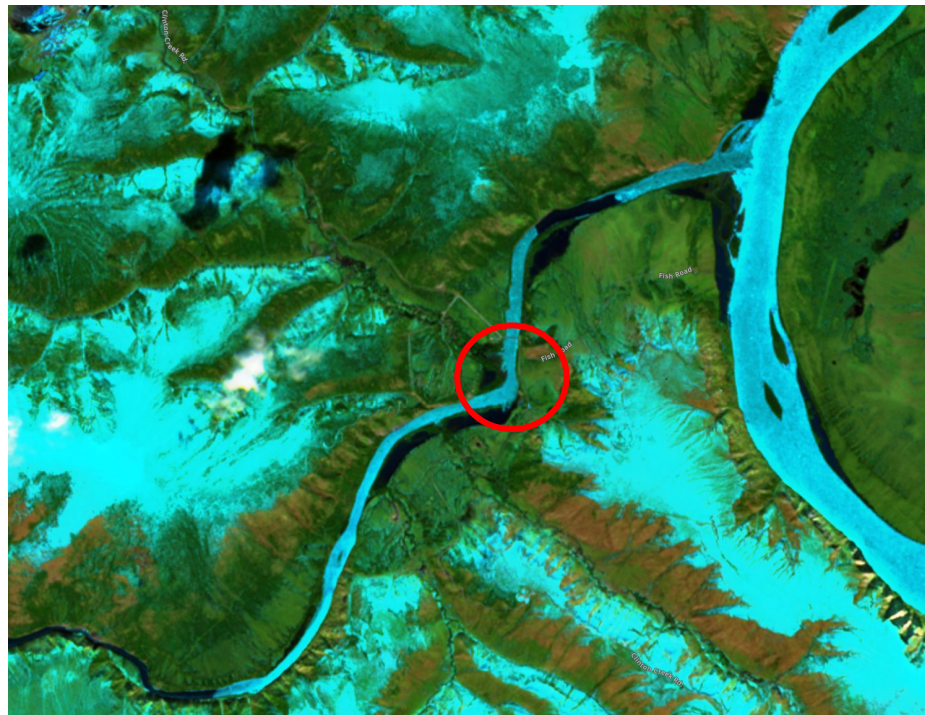
Timeline of Events



May
09-11

Ice jams on Fortymile River

Two ice jams form on the Forty Mile River, flooding Clinton Creek Road and Taylor Highway



Sentinel-2 L2A SWIR image showing ice jam on forty mile at its confluence with the Yukon.

2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events

May
08

Riverwatch officially deployed

Upper Yukon Riverwatch team deployed, marking the start of breakup in Alaska. Breakup front located upstream of Dawson, Canada

May
09

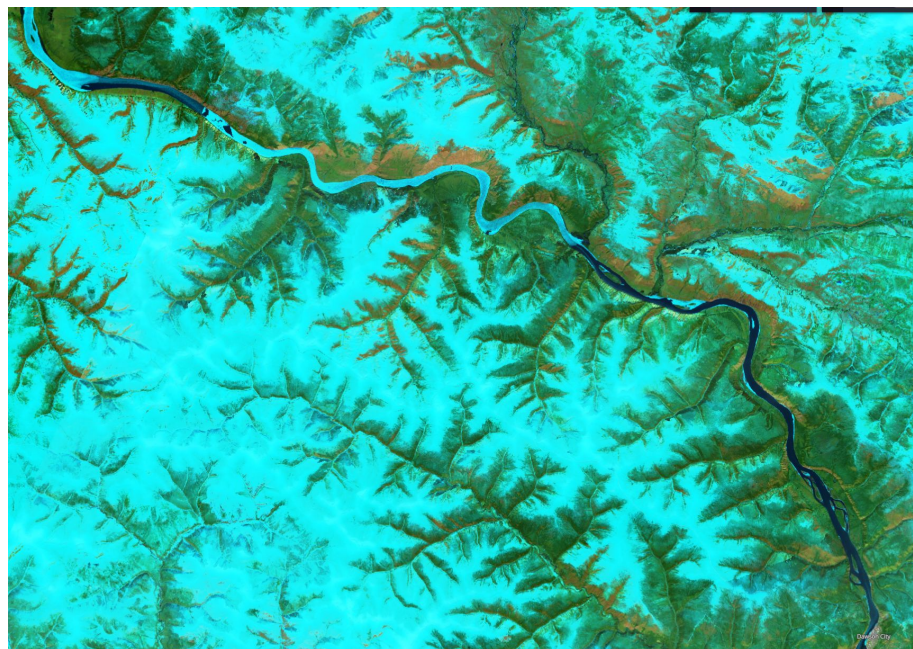
Breakup in Dawson, Canada

Yukon River breakup begins. Multiple ice jams form, major flooding observed across Canadian border.

May
11

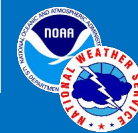
Breakup Front on the Yukon

The breakup front approached Alaska on this day.



Sentinel-2 L2A SWIR image showing ice run below Dawson. This bit of ice is around 20 miles long.

2023 Spring Breakup in Review



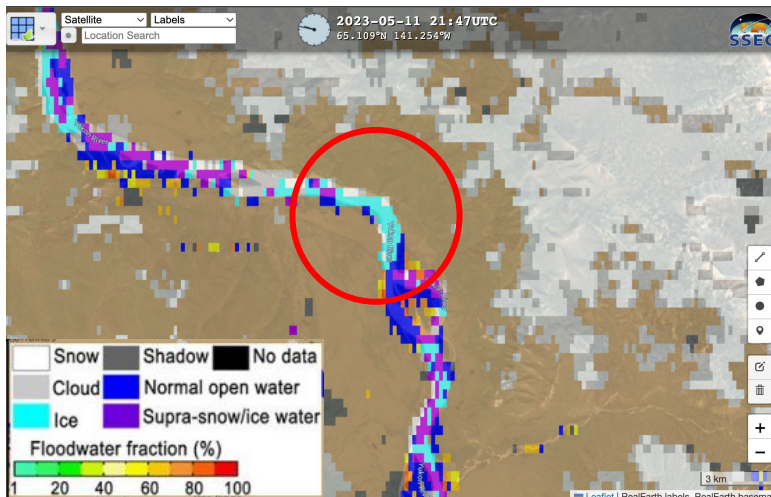
NWS Alaska Region

Timeline of Events

May
12

Moderate flooding in Eagle

Ice jam forms downstream, moderate flooding with damage to seawall, flooding roads, and damage to several structures.



Clockwise from top right: seawall damage on Front St on May 13th; aerial view of Mission Rd between Eagle and Eagle Village on May 13th; DOT crews removing ice and repairing washouts along Mission Rd on May 18th.

2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events

May
12

Moderate flooding in Eagle

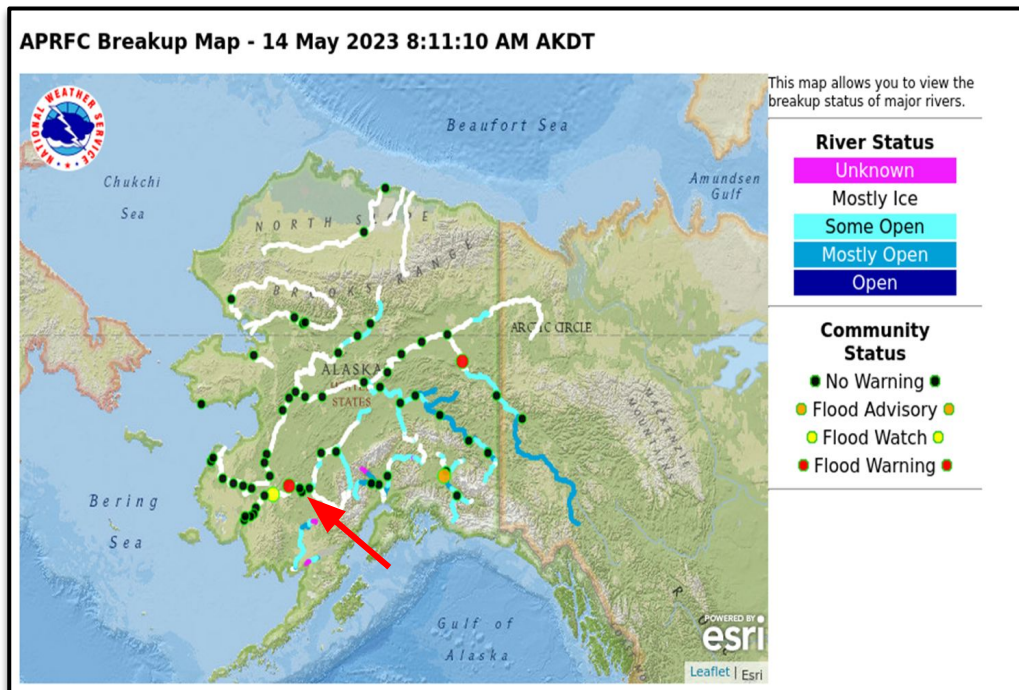
Ice jam forms downstream, moderate flooding with damage to seawall, flooding roads, and damage to several structures.

May
12

continued

Kuskokwim River Breakup

Stoney River and Sleetmute and breakup front is approaching Red Devil.



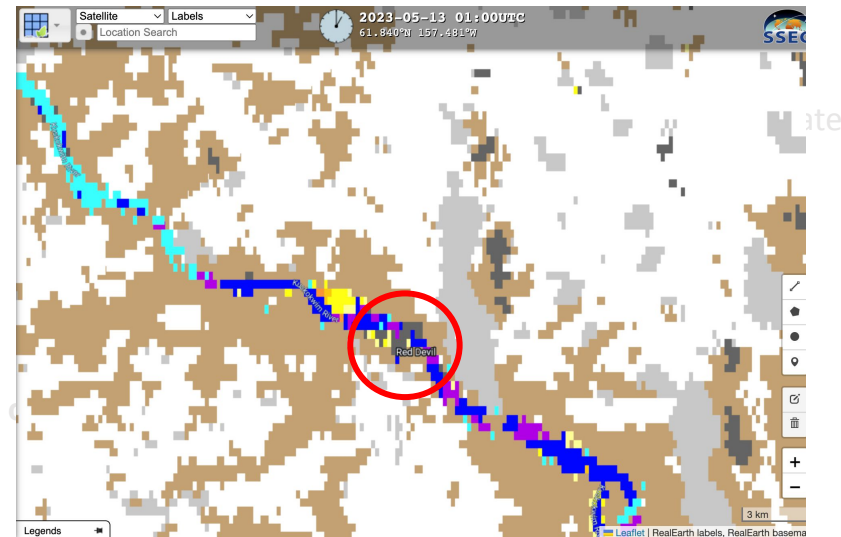
APRFC breakup map highlighting location of Stoney River (red arrow), Sleetmute, and Red Devil along the Kuskokwim River on May 14th.

2023 Spring Breakup in Review



NWS Alaska Region

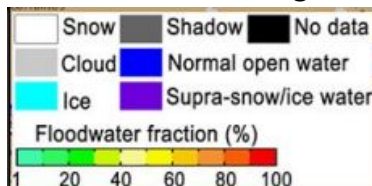
Timeline of Events



May
13

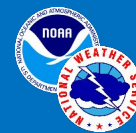
Moderate flood in Red Devil

Water levels rise rapidly, structures inundated, and damage to runway.



Aerial view of Red Devil showing extensive flooding to the runway on May 13th.

2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events

May
12

Moderate flooding in Eagle

Ice jam forms downstream, moderate flooding with damage to seawall, flooding roads, and damage to several structures.

May
12

continued

Kuskokwim River Breakup

Stoney River and Sleetmute and breakup front is approaching Red Devil.

May
13

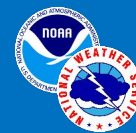
Moderate flood in Red Devil

Water levels rise rapidly, structures inundated, and damage to runway.



Aerial view of Red Devil showing extensive flooding to the runway on May 13th.

2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events

May 13
continued

Catastrophic flooding in Crooked Creek

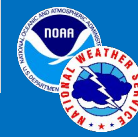
Water levels rose 16ft, exceeding the 2011 record. Residents airlifted by National Guard. Structures destroyed by ice and flood waters.



Extensive damage to structures, with stranded ice and floodwaters, and debris in Crooked Creek - May 15th.

2023 Spring Breakup in Review

Additional Media



NWS Alaska Region

NWS drone video of major flooding in Crooked Creek, AK May 14, 2023



<https://youtu.be/5rc-genH2iQ>

2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events

May 13
continued

Catastrophic flooding in Crooked Creek

Water levels rose 16ft, exceeding the 2011 record. Residents airlifted by National Guard, structures destroyed by ice and flood waters.

May 13
continued

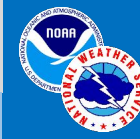
Record Flooding in Circle

Extensive damage, flood waters exceed flood of record (1945). Most structures in town flooded or damaged by large chunks of ice, and airport apron and taxiway flooded.



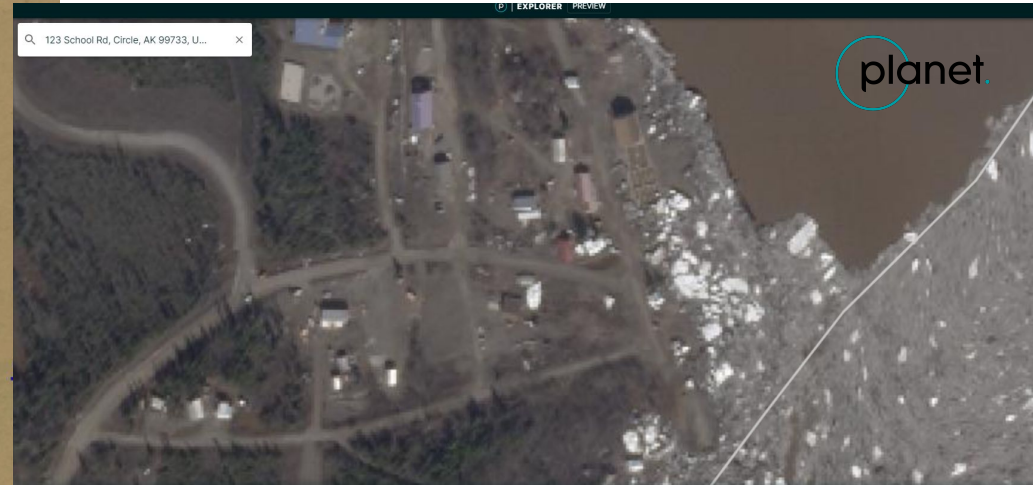
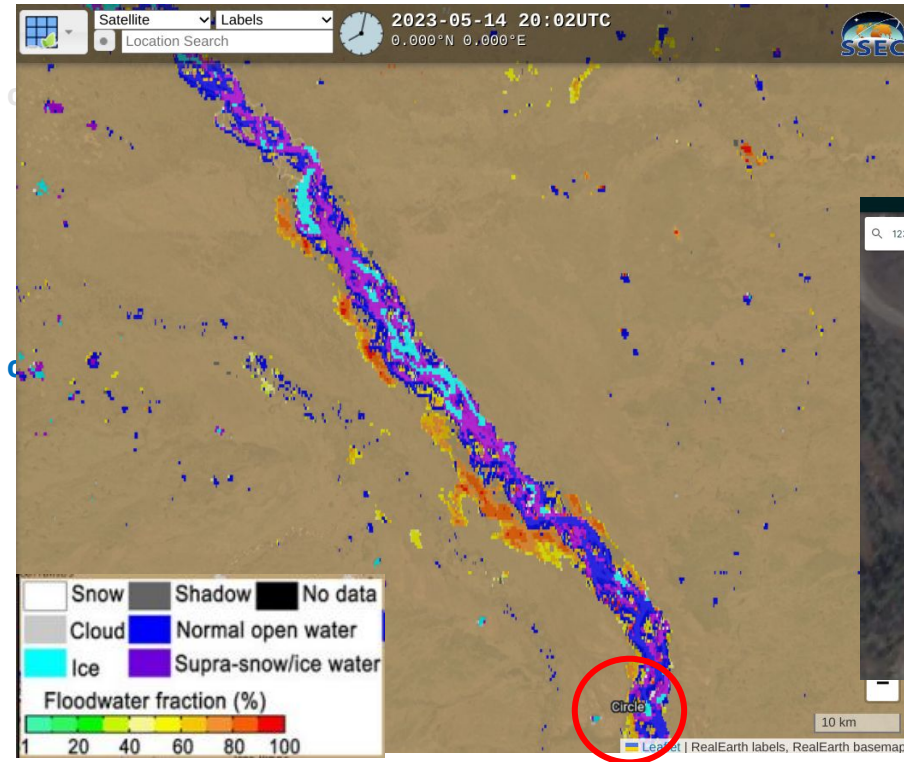
Stranded ice and floodwaters in Circle with residential structures damaged shifted off foundations - May 14th.

2023 Spring Breakup in Review



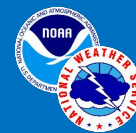
NWS Alaska Region

Timeline of Events



Stranded ice in Circle from Planet.com imagery - May 14th.

2023 Spring Breakup in Review



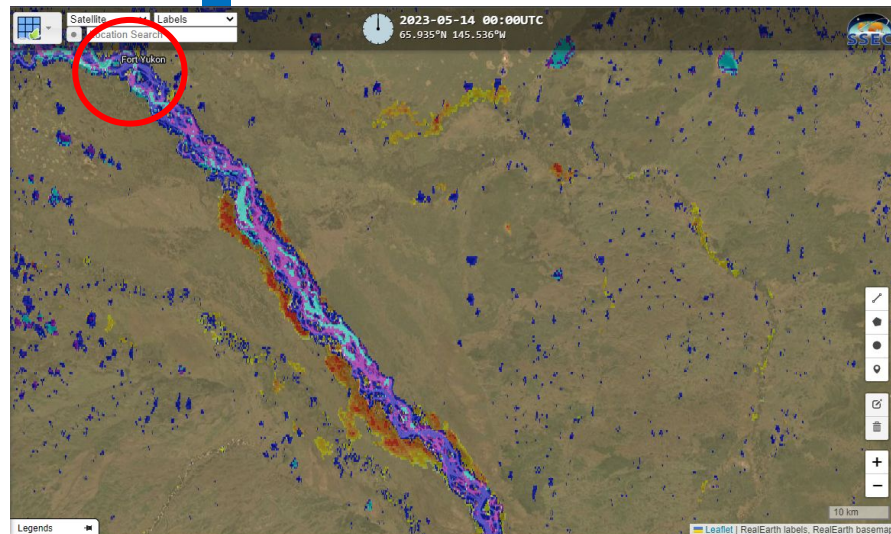
NWS Alaska Region

Timeline of Events

May
14

Flooding in Ft Yukon

Upper Yukon River at Ft. Yukon breakups up and moderate flooding occurs. Several roads, homes, and structures, including the Tribal Hall, inundated with water.



Flooding along Base Road, Fort Yukon - May 15th.

2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events

May
14

Flooding in Ft Yukon

Upper Yukon River moderate flooding occurs. Several roads, homes, and structures, including the Tribal Hall inundated with water.

May
15

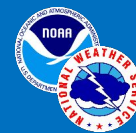
Minor flooding Stevens Village

Breakup front on the Yukon River moves past Stevens Village; minor flooding to roads and barge landing.



Satellite imagery of Stevens Village along the Yukon River showing flooding to low lying areas and roads - May 22nd.

2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events

May
14

Flooding in Ft Yukon

Upper Yukon River moderate flooding occurs. Several roads, homes, and structures, including the Tribal Hall inundated with water.

May
15

Minor flooding Stevens Village

Breakup front on the Yukon River moves past Stevens village; minor flooding to roads and barge landing.

May
15

continued

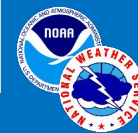
Moderate flooding in Napaimute

Breakup front on the Kuskokwim River moves down river with minor flooding to homes and runway.



Aerial image of the runway at Napaimute - May 22nd.

2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events

May
16

Flooding in Aniak

Breakup front on the Kuskokwim moves past Aniak, with minor flooding at the airport.



Clockwise from top right: Runway lights surrounded by water. Lower right-road covered by flood water. Left-Ice shoved up against Aniak dike.

2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events

May
16

Flooding in Aniak

Breakup front on the Kuskokwim moves past Aniak, with minor flooding at the airport.

May
16

continued

Lower Kalskag flooding

ice jam on the Kuskokwim river raises water levels and causes minor flooding near of roads and water under homes.



Aerial view of flooding around airport runway, with water surrounding homes and structures and flooding of the roads between Upper and Lower Kalskag - May 17th.

2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events

May
16

Flooding in Aniak

Breakup front on the Kuskokwim moves past Aniak, with minor flooding to the airport.

May
16

continued

Lower Kalskag flooding

ice jam on the Kuskokwim river raises water levels and causes minor flooding near of roads and water under homes.

May
17

Flooding of Buckland

Multiple ice jams on the Buckland River causes significant flooding to nearly 80% of community. Roads inundated with water; water under or surrounding homes and structures.



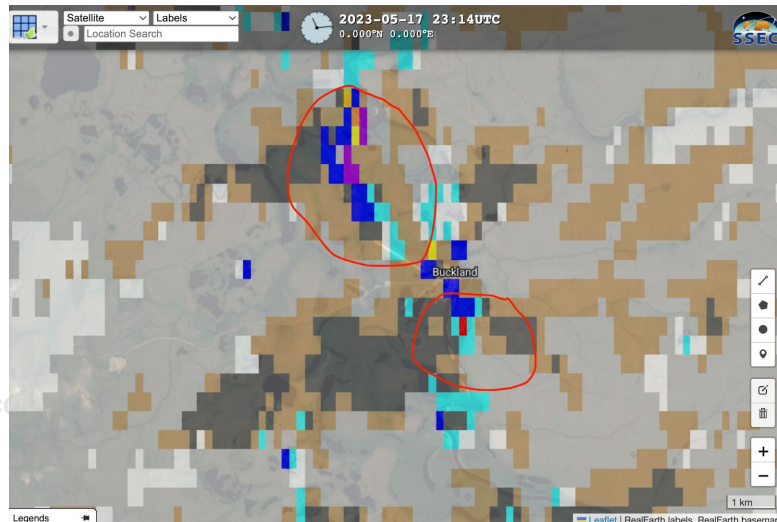
Aerial imagery from River Watch team over the community of Buckland - May 18th.

2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events



May
17

Flooding of Buckland

Multiple ice jams on the Buckland River causes significant flooding to nearly 80% of community. Roads inundated with water; water under or surrounding homes and structures.



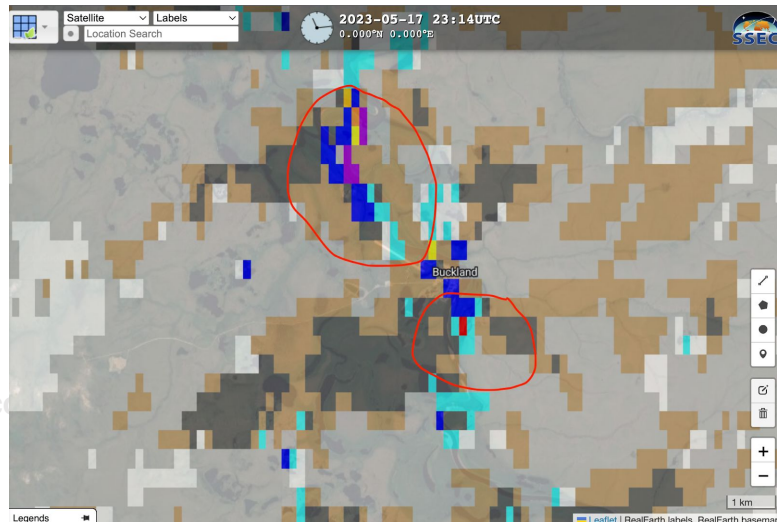
Ice Jam Upstream of Buckland - May 17th.

2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events



May
17

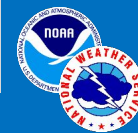
Flooding of Buckland

Multiple ice jams on the Buckland River causes significant flooding to nearly 80% of community. Roads inundated with water; water under or surrounding homes and structures.



Ice Jam Downstream of Buckland - May 17th.

2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events

May
18

Snowmelt flooding Ft Yukon

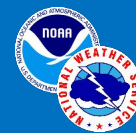
Immediately following breakup flooding, gradual snow melt caused area rivers to swell and flood several homes and roads in the community.



Flooding in Ft Yukon



2023 Spring Breakup in Review



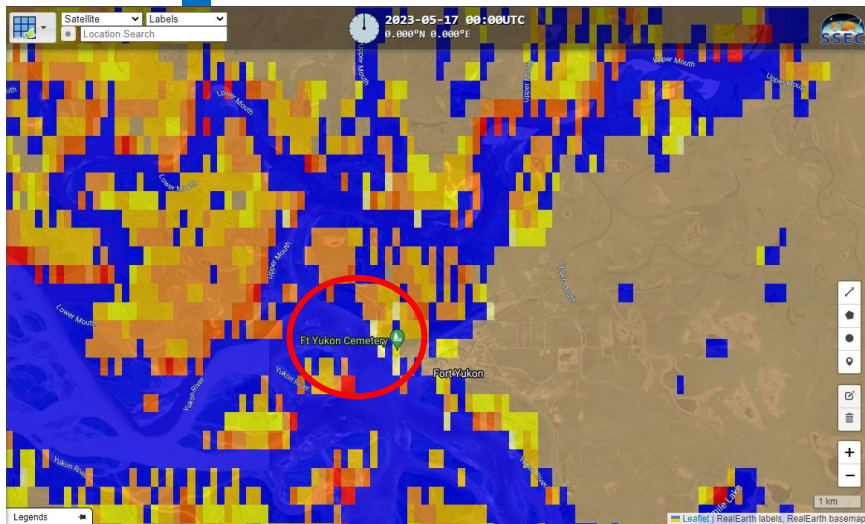
NWS Alaska Region

Timeline of Events

May
18

Snowmelt flooding Ft Yukon

Immediately following breakup flooding, gradual snow melt caused area rivers to swell and flood several homes and roads in the community.



2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events

May
18

Snowmelt flooding Ft Yukon

Quickly following breakup flooding, gradual snow melt caused area rivers to swell and flood several homes and roads in the community.

May
19

Major flooding in Kwethluk

Ice jams release and push large volume of water down Kuskokwim. Water inundated homes, damage to roads and vehicles.



Flooding in the community of Kwethluk on May 19th.

2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events

May
18

Snowmelt flooding Ft Yukon

Quickly following breakup flooding, gradual snow melt caused area rivers to swell and flood several homes and roads in the community.

May
19

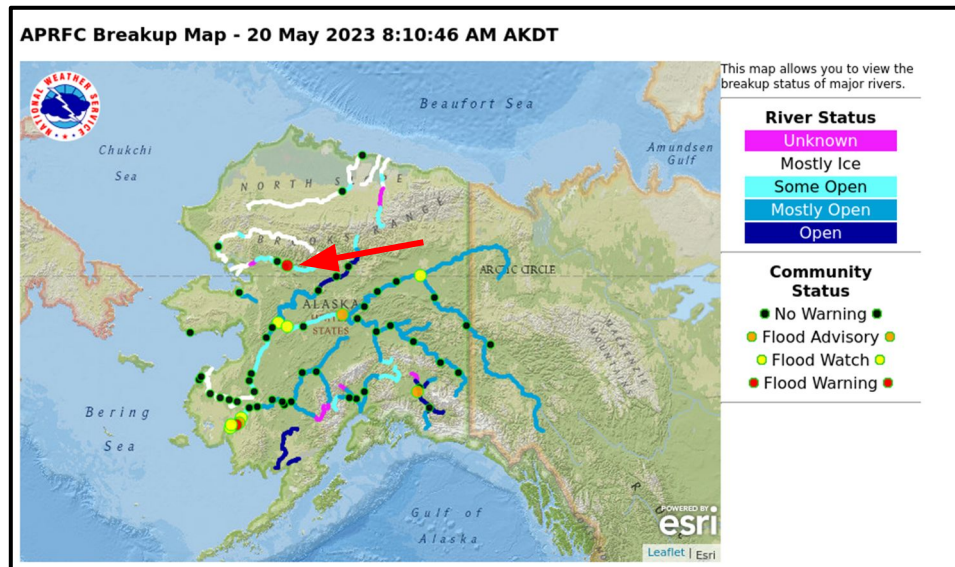
Major flooding in Kwethluk

Ice jams release and push large volume of water down Kuskokwim. Water inundated homes, damage to roads and vehicles.

May
19-20

Moderate flooding in Kobuk

Ice jam on the Kobuk River leads to moderate flooding, with water under several homes



APRFC breakup map highlighting location of Kobuk (red arrow) along the Kobuk River on May 20th.

2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events

May
18

Snowmelt flooding Ft Yukon

Quickly following breakup flooding, gradual snow melt caused area rivers to swell and flood several homes and roads in the community.

May
19

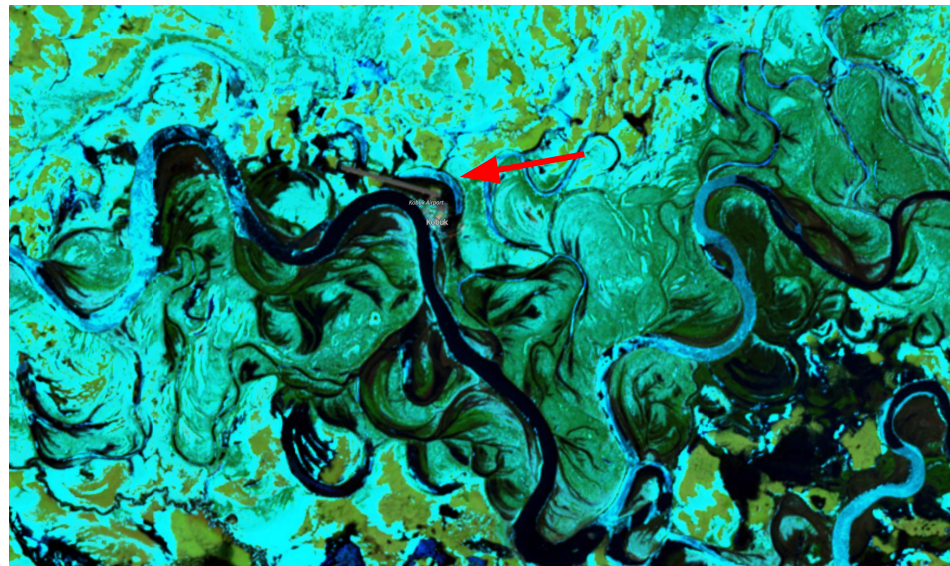
Major flooding in Kwethluk

Ice jams release and push large volume of water down Kuskokwim. Water inundated homes, damage to roads and vehicles.

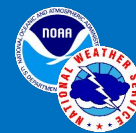
May
19-20

Moderate flooding in Kobuk

Ice jam on the Kobuk River leads to moderate flooding, with water under several homes



2023 Spring Breakup in Review



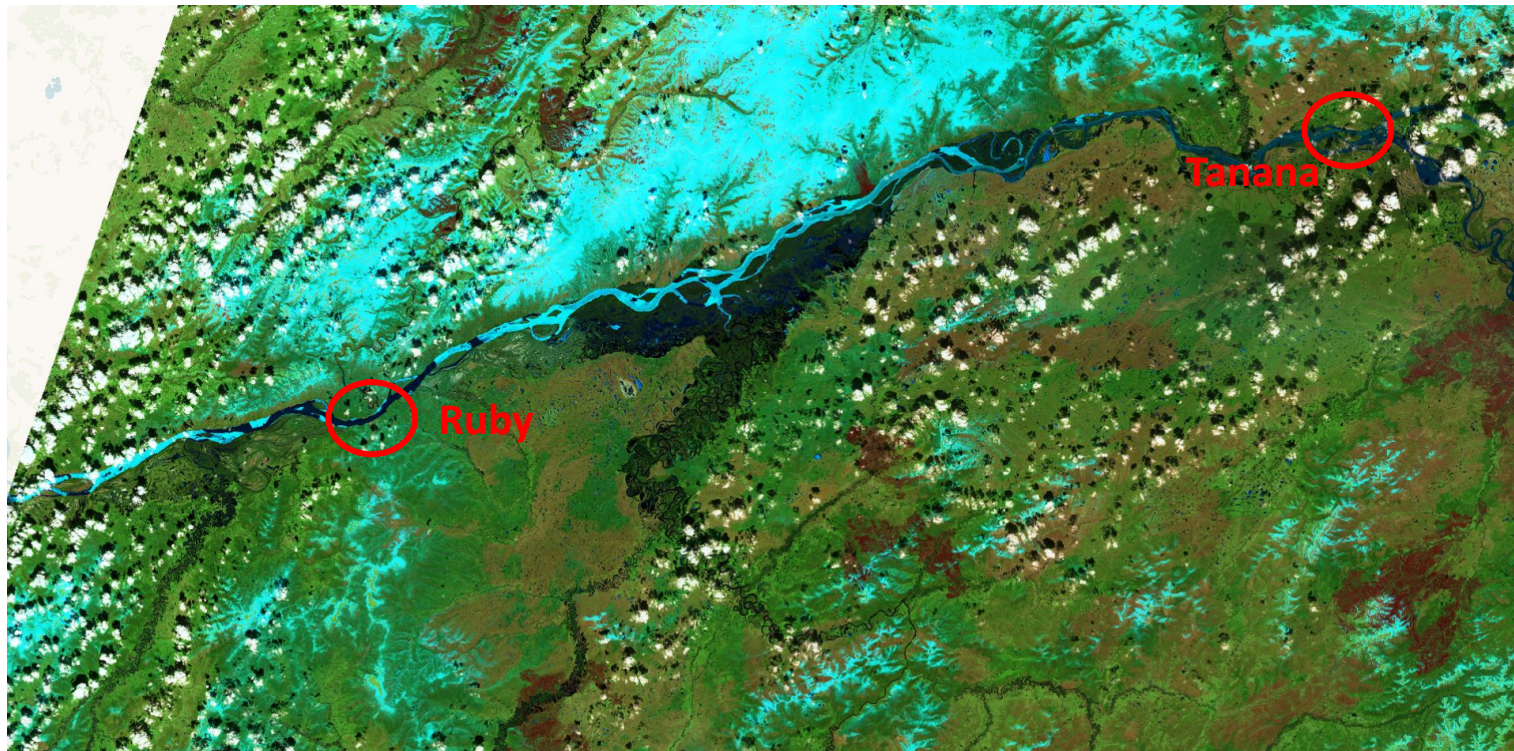
NWS Alaska Region

Timeline of Events

May
19-20
continued

Large ice jam on Yukon River (Around 50 miles long)

Galena



2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events

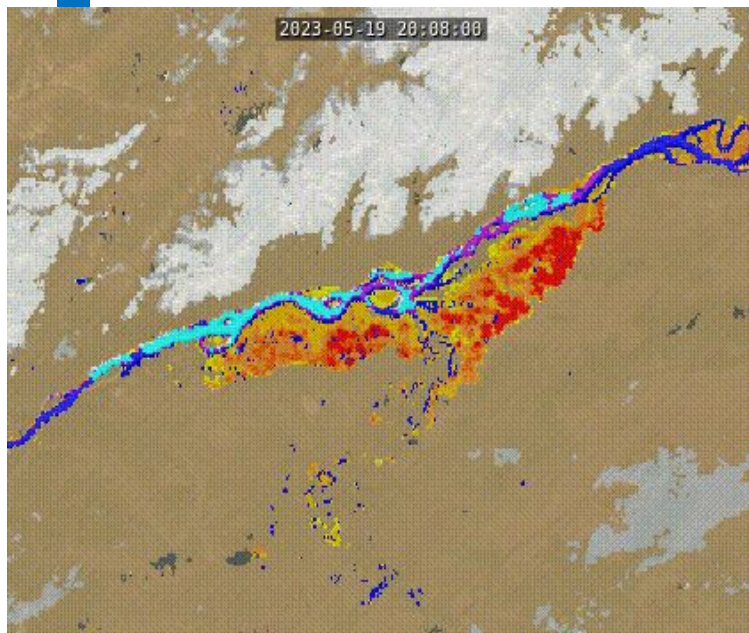
May

19-20

continued

Large ice jam on Yukon River

A large ice jam upstream causing significant out of bank flow, with flooding along Kokrine Hills/Bible Camp and Nowitna River.



*Large ice jam
~50+ miles long
at Big Eddy on
the Yukon River
(upstream of
Ruby, AK) -
May 18th.*

*Significant
flooding at
Bible Camp
near Big Eddy
on the Yukon
River - May
18th.*

2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events

May

19-20

continued

Large ice jam on Yukon River

A large ice jam upstream causing significant out of bank flow, with flooding along Kokrine Hills/Bible Camp and Nowitna River.

May

21

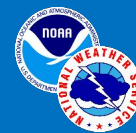
Minor flooding Holy Cross

The combination of an ice jam up-river and snowmelt lead to flooding, with homes surrounded by water for several days.



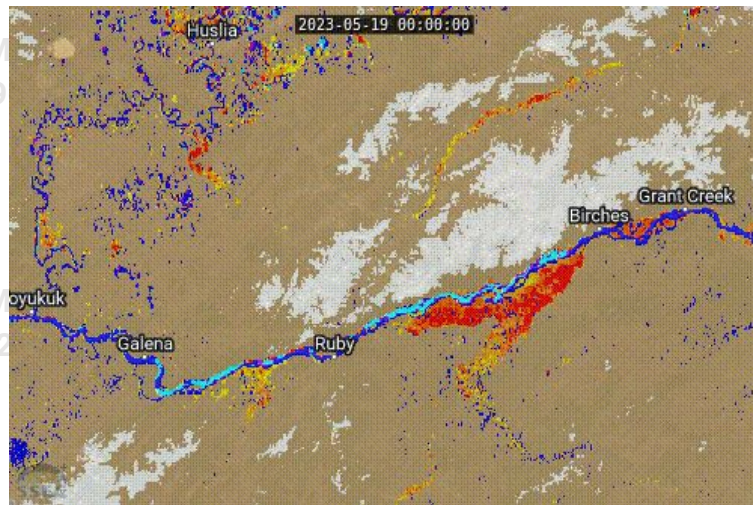
Village of Holy Cross

2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events



May
22-26

Minor flooding in Galena

Back water and continued snow melt causes prolonged high water levels on Yukon River, with minor flooding of roads.



Galena aerial image captured by the U.S. Fish and Wildlife Service on May 24th

Road flooding in Galena captured by community member May 23rd



2023 Spring Breakup in Review



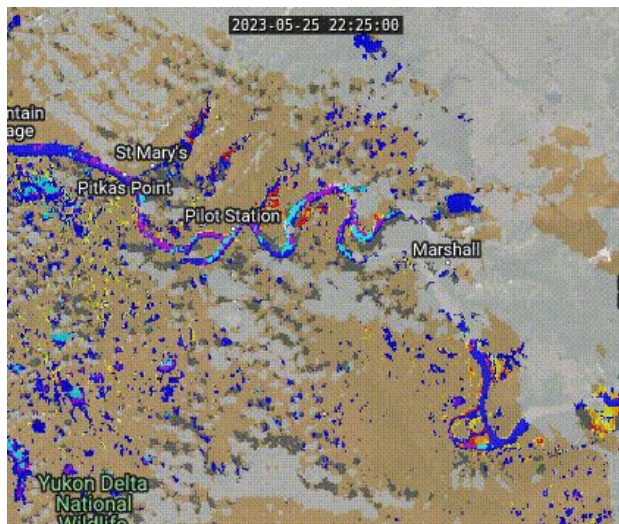
NWS Alaska Region

Timeline of Events

May
22-26
continued

Prolonged major flooding in Russian Mission

Yukon River ice jam downstream of Russian Mission causes a week long flooding event. Several homes and runaway damaged



Extent of flooding in Russian Mission, with the airport (top right), and estimated high water mark (lower left), and community (top left/lower right).

2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events

May
22-26

continued

Prolonged flooding in Russian Mission

Yukon River ice jam downstream of Russian Mission causes a week long flooding event. Several homes and runaway damaged

May
27-29

Yukon Delta Flooding

Yukon River breakup front moves downstream to the delta flooding Emmonak, Alakanuk, and Nunam Iqua.



Flooding observed in Alakanuk May 28th



Flooding observed in Emmonak May 28th

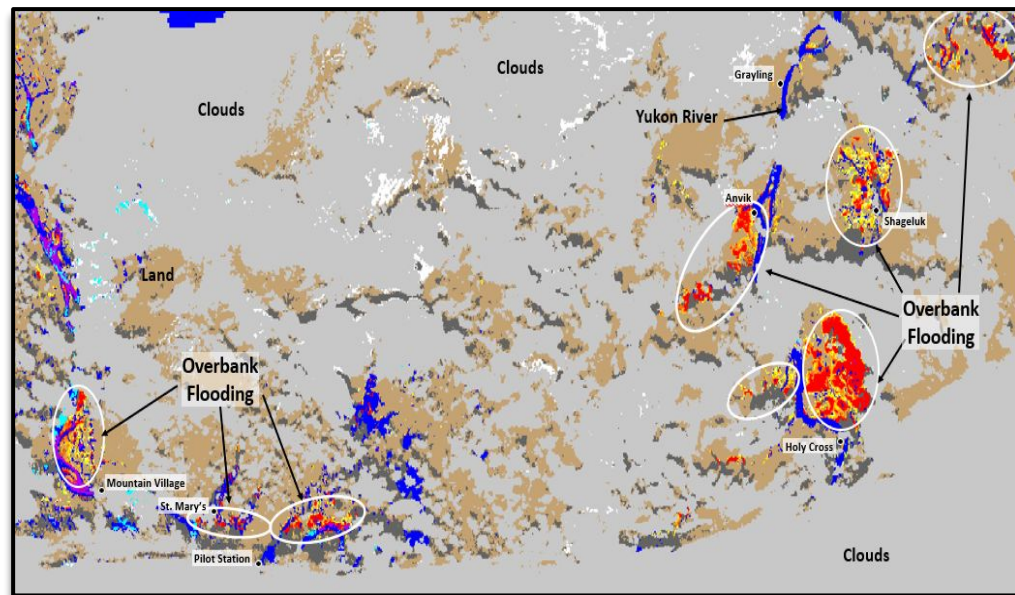
2023 Spring Breakup in Review



NWS Alaska Region

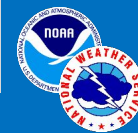
Timeline of Events

May 22-26 continued	Prolonged flooding in Russian Mission Yukon River ice jam downstream of Russian Mission causes a week long flooding event. Several homes and runaway damaged
May 27-29	Yukon Delta Flooding Yukon River breakup front moves downstream to the delta flooding Emmonak, Alaskuk, and Nunam Iqua.
May 27-29 continued	Backwater and overflow Backwater from previous Yukon River ice jams and upstream snowmelt causes widespread overbank flooding of lowlands from Mountain Village to Grayling.



VIIRS Imagery showing the extent of out of bank flow and flooding (yellow/orange/red) across the lower Yukon River - May 28th.

2023 Spring Breakup in Review



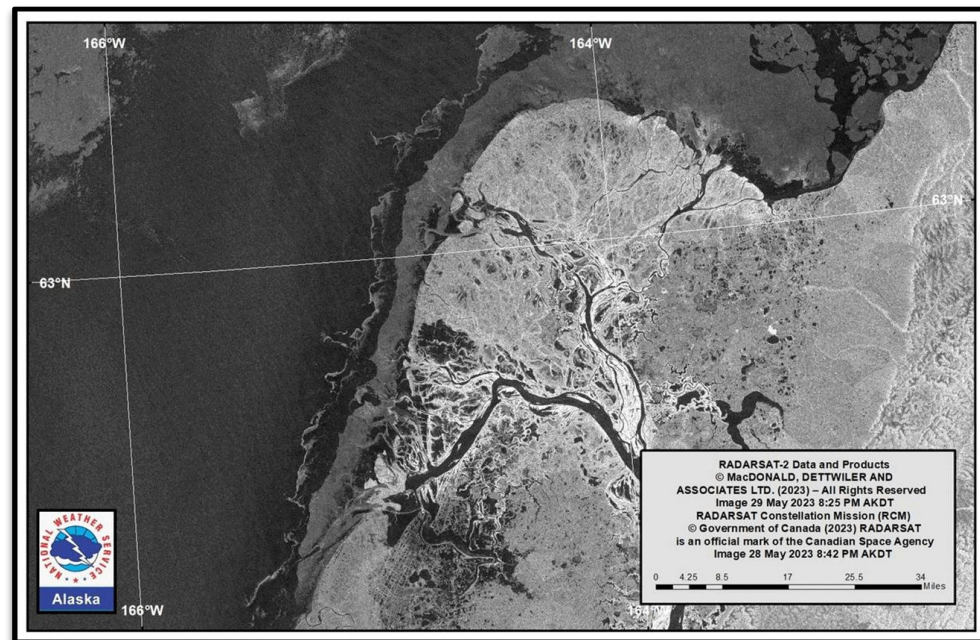
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Timeline of Events

May
30

Yukon breakup front exits

Yukon breakup front exits into the Bering Sea, residual high water persists through the end of May



Satellite imagery of shorefast ice still in place along the Yukon Delta - May 29th.

2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events

May
30

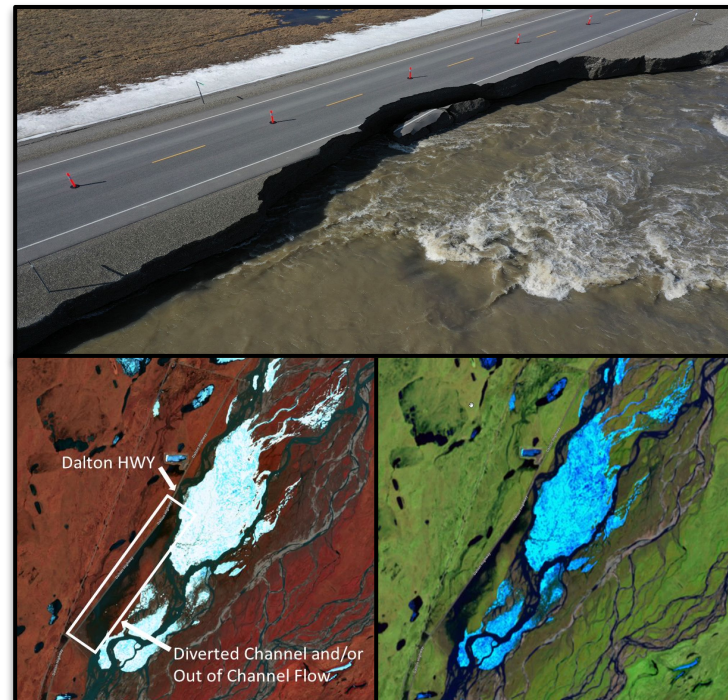
Yukon breakup front exits

Yukon breakup front exits into the Bering Sea, residual high water persists through the end of May

June
05-20

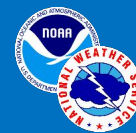
Aufeis and erosion on the Sag

A large area of aufeis remains following breakup on the Sagavanirktok River. The channel diverges and causes significant erosion on Dalton Highway. Enhanced snowmelt keeps water levels high through June.



Dalton Highway erosion caused by a diverted channel on the Sagavanirktok River on June 7th (top). Sentinel Images highlighting aufeis and diverted channel (bottom left/right).

2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events

May
30

Yukon breakup front exits

Yukon breakup front exits into the Bering Sea, residual high water persists through the end of May

June
05-20

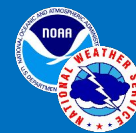
Aufeis and erosion on the Sag

A large area of aufeis remains following breakup on the Sagavanirktok River. The channel diverges and causes significant erosion on Dalton Highway. Enhanced snowmelt keeps water levels high through June.



Dalton Highway erosion June 12th AK DOT Drone

2023 Spring Breakup in Review



NWS Alaska Region

Timeline of Events

May
30

Yukon breakup front exits

Yukon breakup front exits into the Bering Sea, residual high water persists through the end of May

June
05-20

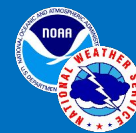
Aufeis and erosion on the Sag

A large area of aufeis remains following breakup on the Sagavanirktok River. The channel diverges and causes significant erosion on Dalton Highway. Enhanced snowmelt keeps water levels high through June.



Dalton Highway erosion June 14th AK DOT Drone

2023 Spring Breakup in Review



NWS Alaska Region

Thanks!

Special Thank You to:

- Local Observers throughout the state
- State Emergency Office
- William Straka
- Brian Brettschneider
- Fresh Eyes On Ice

