Streamflows at Bering River

Data collected for instream water reservations

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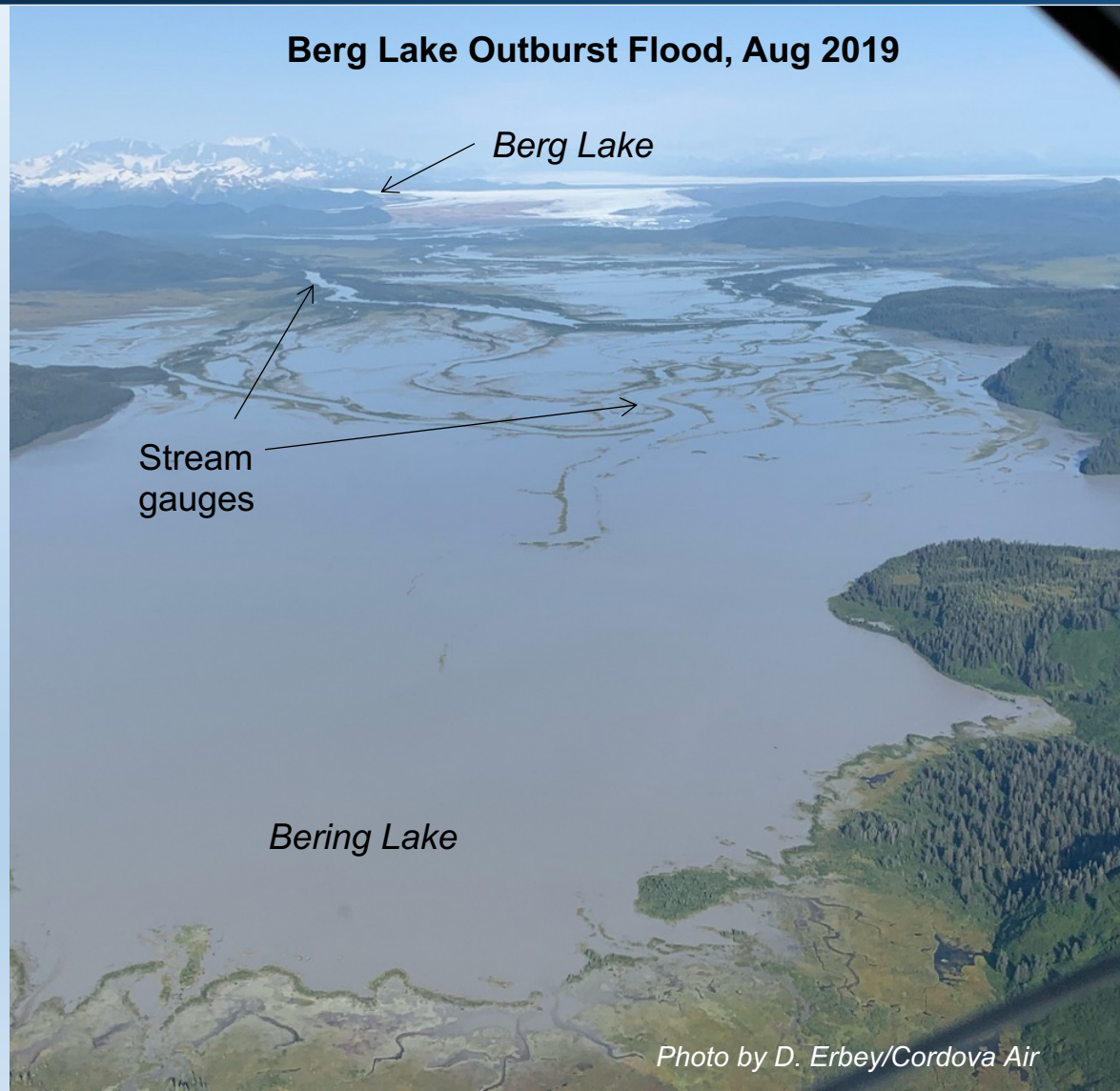
Purpose and need

Highly productive habitat for 5 species of Pacific salmon

ANILCA 501(b) "…the **conservation of fish** and wildlife **and their habitat** shall be the **primary purpose** of management" of NFS lands at **Bering River**.

Why stay awake during this talk?

Water data collected in a dynamic and remote coastal landscape



An overview of…

1. **Study area**
2. **Methods- successes, limitations, & challenges**
3. **Dataset and preliminary results**
4. **Glacier-dammed lake outburst floods**

Catchment location and characteristics

Legend

HUC10 - Headwaters Bering River

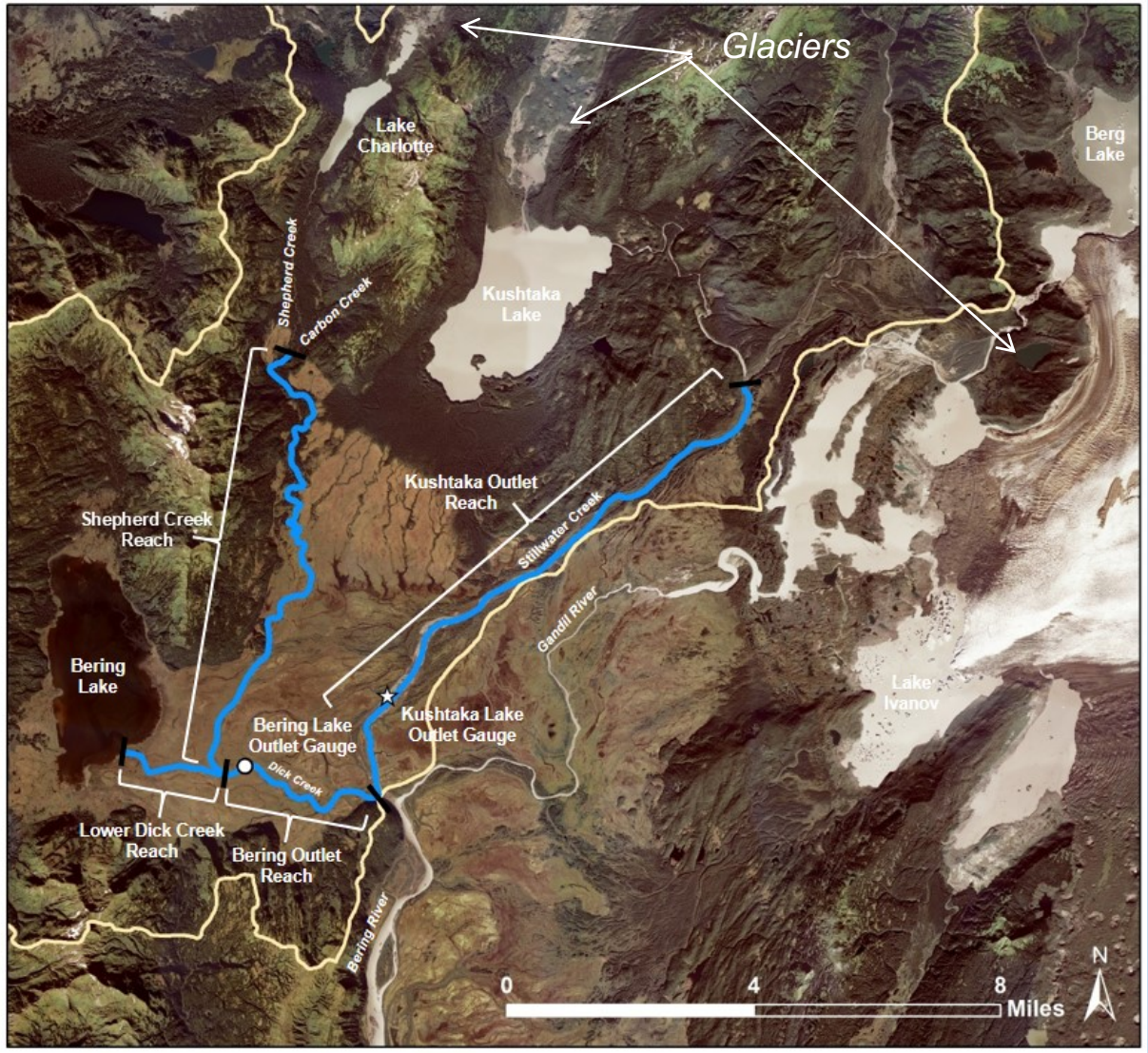
Bering Lake Outlet Gauge

Kushtaka Lake Outlet Gauge

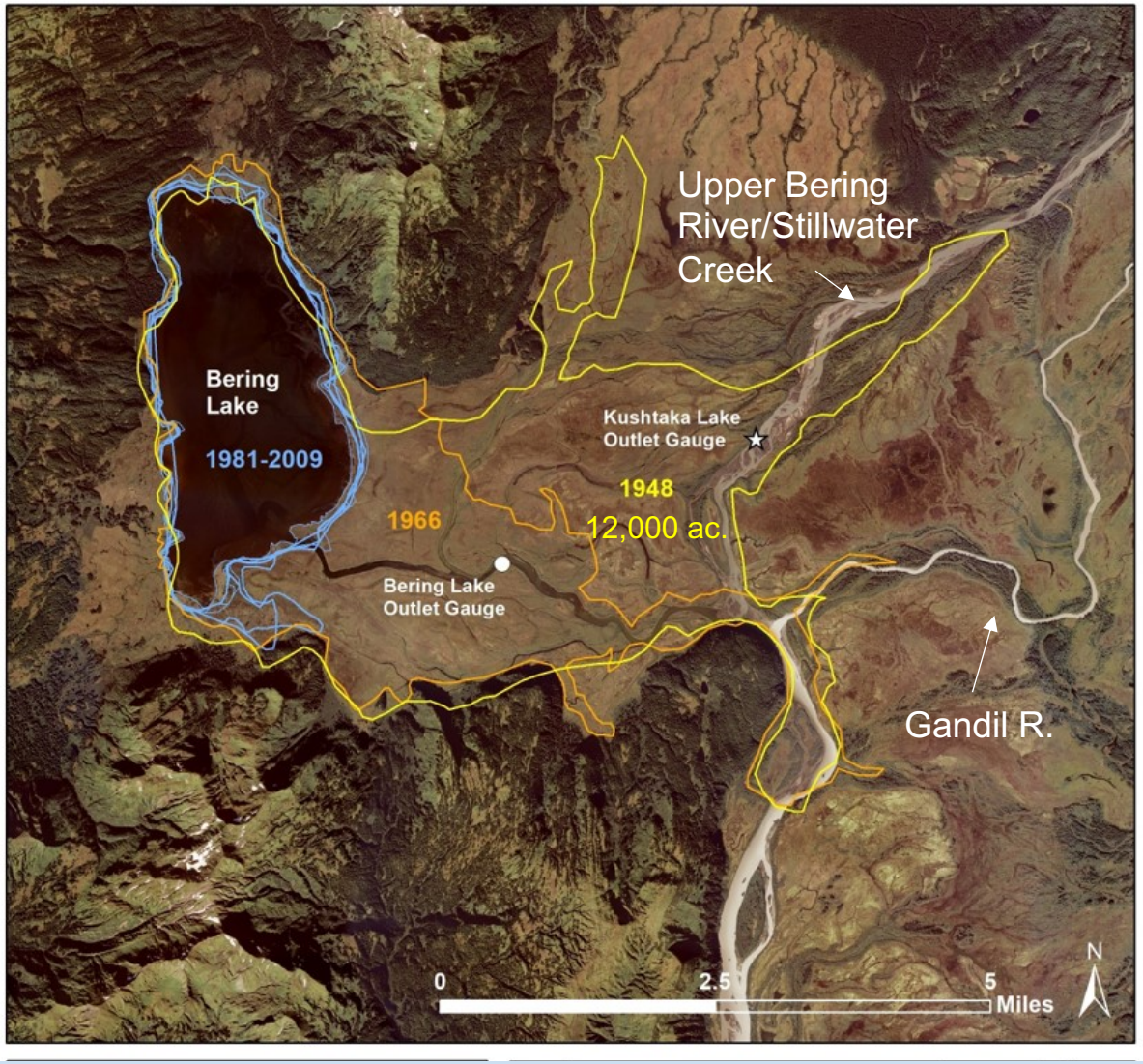
Reach Name	Length (mi)	Length (km)
Lower Dick Creek Reach	1.9	3.0
Shepherd Creek Reach	9.5	15.3
Bering Outlet Reach	3.1	5.0
Kushtaka Outlet Reach	10.1	16.2

Map produced 07/24/2019 by W. Schreck, USFS Fish Biologist. Aerial Imagery: DOQQ4b60cm2009_2011.

- Valuable salmon migration habitat
- Accessible only by aircraft and boat
- Maritime climate
- 75 to 362 km^2 catchments
- 0 to 27% perennial ice and snow
- Lakes upstream of all reaches
- 50 to 150 m wide, low-gradient (<0.001) channels



Dynamic landscape



Bering Lake- 3,000 acres today, 25% of the pre-1964 earthquake surface area.

Tidal influence

Changes in meltwater and glacier extent

Infested with *Elodea*, an invasive macrophyte

Tsunamis and GLOFs

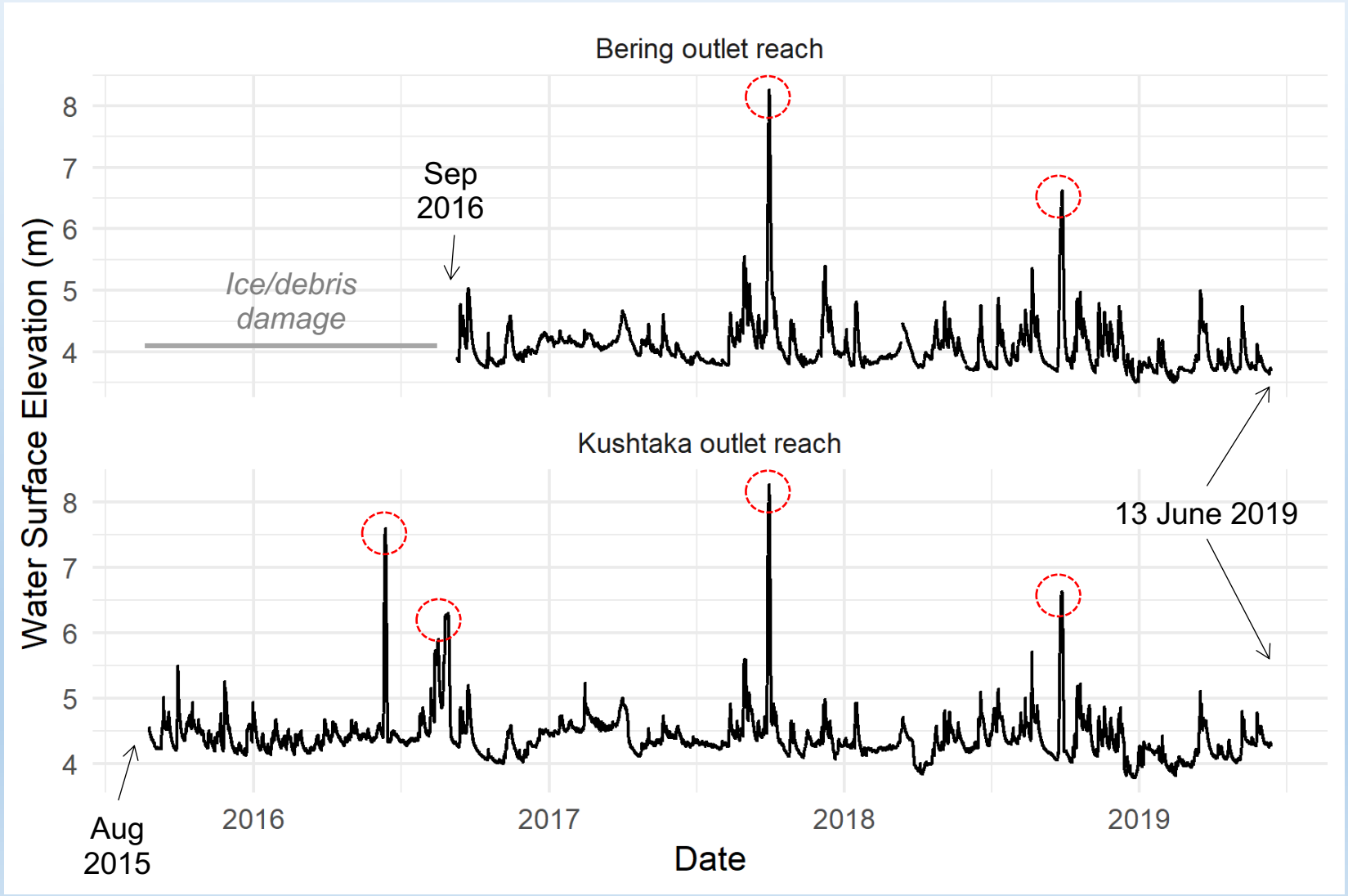
Stone net sinkers

Field Methods- Stage data collection

Unvented pressure transducers (In-situ Leveltroll 300*) in a galvanized steel stilling wells.

Year-round stage record, but no through-ice discharge measurements

Berg Lake outburst floods (GLOFs)



*The use of trade names is for informational purposes and does not constitute endorsement by the USDA

Field Methods- Discharge data collection

Un-wadable, used ADCP

Open water period only

Complicated by vegetation at Bering Outlet and Lower Dick Creek

Collection to date: 17 measurements at Kushtaka Outlet, 20 at Bering Outlet, and 12 at Lower Dick Creek

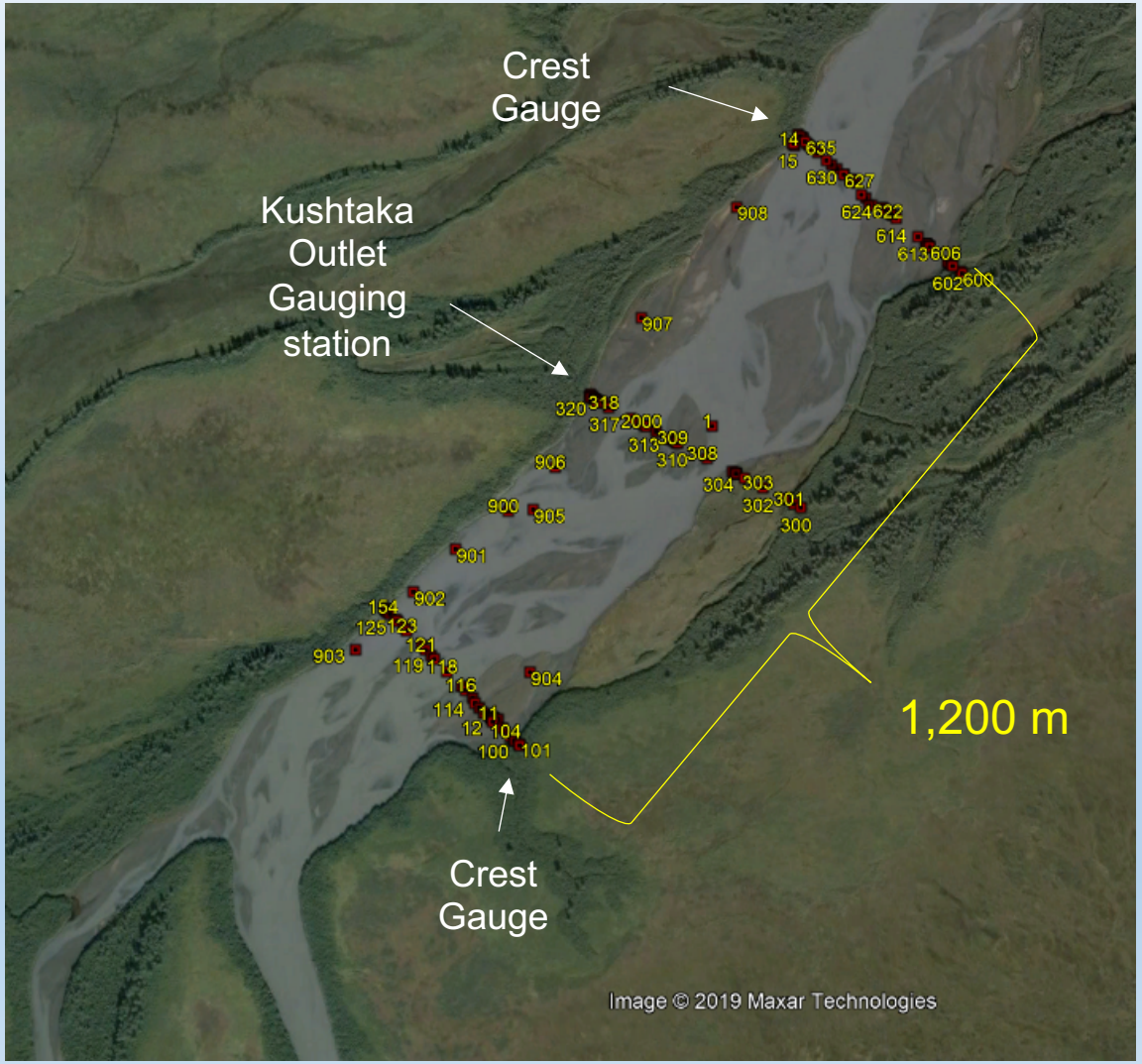
Bering Outlet

Discharge indirect methods

GNSS GPS survey

Crest gauges

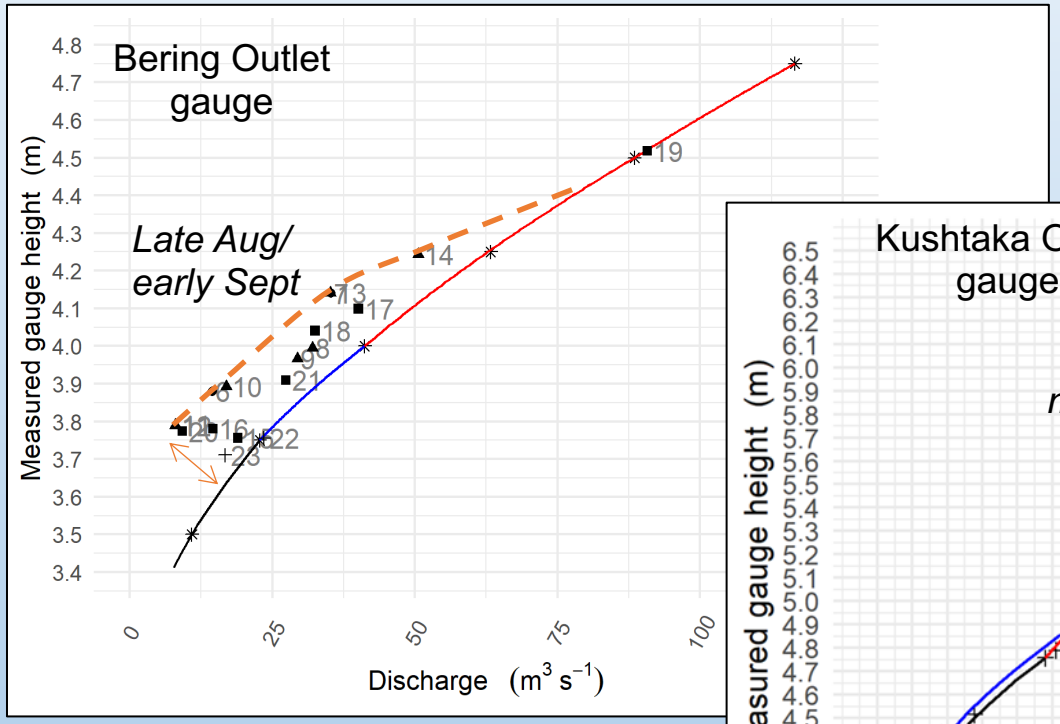
Slope-conveyance and slope-area methods to estimate discharge

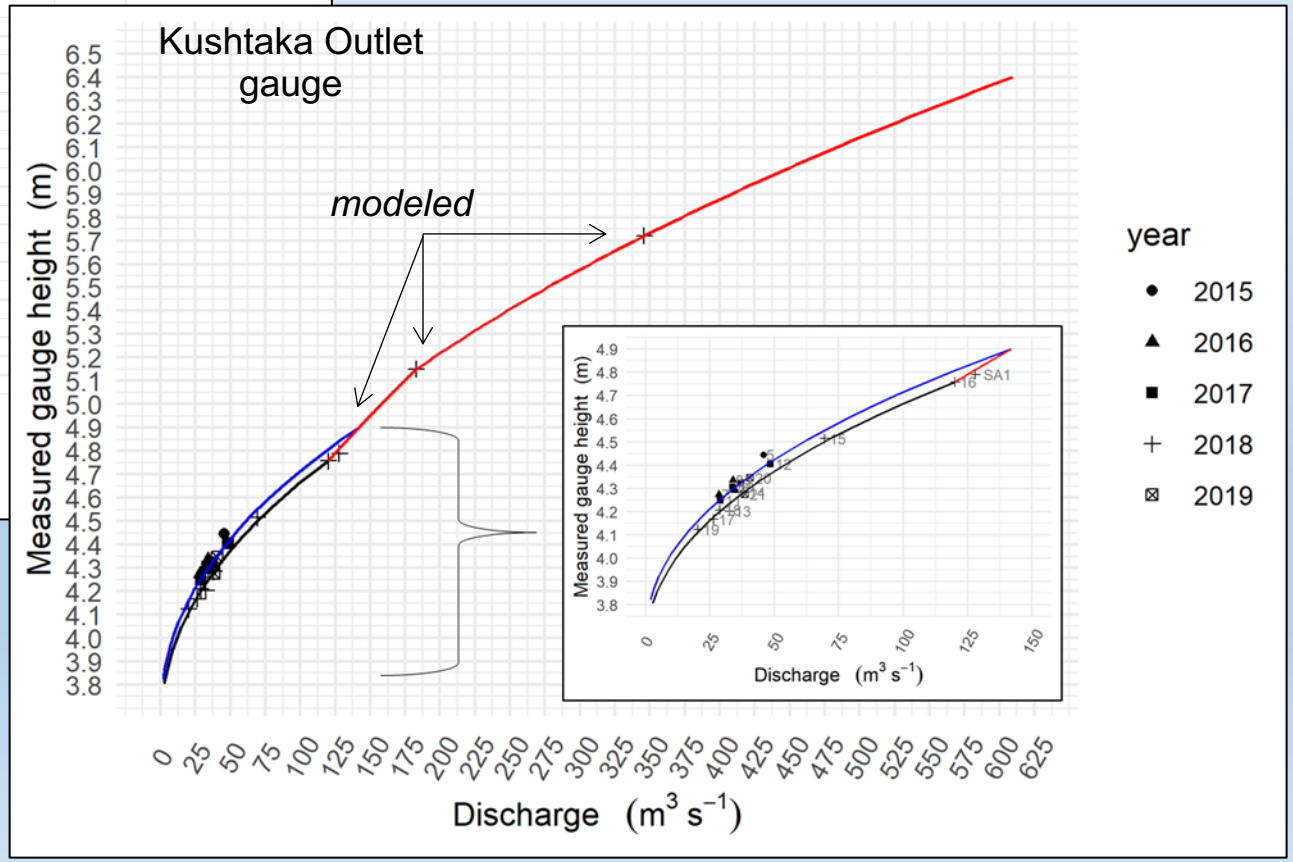


Rating curves

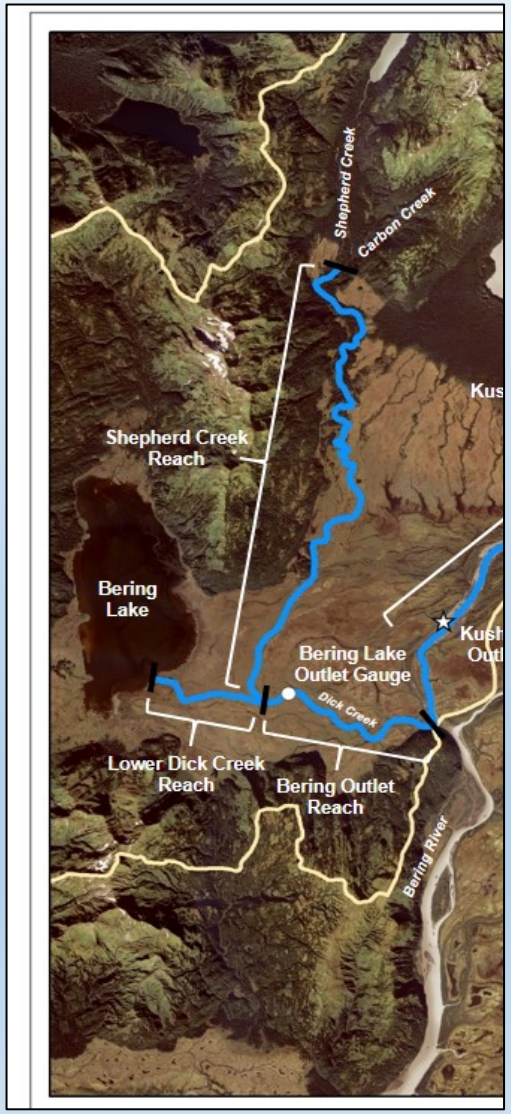
Seasonal rating shifts at Bering Outlet to account for vegetation growth.

Estimated base flows during GLOFs to remove cross-basin flood effects

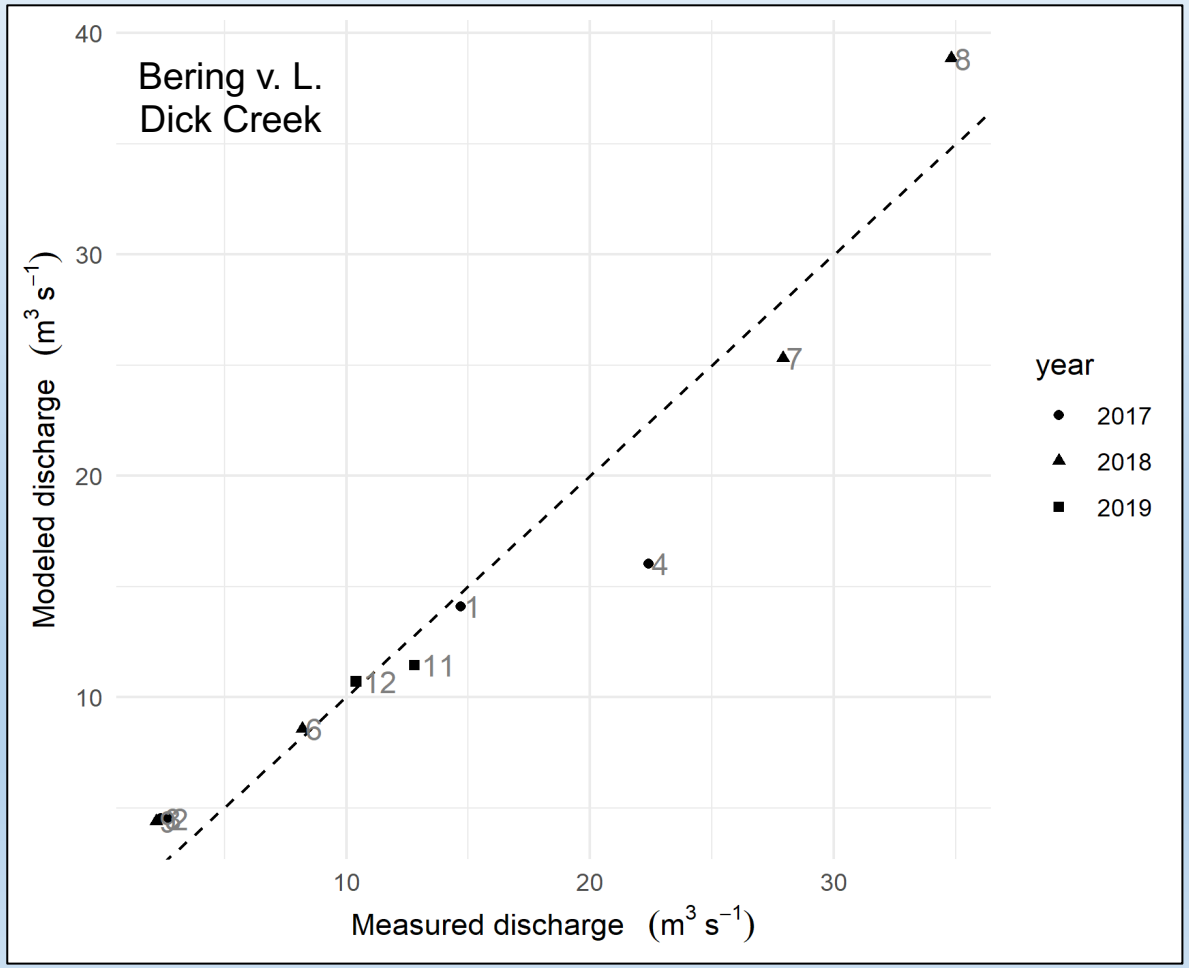




Record extensions at ungauged reaches



Shepherd Creek extrapolated through mass balance

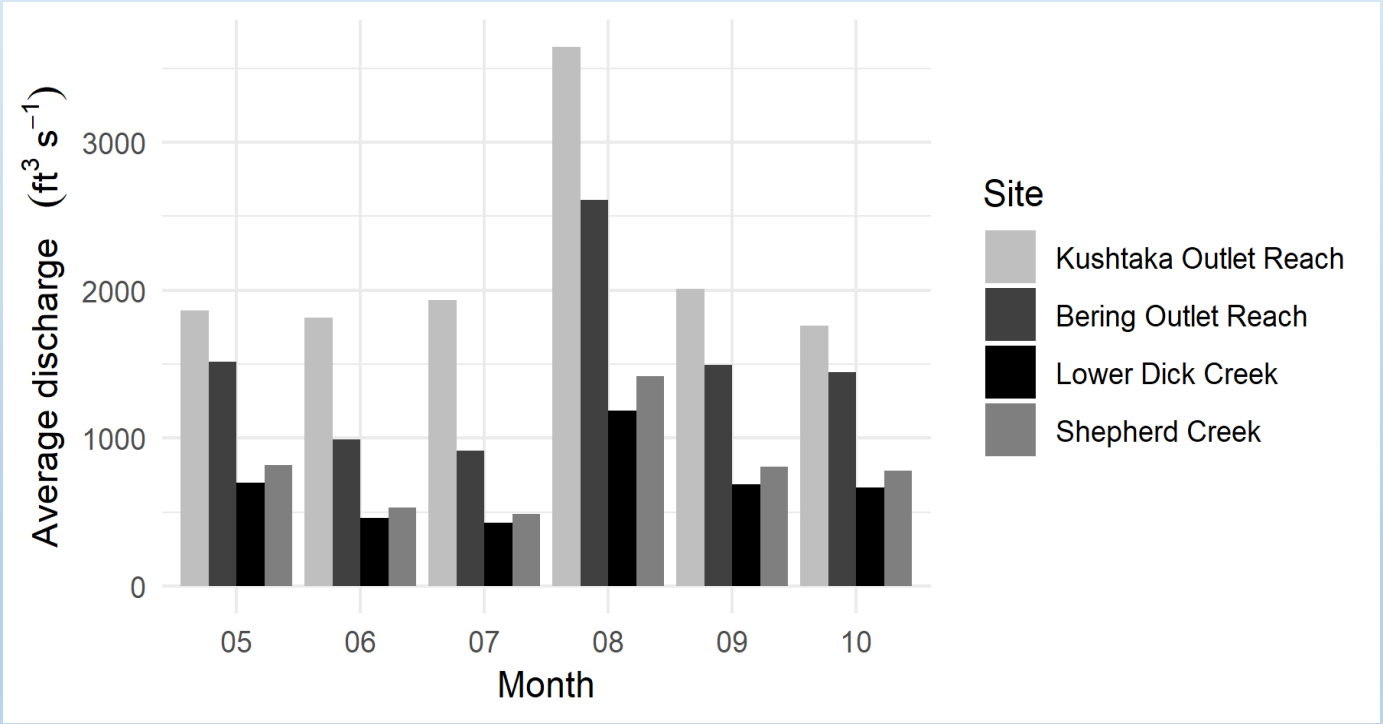


Flow patterns

Distinct snowmelt freshet in late April through May at Bering Outlet reach.

Freshet blends with mid-summer glacier melt at Kushtaka Outlet reach.

Discharge highest in August due to large storms during first three years of study



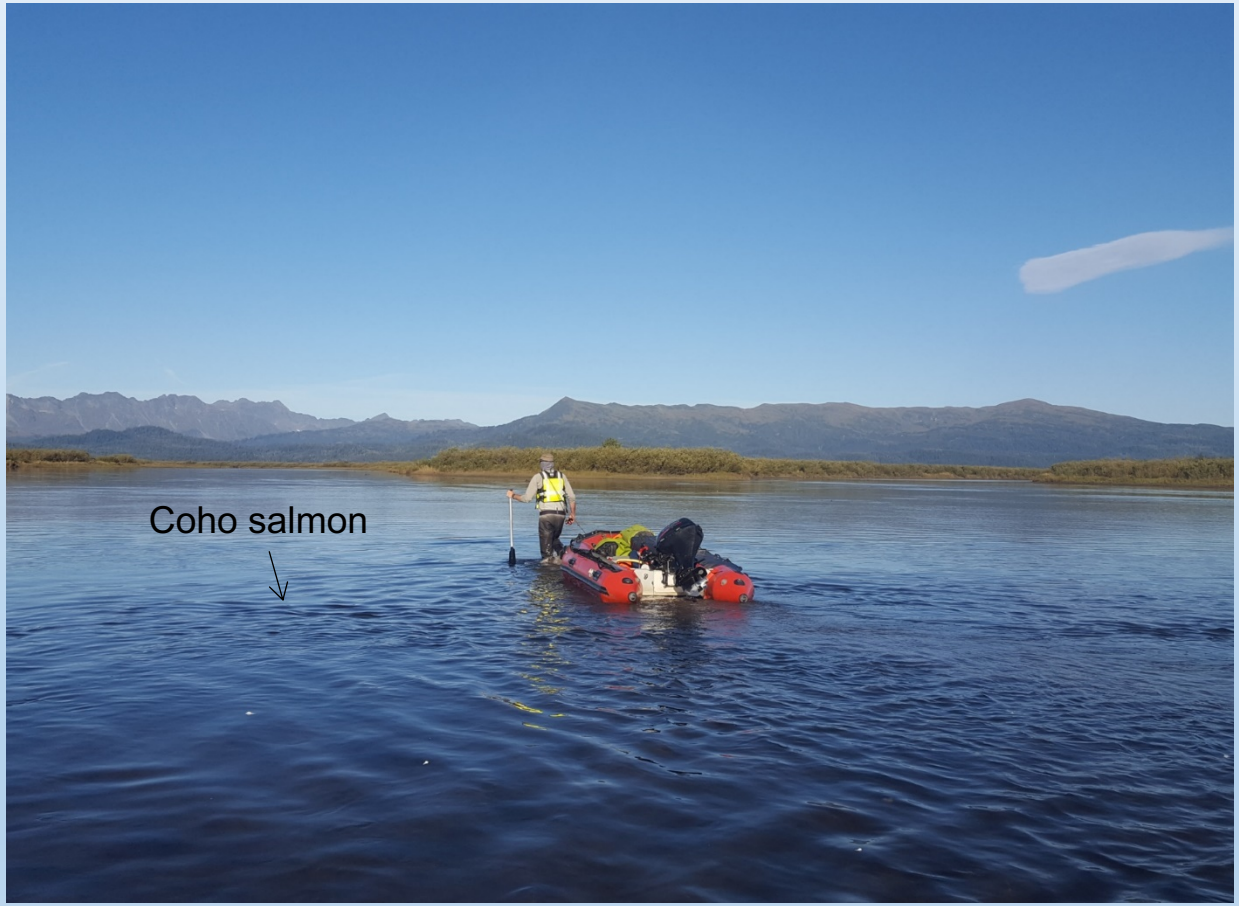
Next steps

Collect stage and discharge data for 1-2 more years

Refine ratings and temporary shifts

File for minimum instream flows using flow duration methodology

Finalize report describing and comparing flow patterns across the study reaches

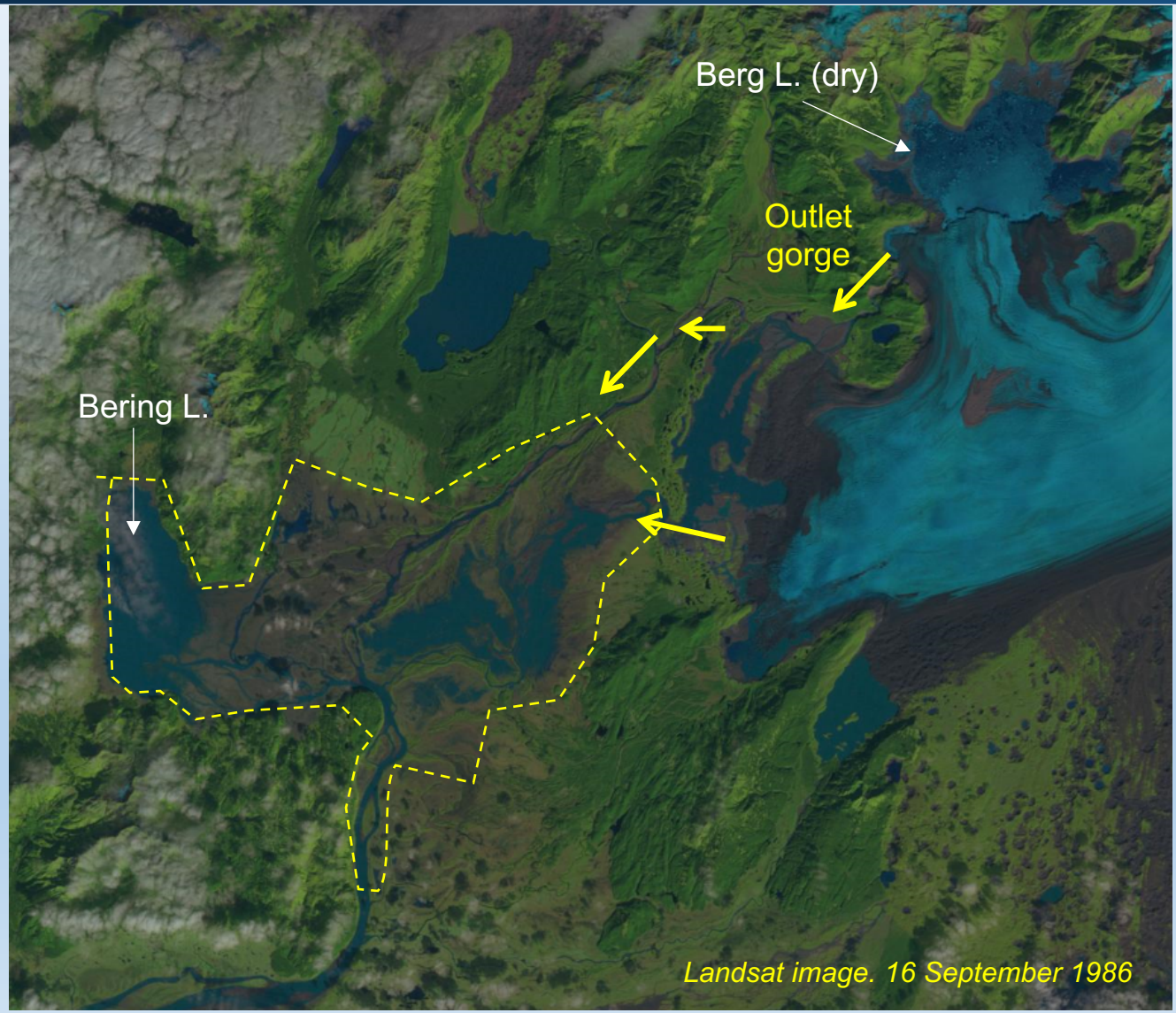


Outburst floods- historical record

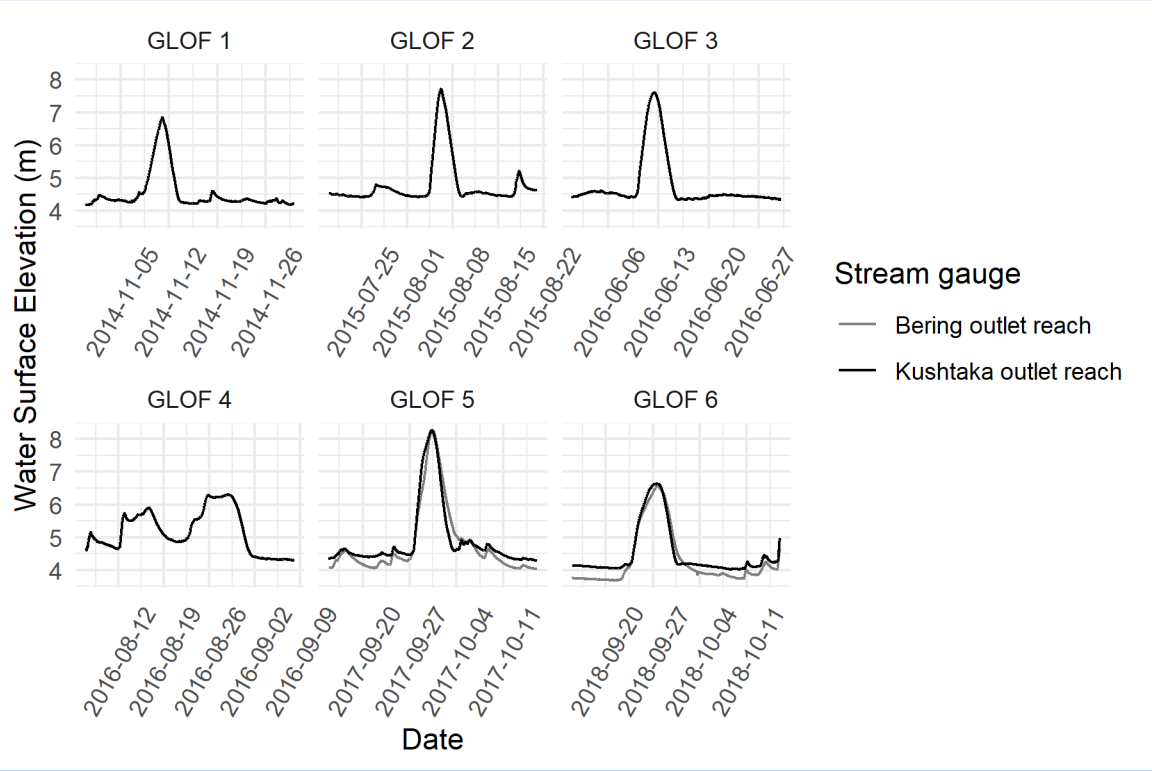
Episodic releases due to ice damming at outlet in late 1800s, 1981,1983, 1986, and 1994

Martin 1908

Post and Mayo 1971: Berg Lake “presents one of the greatest potential floods of any glacier dammed lake in Alaska” with peak flows “far exceeding [1,000,000 c.f.s.]”



Outburst floods during study



7 Floods:

Nov 2014

Aug 2015

Jun 2016

Aug 2016

Sept 2017

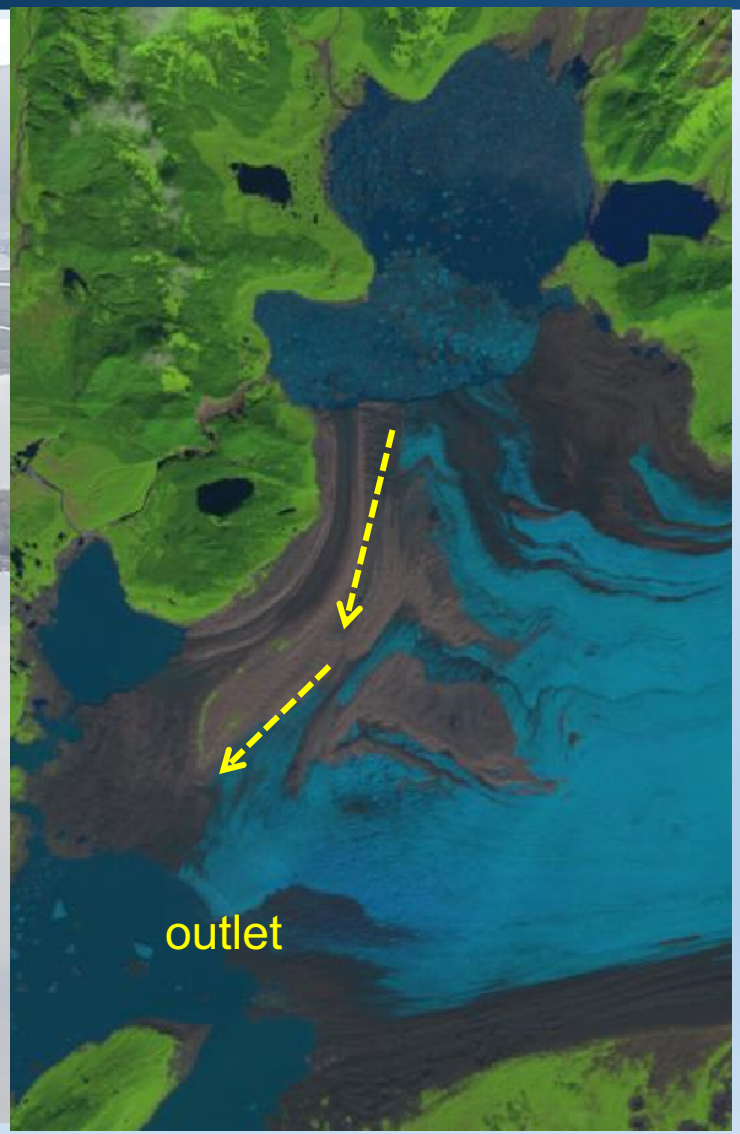
Sept 2018

Aug 2019

Release 3-6 days
Inundation effects linger up to 1.5 months

Berg Lake ~25 sq. km
Inundation zone ~100 sq. km

Outburst floods during study



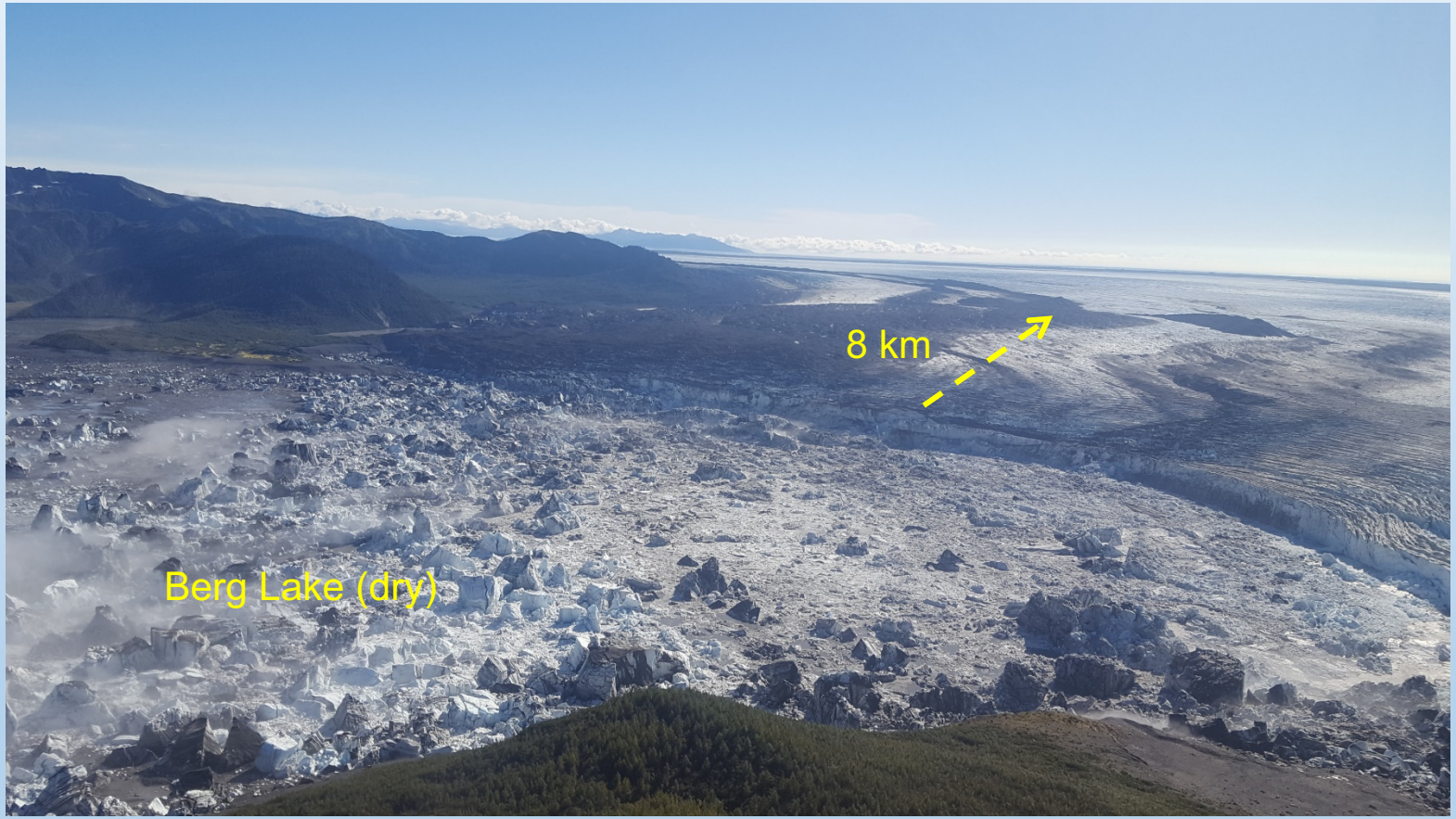
Outburst flood mechanism

Bruce Molnia, Kim Angeli, and Shawn Dilles (USGS) propose:

Glacier terminus thinned 120 m since 1948

Rising lake level floats terminus, draining lake

Check out their work at AGU 2019



Thank you

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Record extensions at gauges