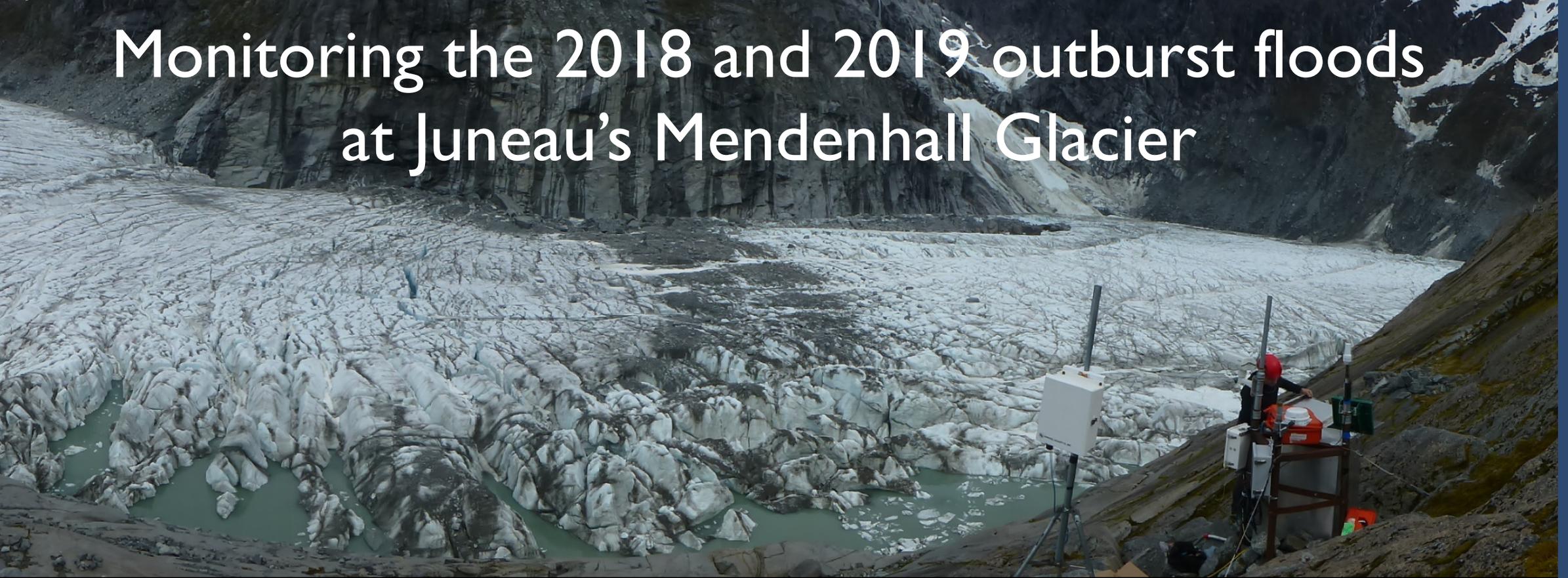


# Monitoring the 2018 and 2019 outburst floods at Juneau's Mendenhall Glacier



Christian Kienholz<sup>1</sup>, Jamie Pierce<sup>2</sup>, Eran Hood<sup>1</sup>, Gabriel Wolken<sup>3</sup>, Aaron Jacobs<sup>4</sup>,  
Dina Abdel-Fattah<sup>3</sup>, Jason Amundson<sup>1</sup>, Crane Johnson<sup>4</sup>, Jeff Conaway<sup>2</sup>, Tom Mattice<sup>5</sup>



1



2



3



4



5

# Study area

Mendenhall Glacier

Suicide Basin

Suicide Glacier

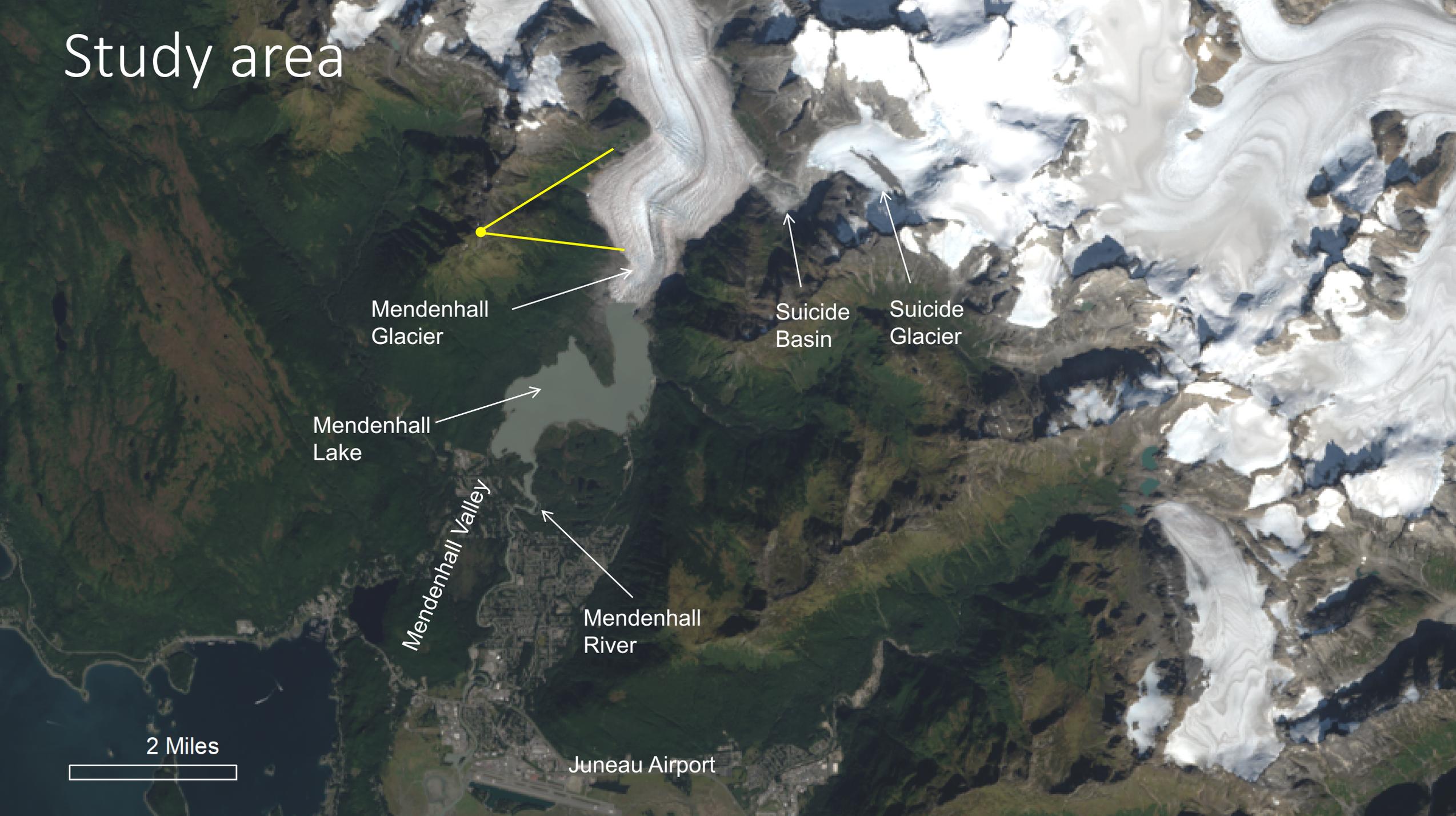
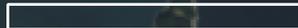
Mendenhall Lake

Mendenhall Valley

Mendenhall River

Juneau Airport

2 Miles



2018

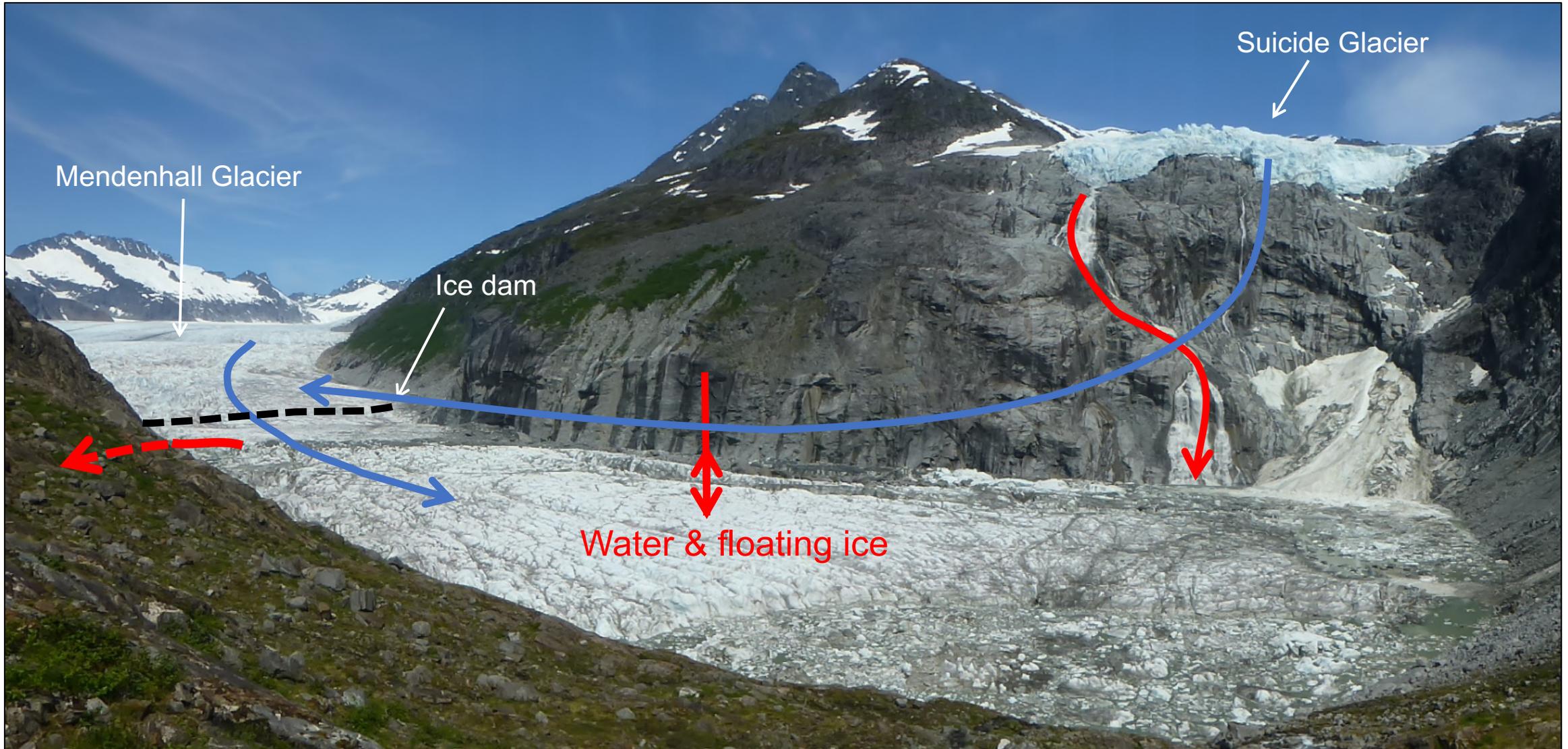
Mendenhall Glacier

Suicide Glacier

Suicide Basin



# Suicide Basin

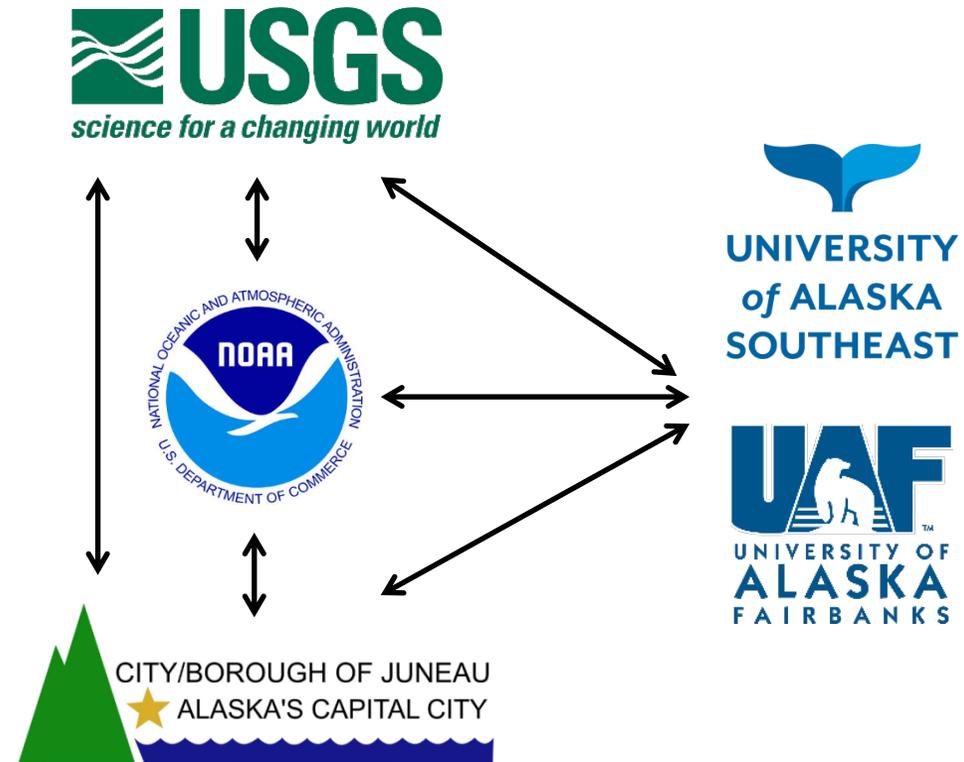


# Downstream consequences

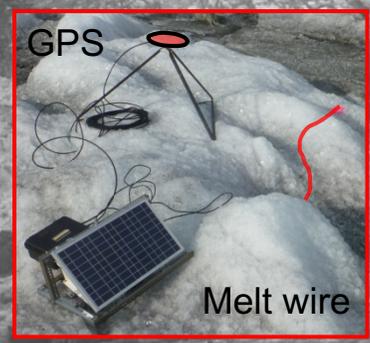
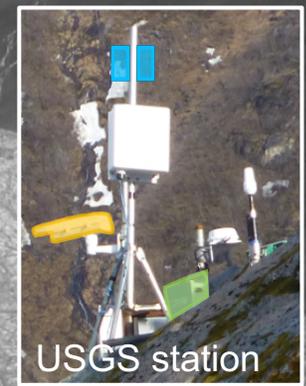


# Partner agencies & role of University of Alaska

- USGS
  - Monitoring of Mendenhall Lake
  - Monitoring of Suicide Basin
- NOAA & NWS
  - River forecasting and flood warnings
- CBJ
  - Emergency management
- UAS & UAF
  - Data collection and analysis to improve process understanding
  - Development of tools to facilitate outburst flood monitoring and forecasting
  - Development of strategies for best dissemination of results



# Field instrumentation

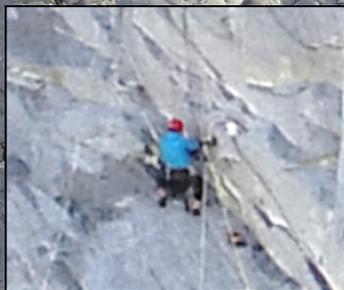


USGS station



2018-07-12

165 ft



AK CASC

2018-05-19

Satellite 2018-05-24 21:00:55 UTC  
56.45937, -134.50381 14.1V 5.5°C P

# 2018 event



UNIVERSITY  
of ALASKA  
SOUTHEAST

**AK CASO**  
Alaska Climate Adaptation Science Center

2018-05-24

01:00 PM

Image: USGS

**AK CASO**

Slide 2019-05-17 14:00:49 UTC  
56.45935, -134.50380 12.4V 4.0°C P

# 2019 event

- 480 m
- 470 m
- 460 m
- 450 m
- 440 m
- 430 m
- 420 m
- 410 m
- 400 m
- 390 m
- 380 m
- 370 m

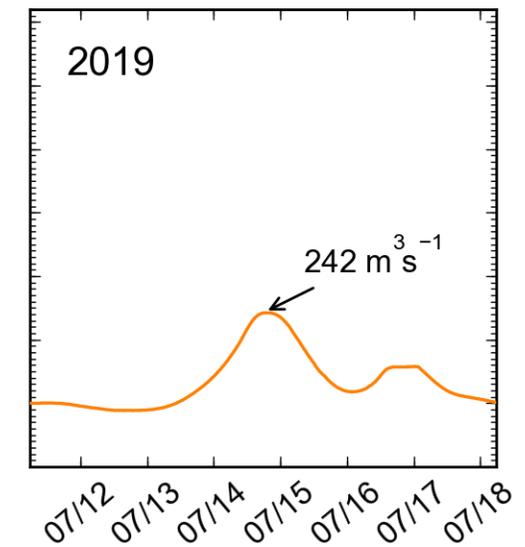
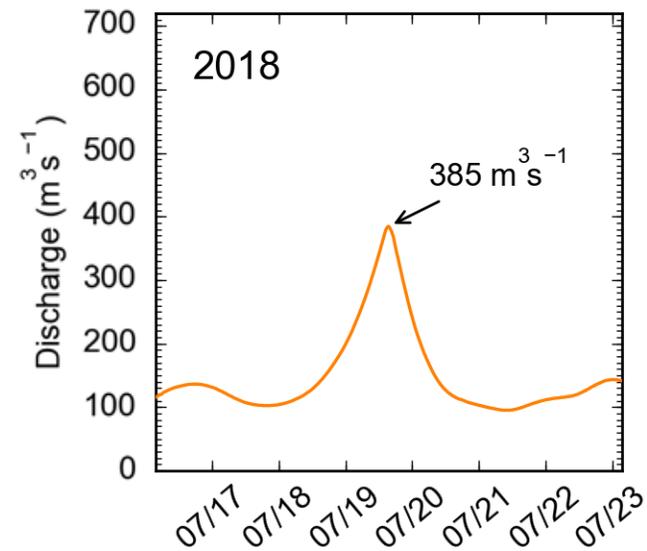


2019-05-17  
06:00 AM

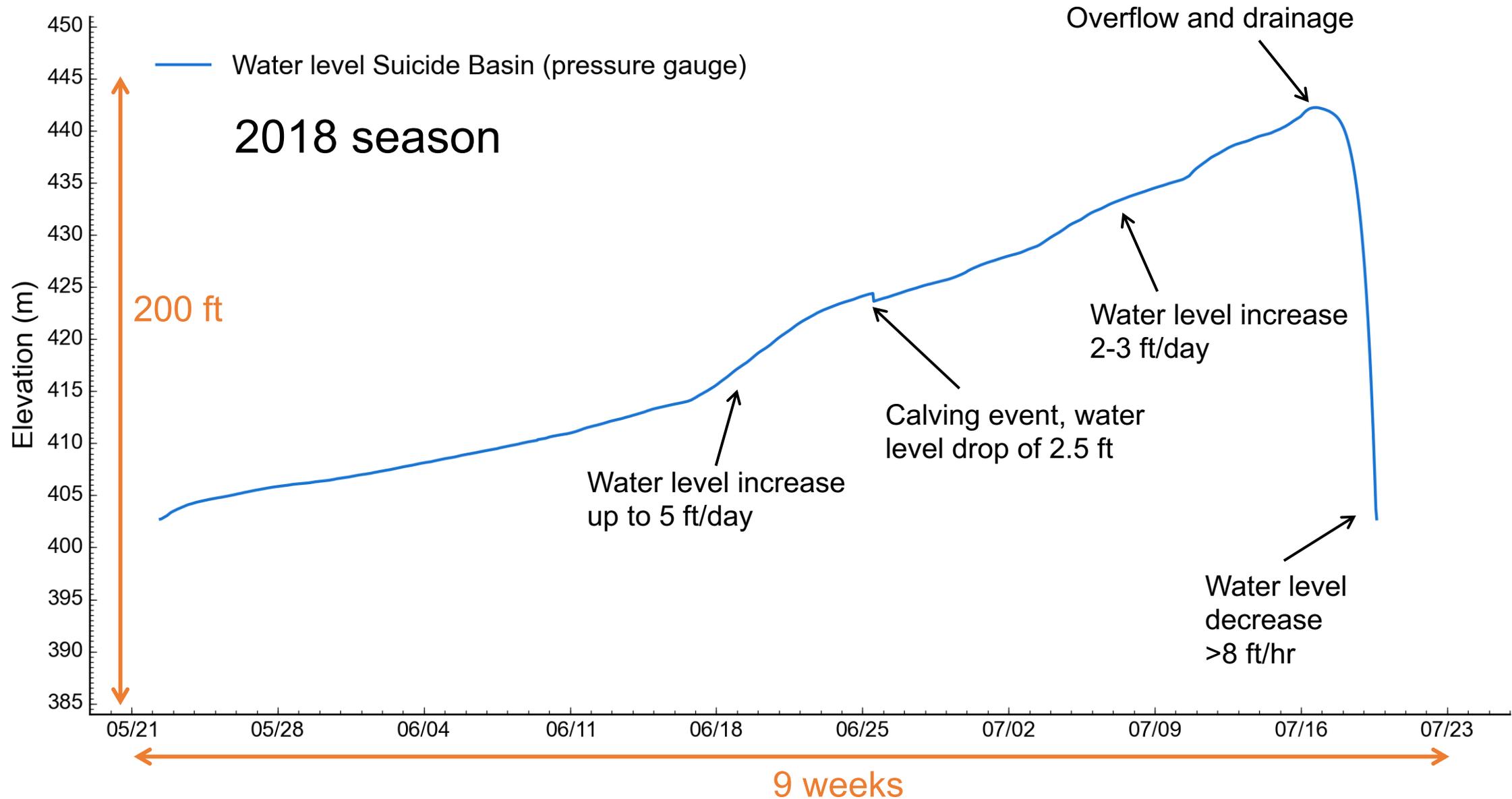


**AK CASO**

# Mendenhall Lake response



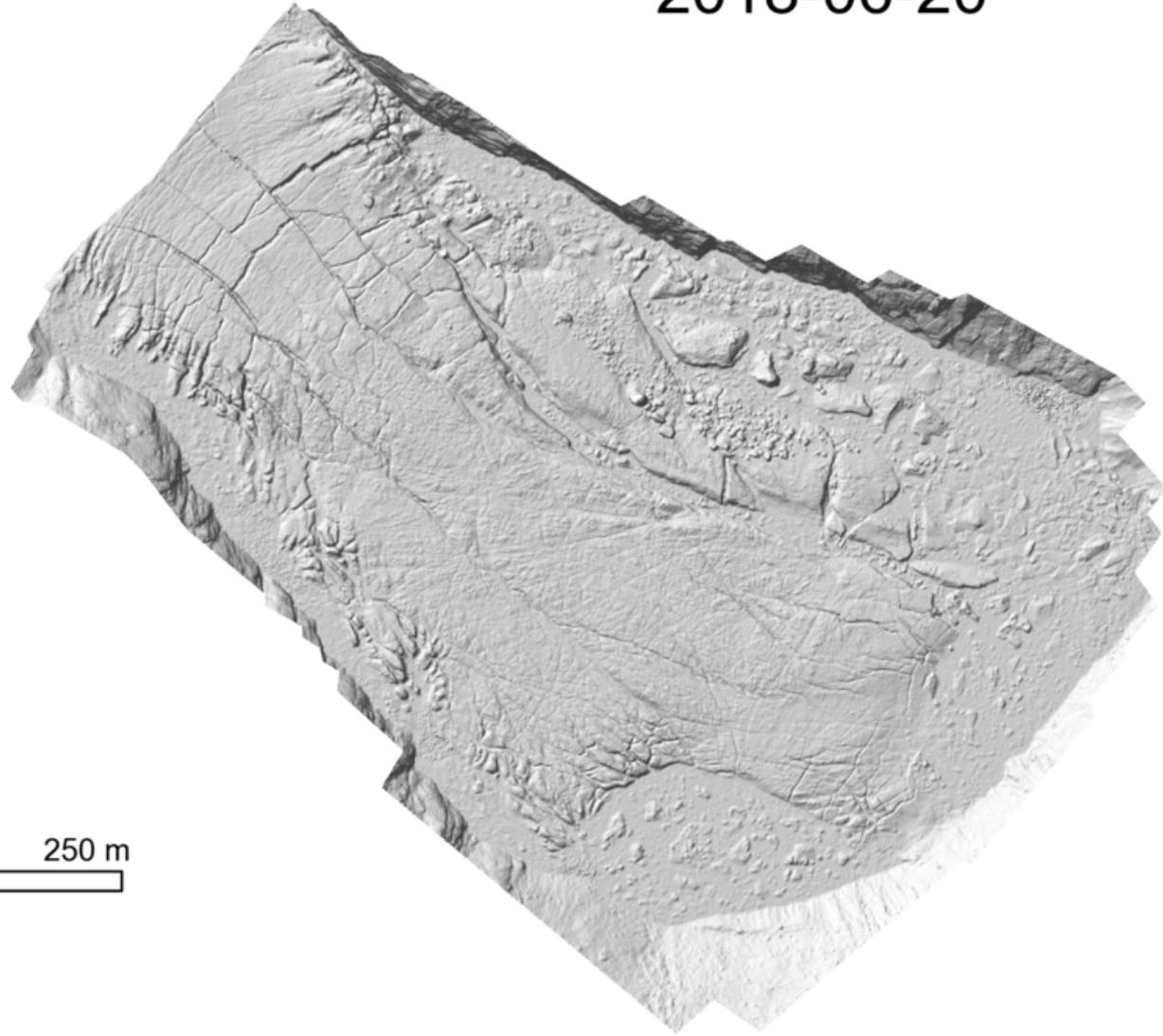
# Suicide Basin water level





# Drone-based monitoring

2018-06-20

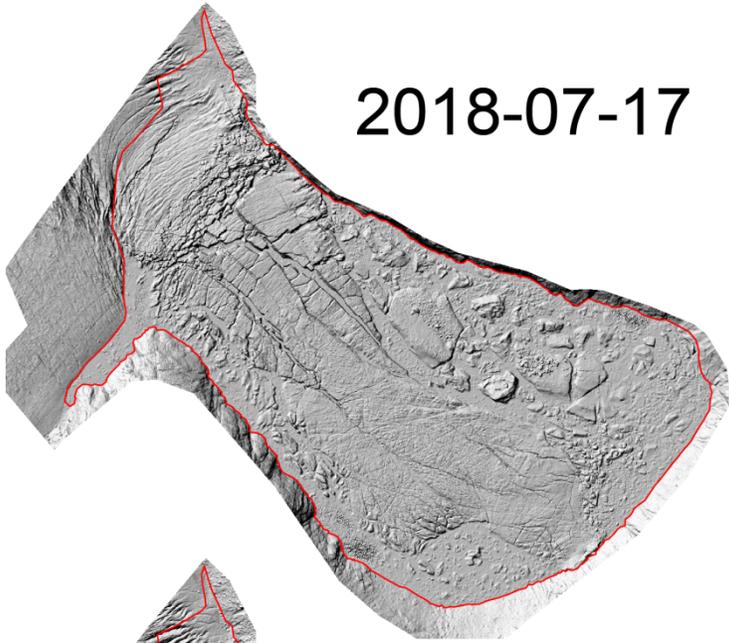


0 250 m

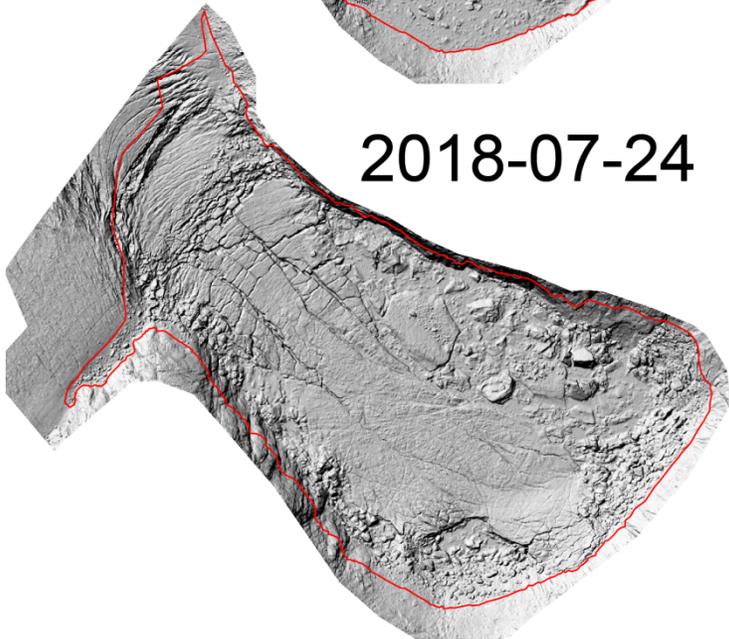
A horizontal scale bar with a black outline, positioned below the text '0 250 m'. The bar is divided into two equal segments by a vertical tick mark in the center.

# Elevation and volume calculations

2018-07-17

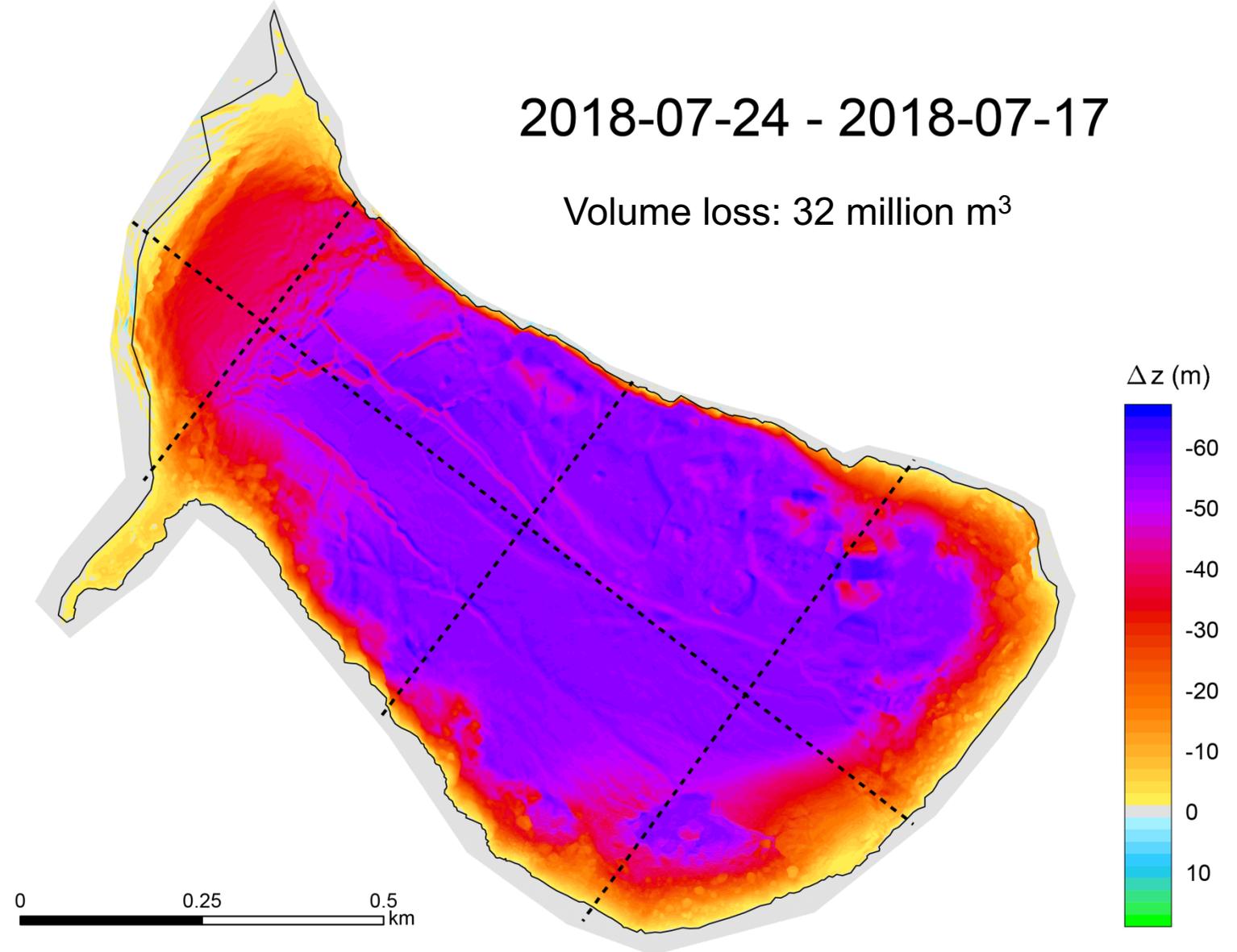


2018-07-24

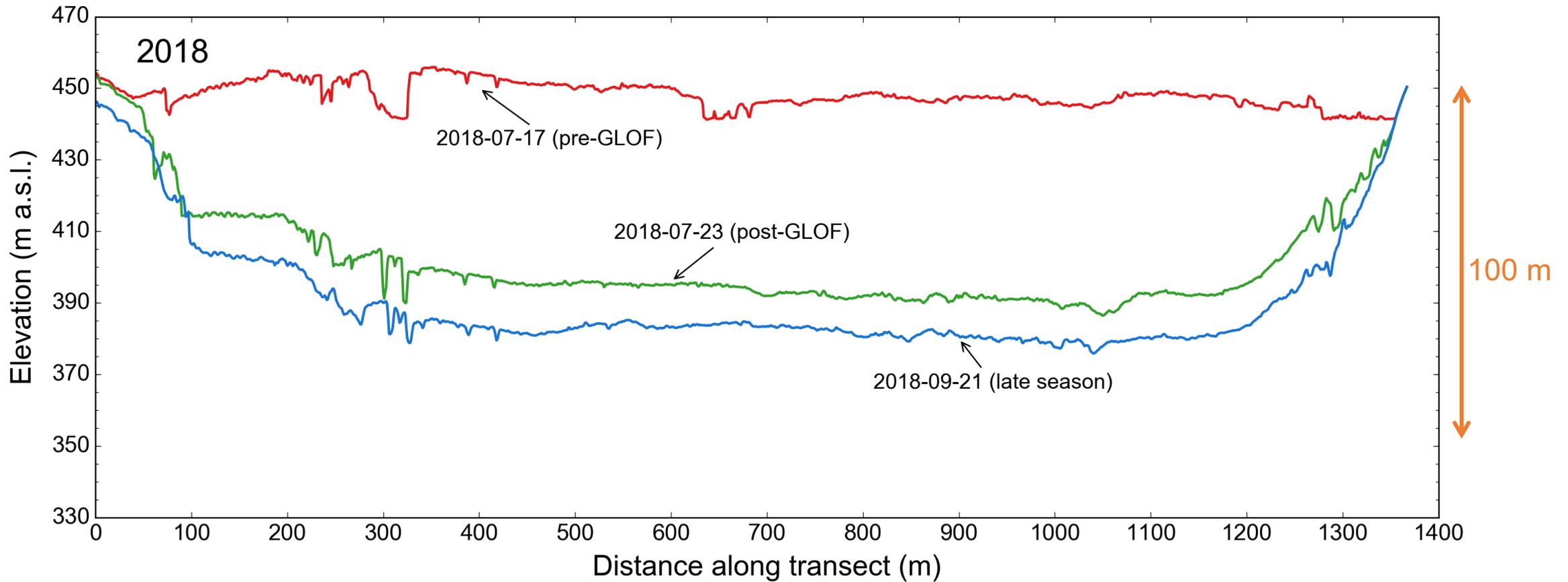


2018-07-24 - 2018-07-17

Volume loss: 32 million m<sup>3</sup>

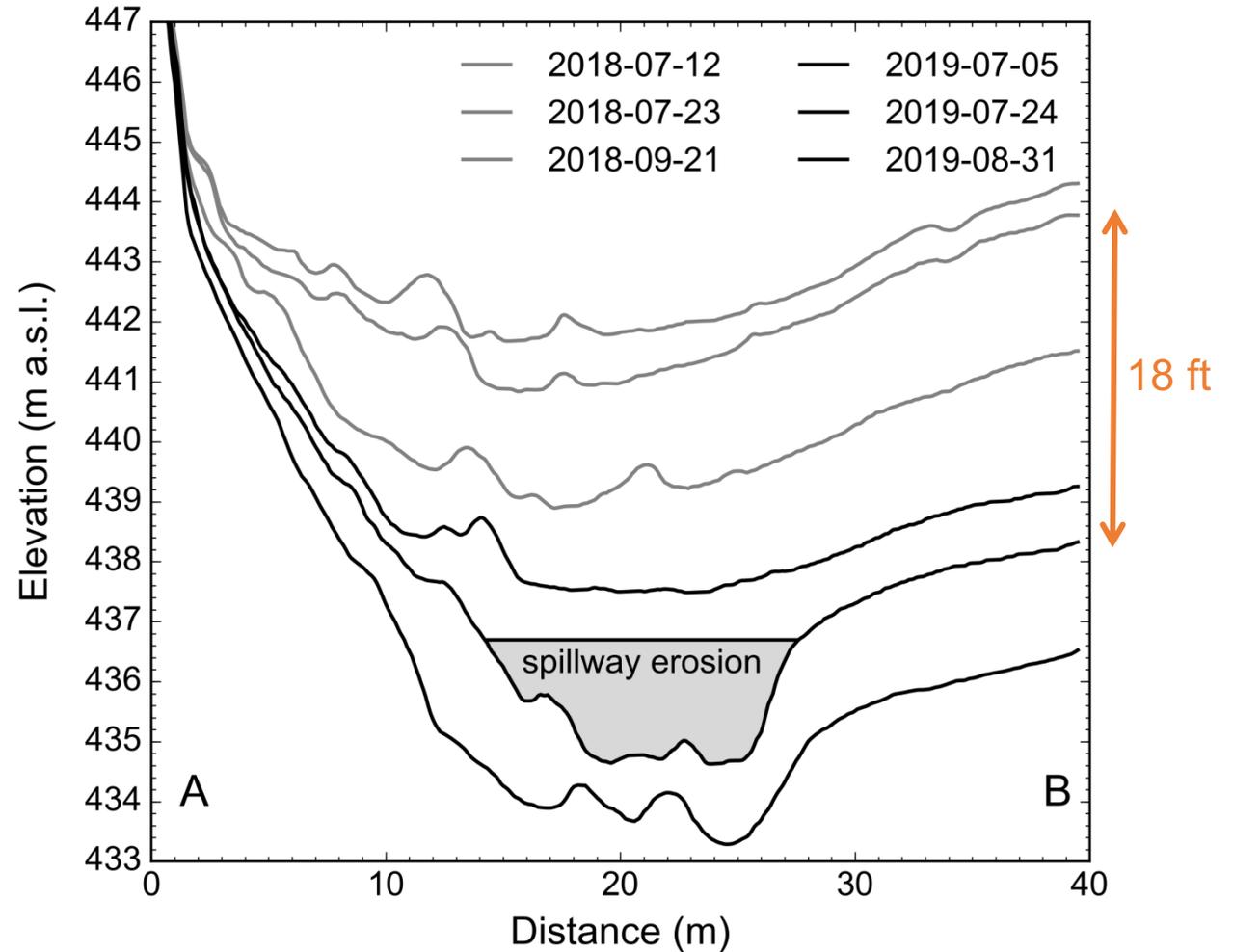
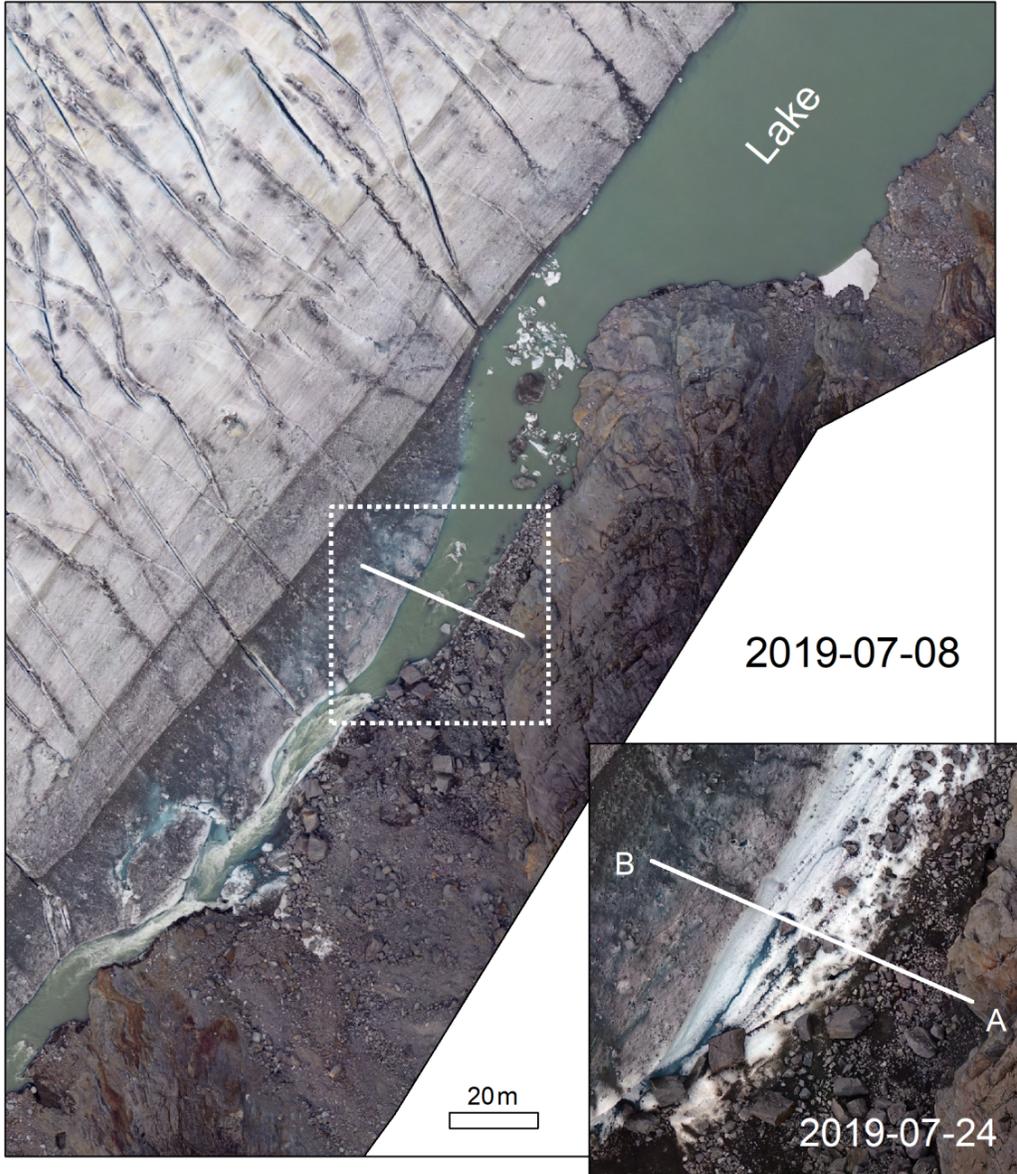


# Elevation and volume calculations



- Only partial drainage during GLOF events
- More than 30% of the total water volume remained in the basin in both years

# Elevation and volume calculations



- 5.5 m thinning over one year
- 7 m along spillway

# Elevation and volume calculations

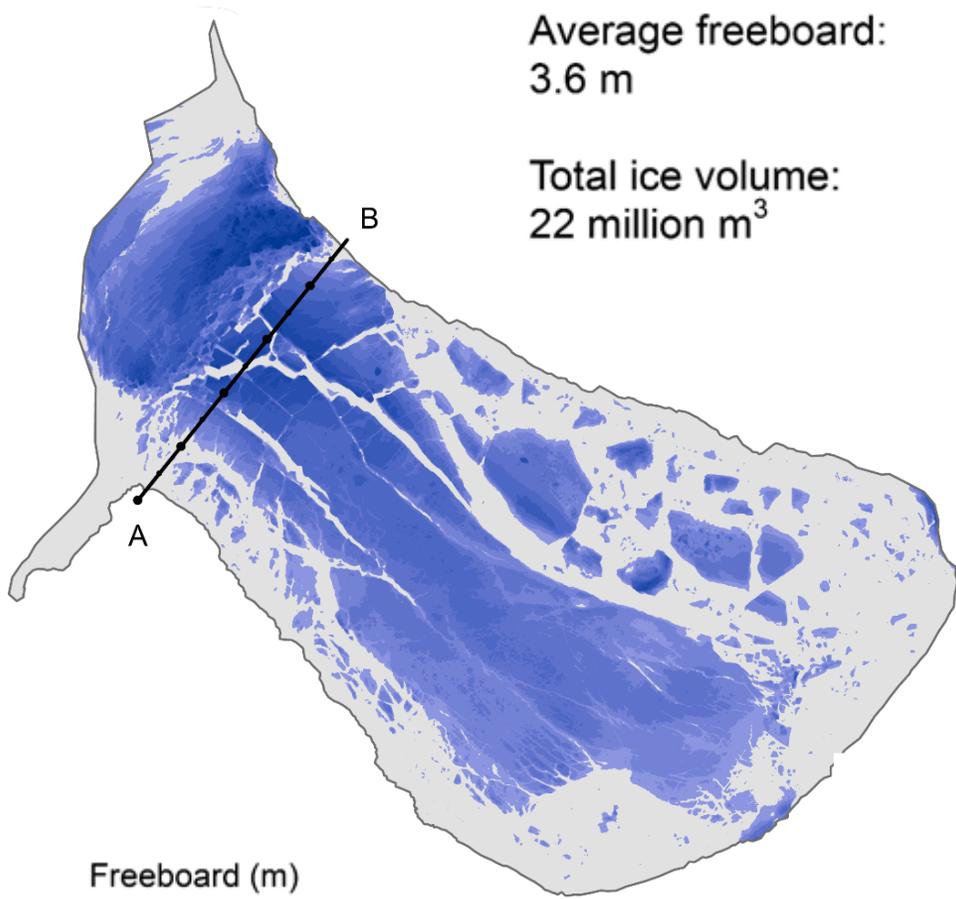


# Ice thickness and ice volume estimations

2018-07-17

Average freeboard:  
3.6 m

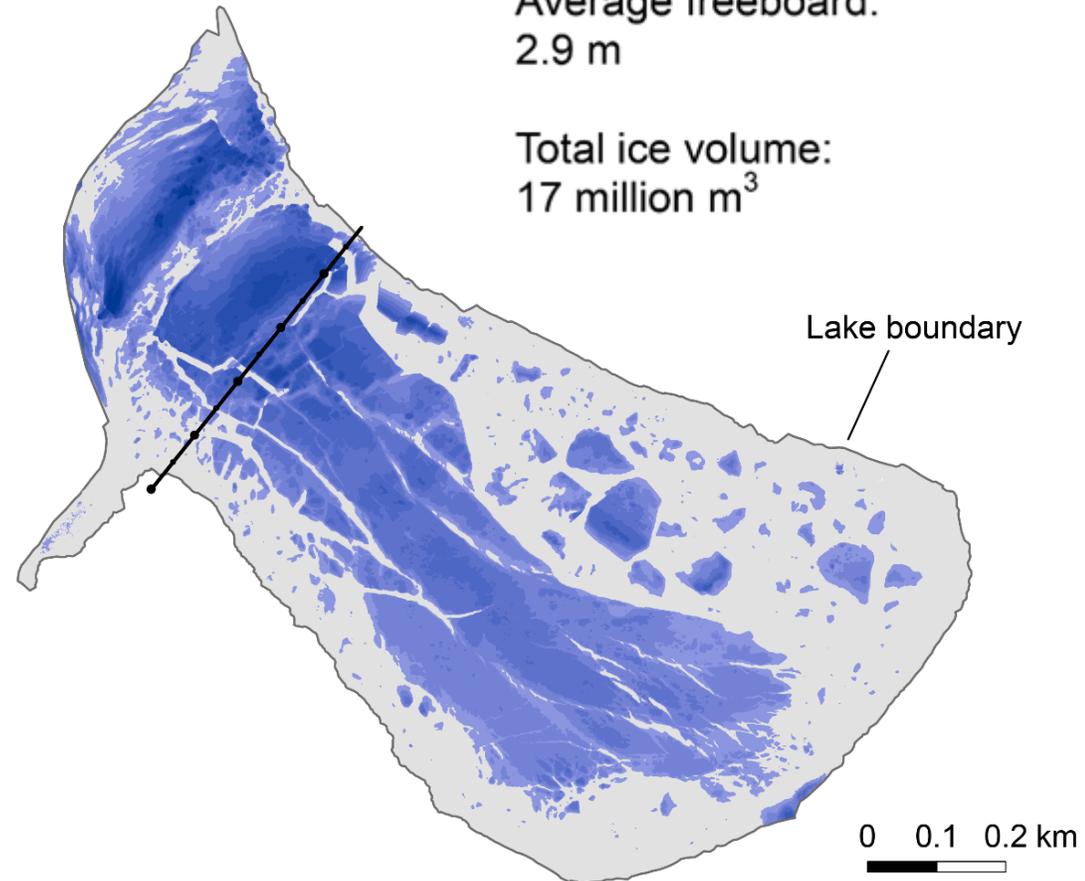
Total ice volume:  
22 million m<sup>3</sup>



2019-07-08

Average freeboard:  
2.9 m

Total ice volume:  
17 million m<sup>3</sup>

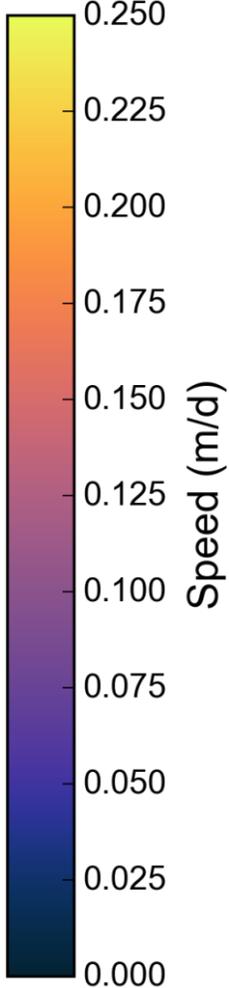
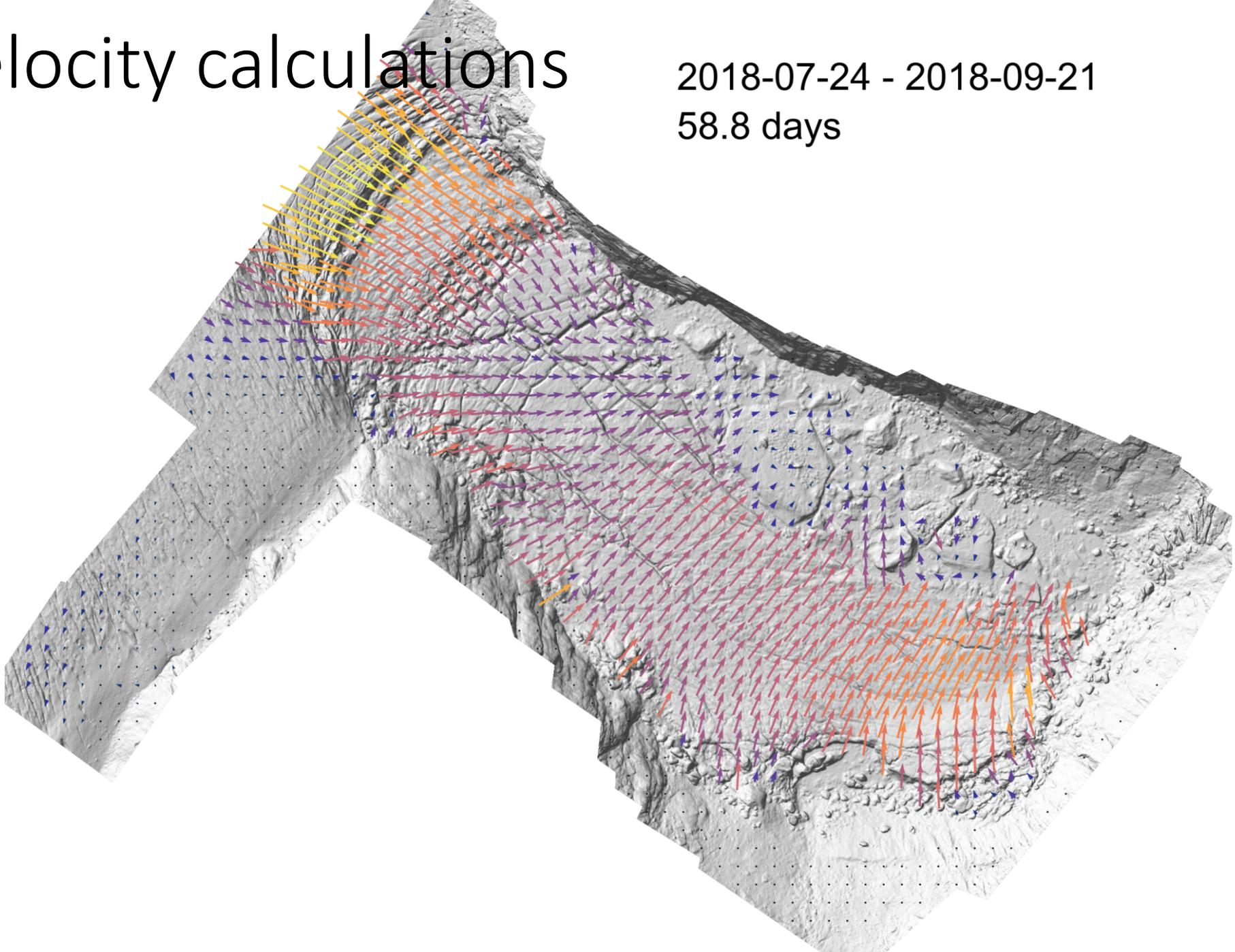


- 7 m thinning over one year

# Velocity calculations

2018-07-24 - 2018-09-21

58.8 days



# Outlook

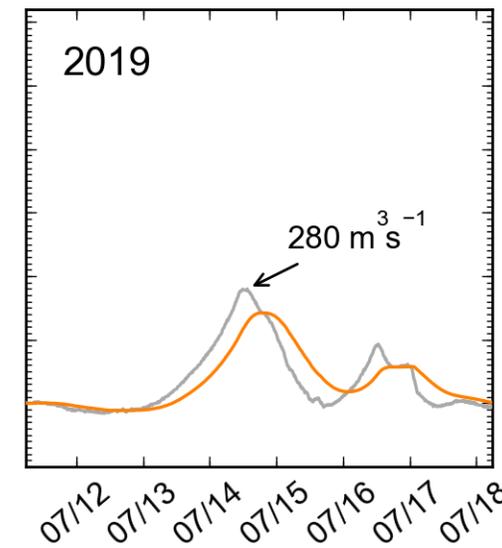
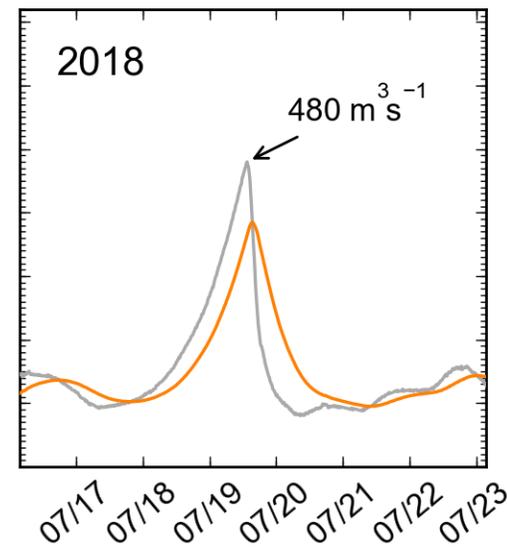
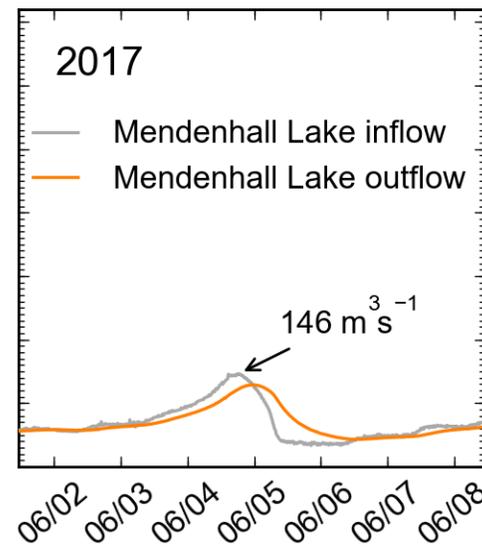
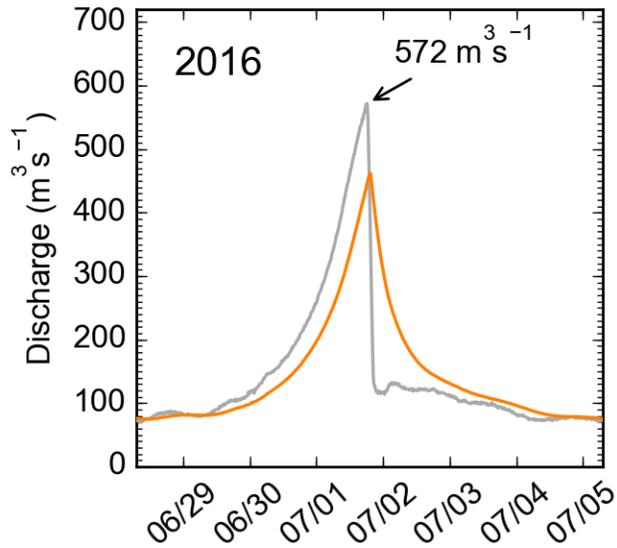
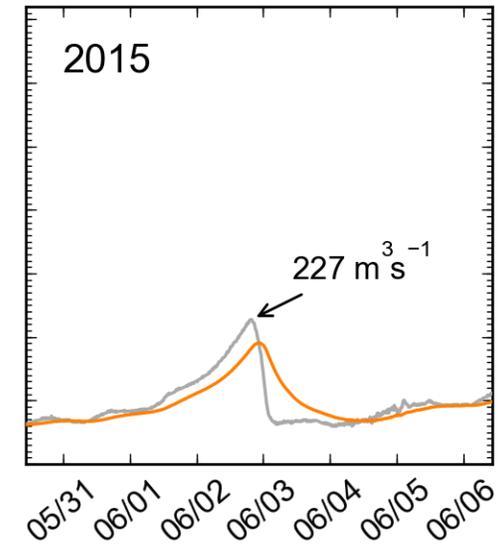
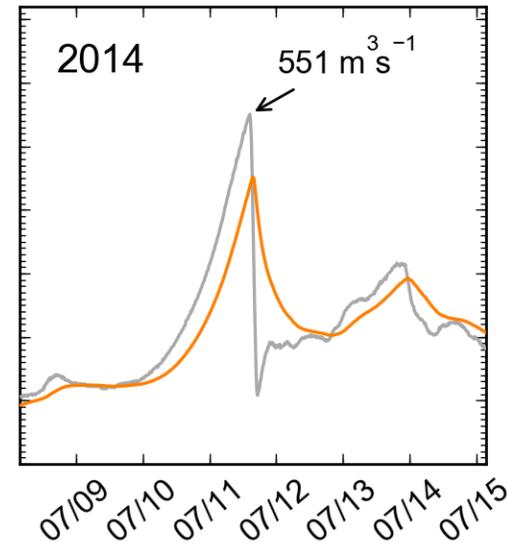
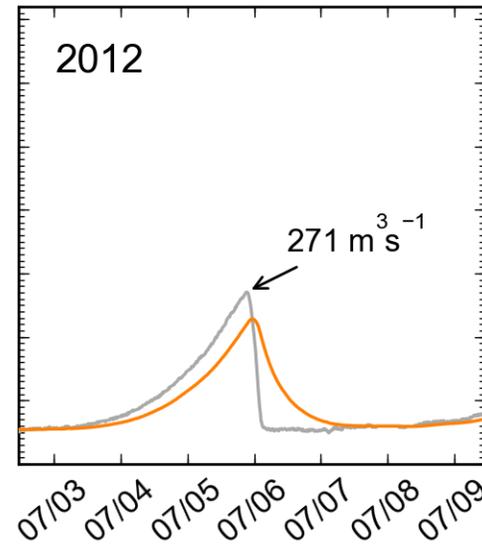
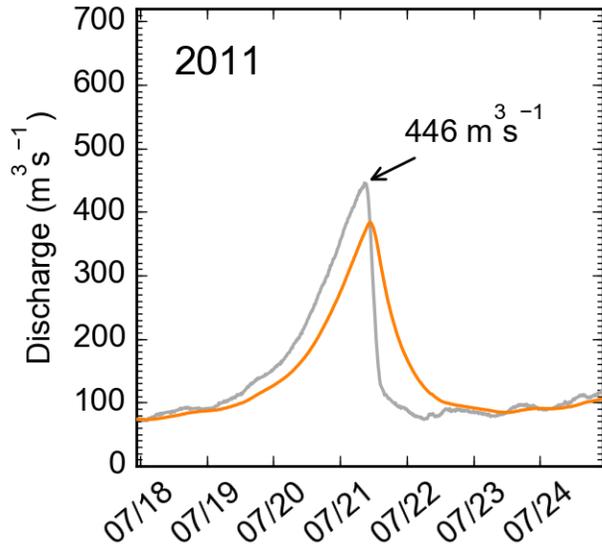
- Suicide Basin will be able to host a seasonal lake for at least another decade
- Floating tongue will collapse within the next five years and a calving front will form
- Seasonal lakes will likely keep draining in a catastrophic fashion - more complete drainage than observed today is possible
- Thinning ice dam ( $>5$  m/y) reduces the storage volume in the basin
- Fast thinning ice in the basin (7 m/y) and lateral expansion of the lake increase the storage volume
- Rain on top of GLOF event may cause additional flooding
- <https://casc.alaska.edu/projects/glacier-outburst-flood-modeling>



Questions?



# Mendenhall Lake response



# Downstream consequences



E. Hood



E. Hood

# Downstream consequences

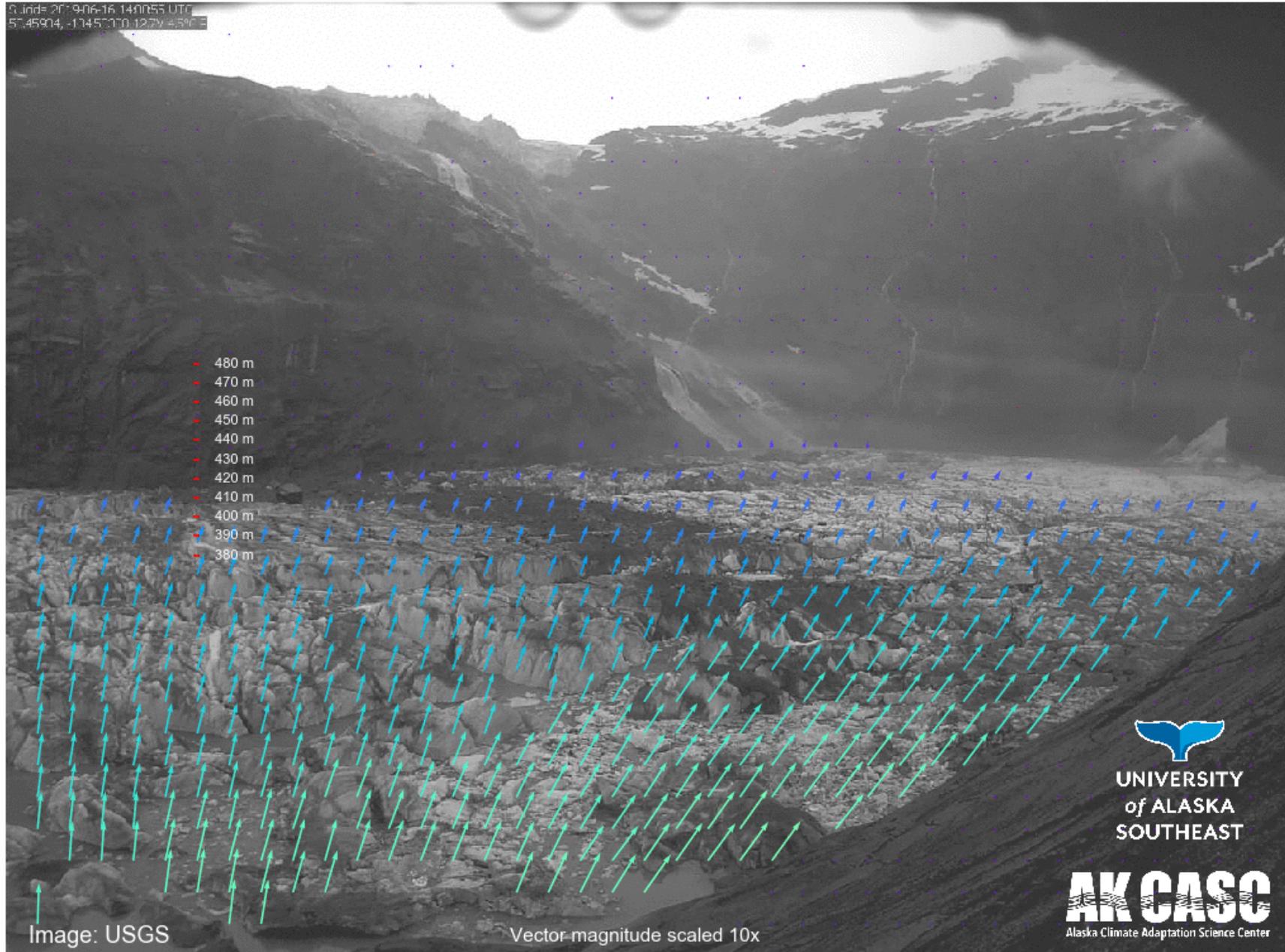


E. Hood



2019-06-15 06:00 AM - 2019-06-16 06:00 AM (24.0 hours)

G. Jide: 2019-06-16 14:00:55 UTC  
57.45904, -134.50070, 12.79 ± 5.0%



**AK CASCO**