

# Monitoring thermokarst activity and landscape change in the Eureka Sound Lowlands, Ellesmere Island, Nunavut

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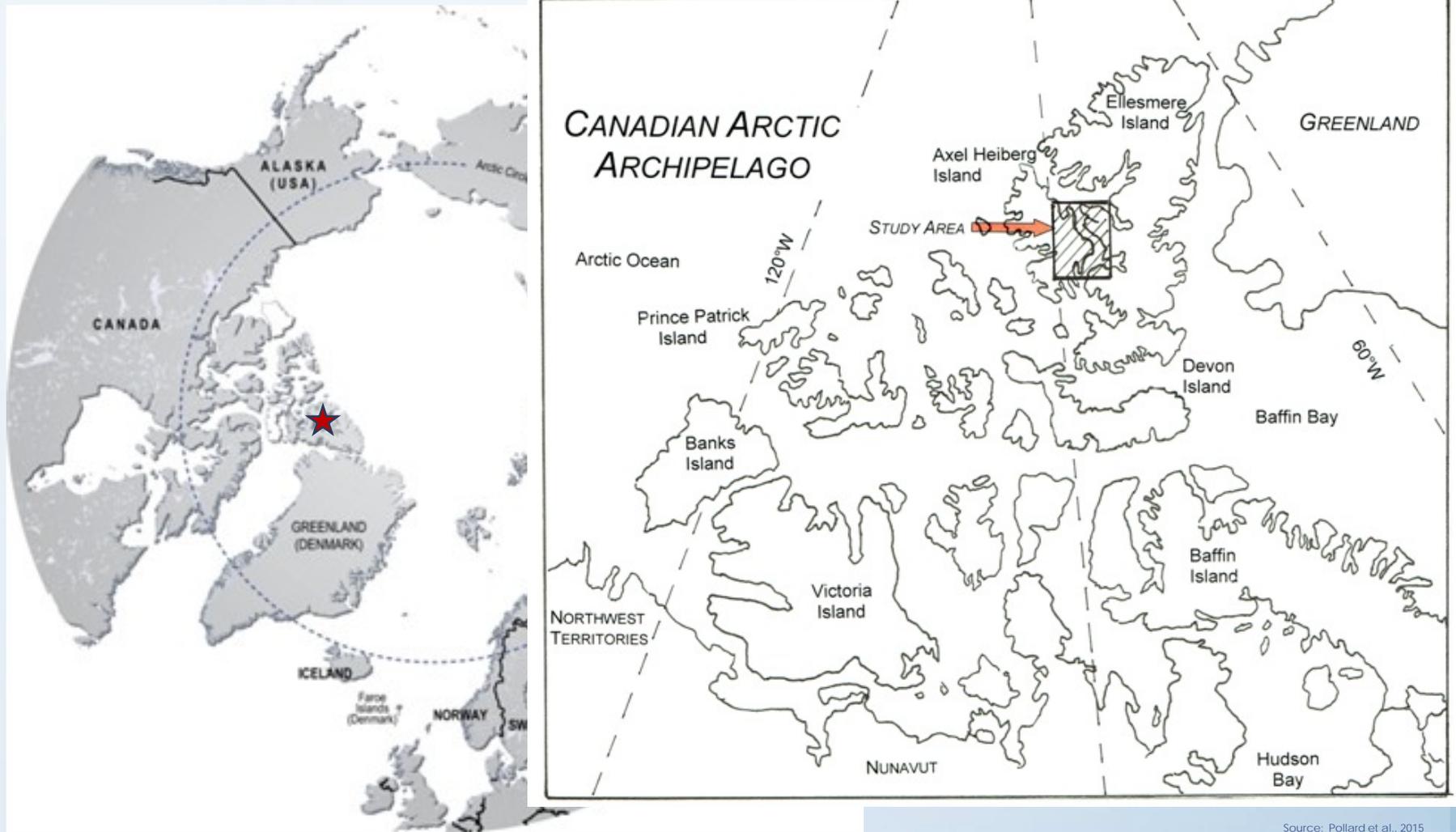
# Eureka Sound Lowlands, Ellesmere and Axel Heiberg Islands, Nunavut



Source: [http://www.grida.no/graphicslib/detail/arctic-map-political\\_1547](http://www.grida.no/graphicslib/detail/arctic-map-political_1547)

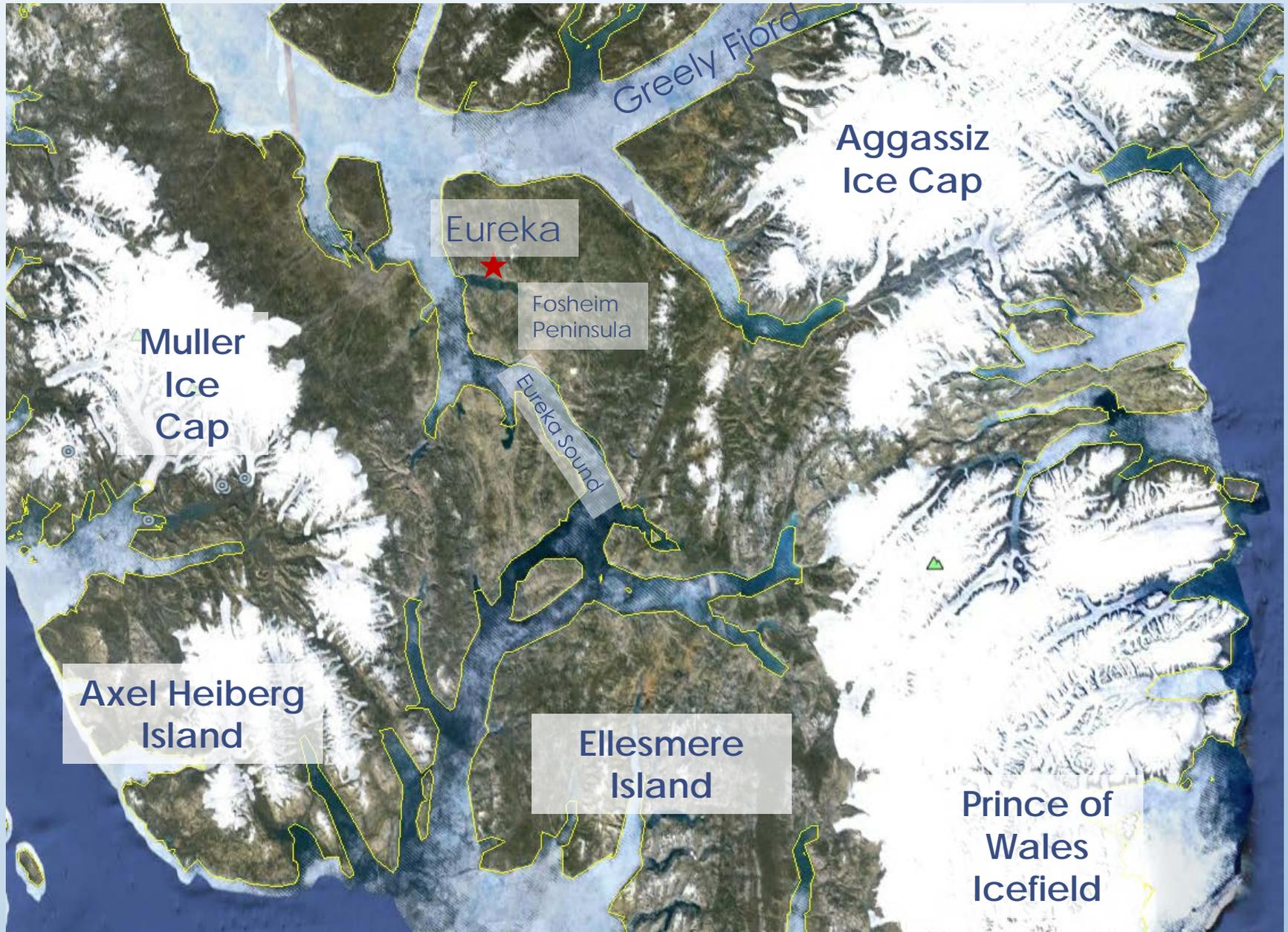


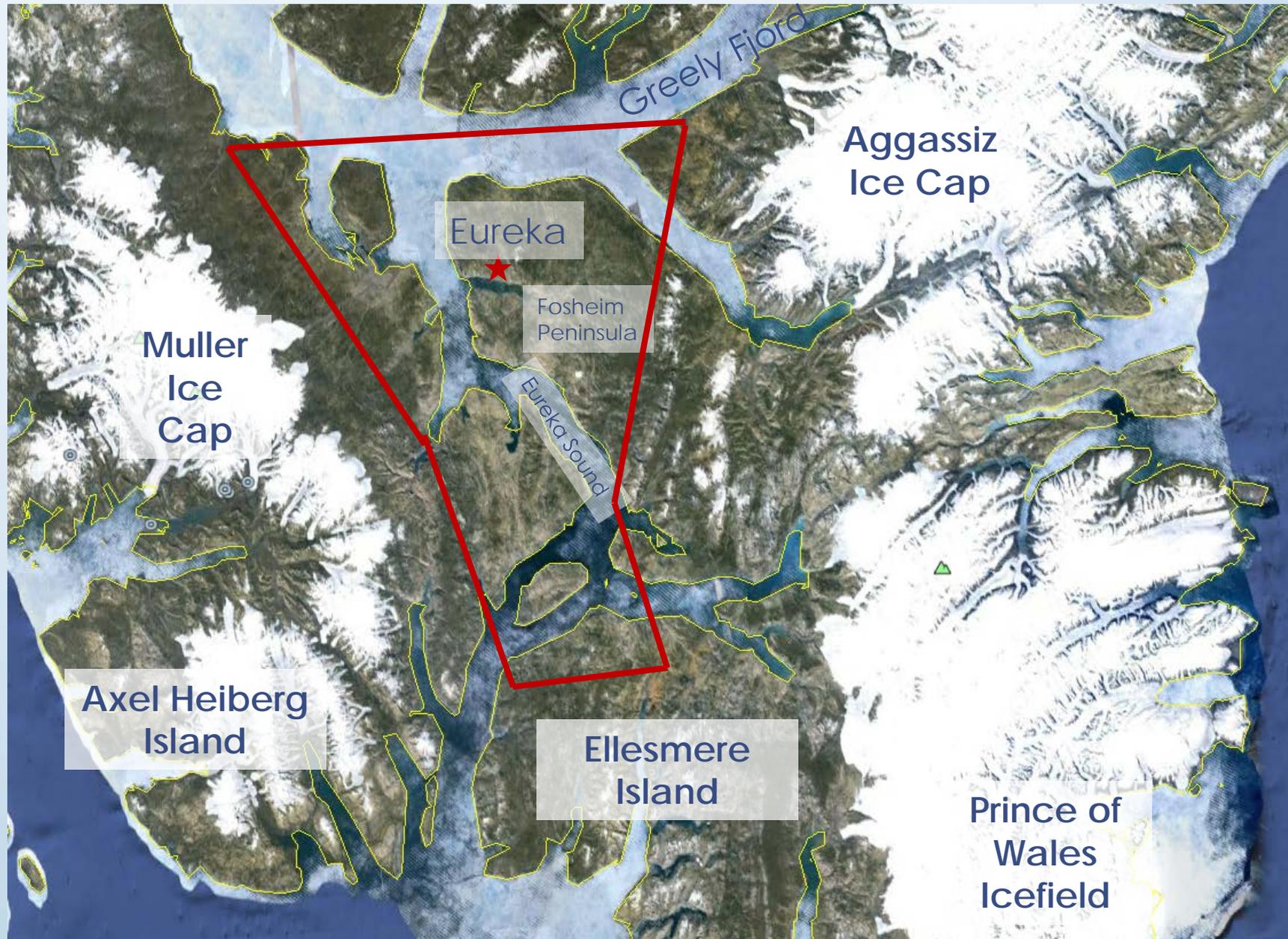
# Eureka Sound Lowlands, Ellesmere and Axel Heiberg Islands, Nunavut



Source: [http://www.grida.no/graphicslib/detail/arctic-map-political\\_1547](http://www.grida.no/graphicslib/detail/arctic-map-political_1547)

Source: Pollard et al., 2015





# Eureka Sound Lowlands

- Polar desert climate
- MAAT:  $-19.7^{\circ}\text{C}$ , January:  $-36.1^{\circ}\text{C}$ , and July  $+5.4^{\circ}\text{C}$
- 67 mm annual precipitation (~60% as snow)
- Continuous permafrost, permafrost depth  $>500\text{ m}$
- Thin Active layer, mean thickness  $\sim 57\text{ cm}$
- Ice rich permafrost!



# Ice-Rich Permafrost



Massive Ice

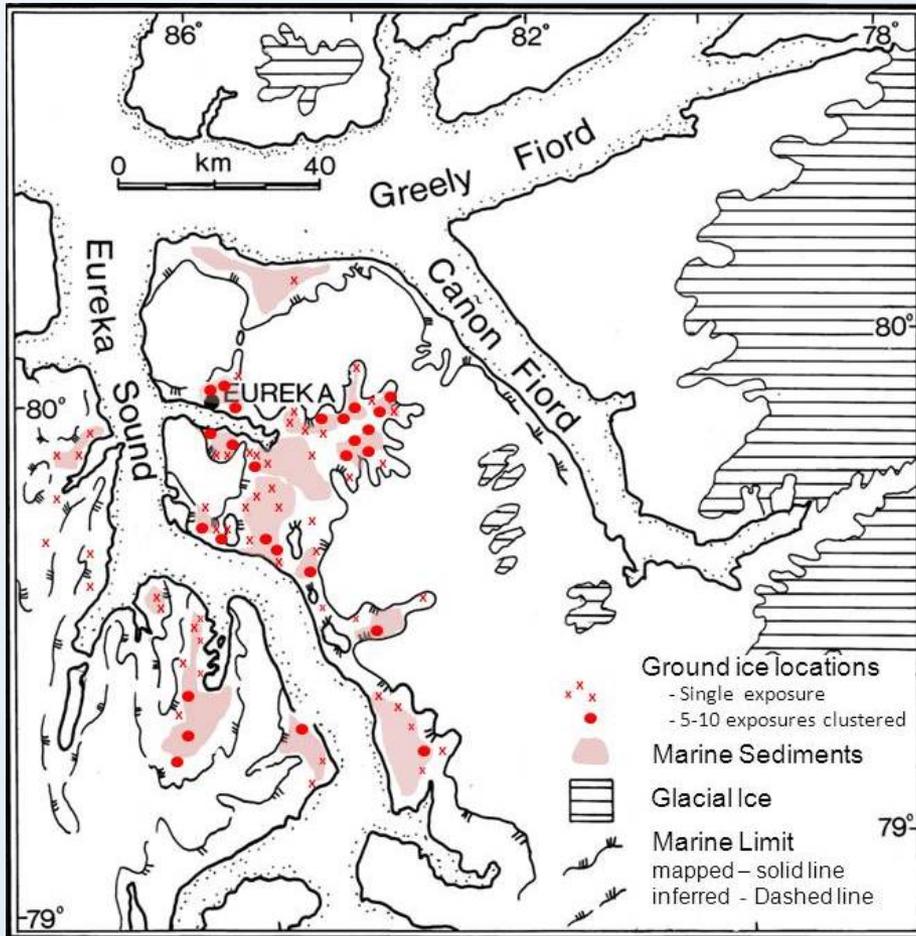


Ice Wedges

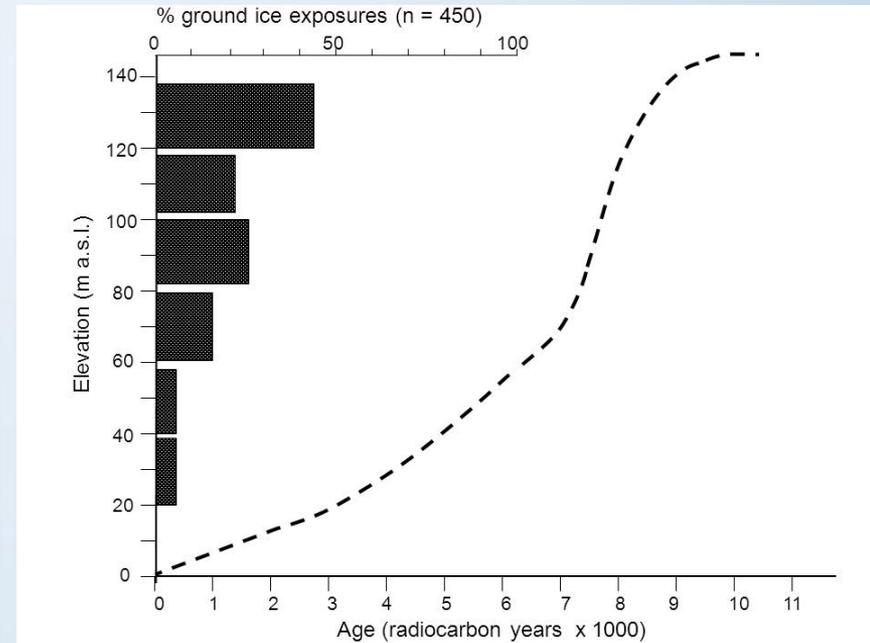
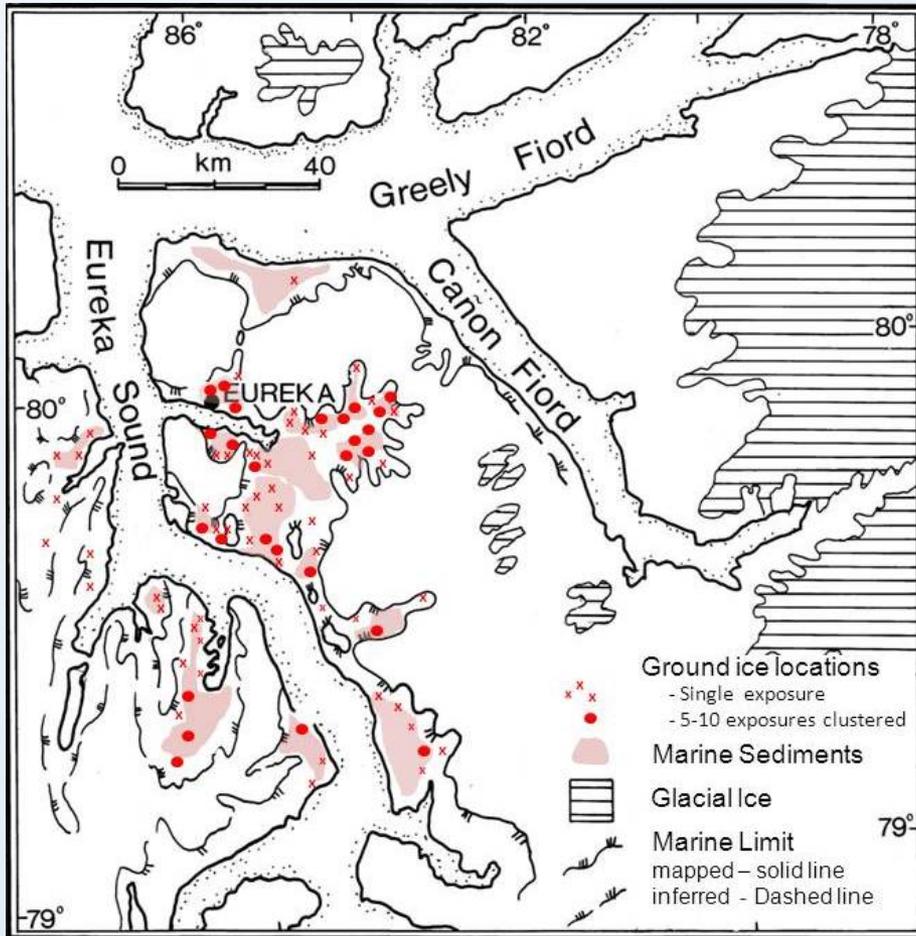


Source: Couture & Pollard, 2007

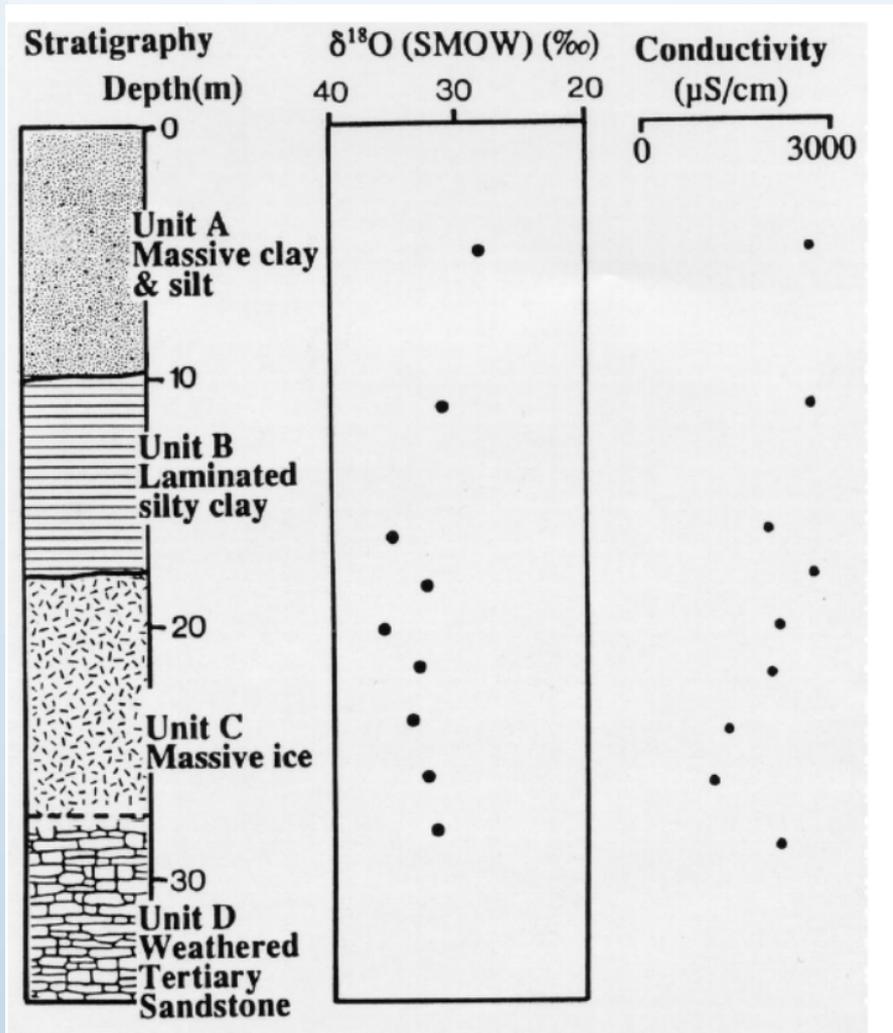
# Ground Ice Distribution



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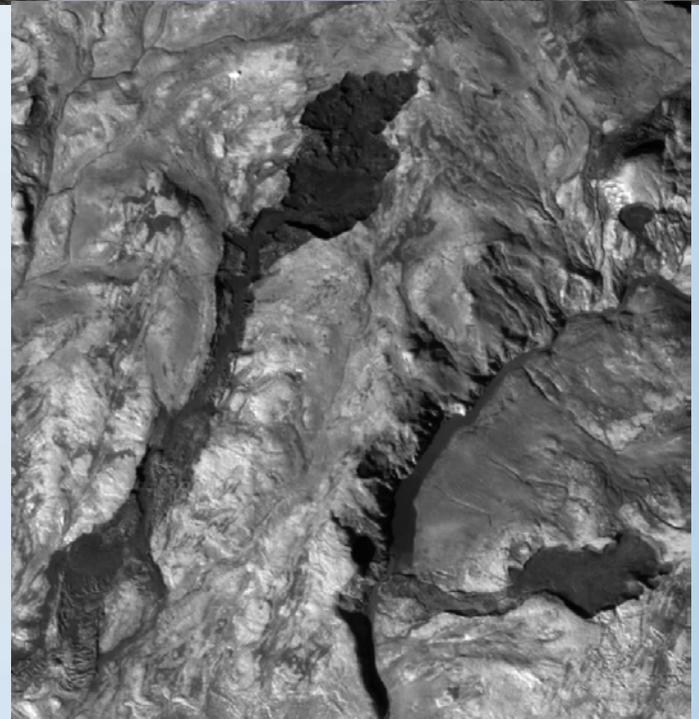
# Ground Ice Characterization



Source: Pollard and Bell, 1998



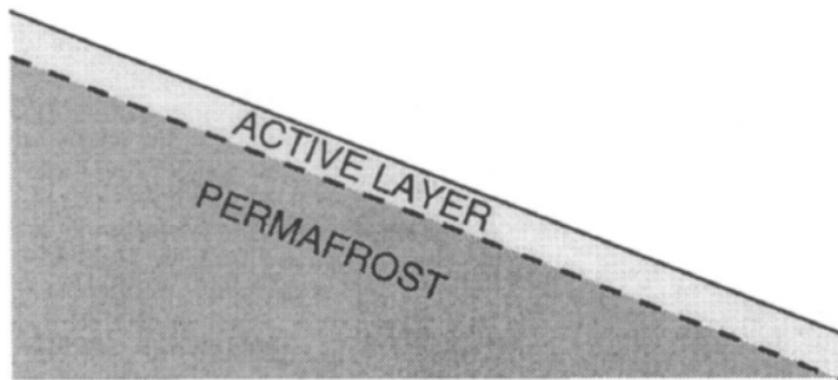
# Thermokarst: Retrogressive Thaw Slump



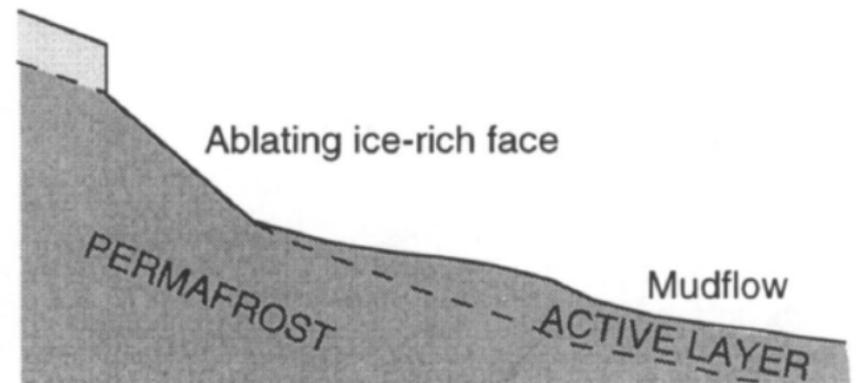
# Thermokarst: Retrogressive Thaw Slump



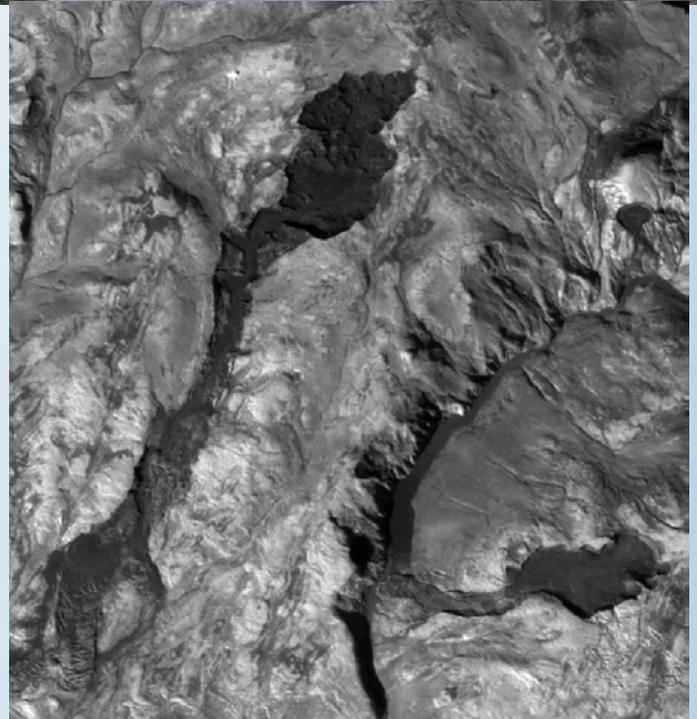
Before retrogressive thaw slump



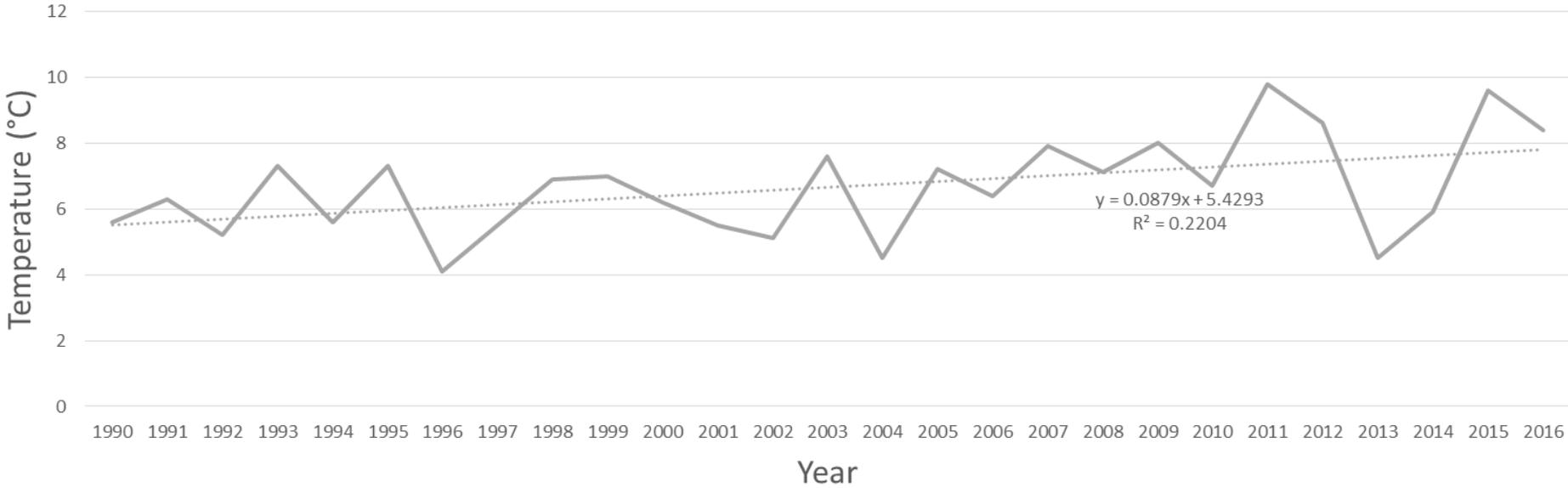
During headwall regression



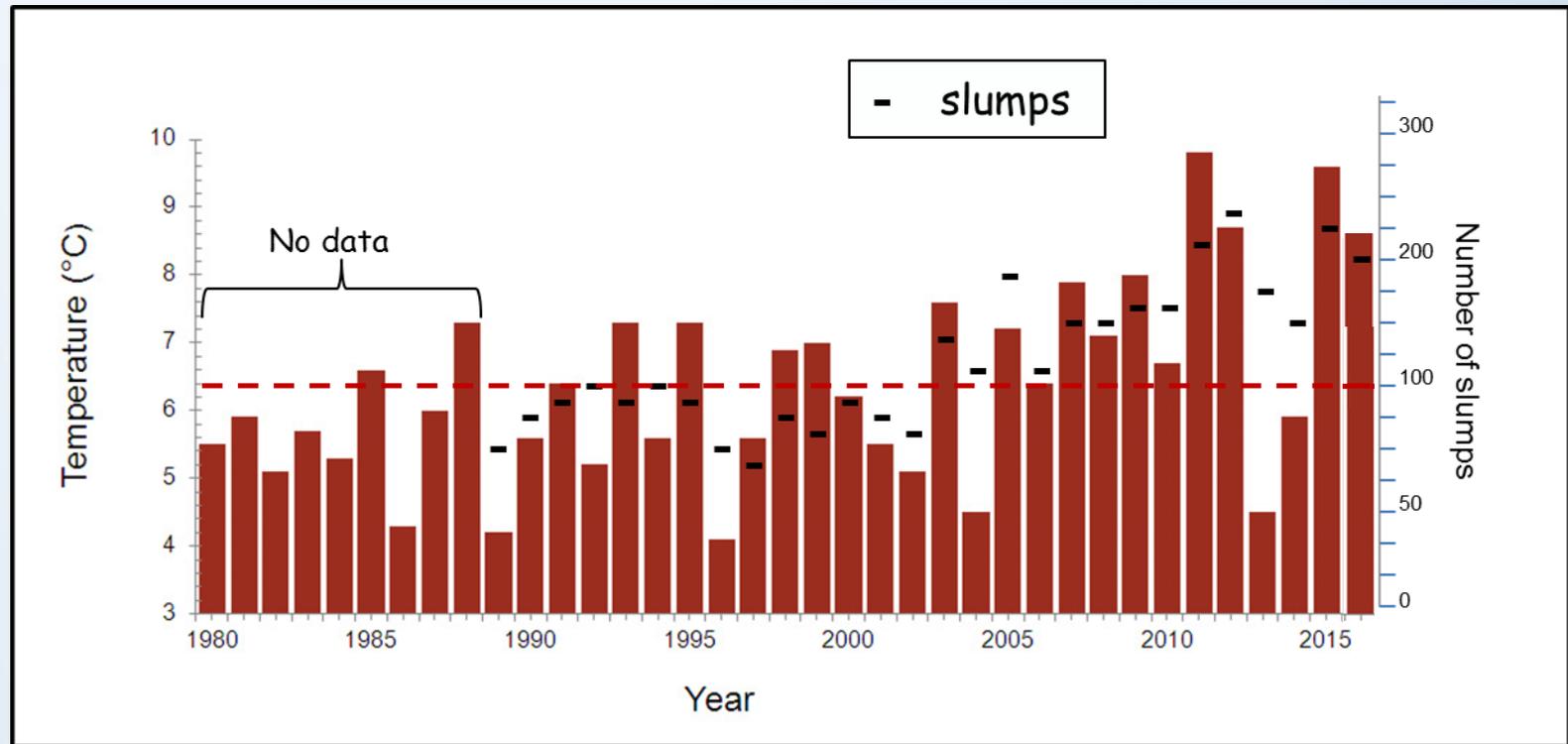
# Thermokarst: Retrogressive Thaw Slump



# Mean July Temperatures (°C) between 1990-2016 in Eureka, Ellesmere Island, Nunavut

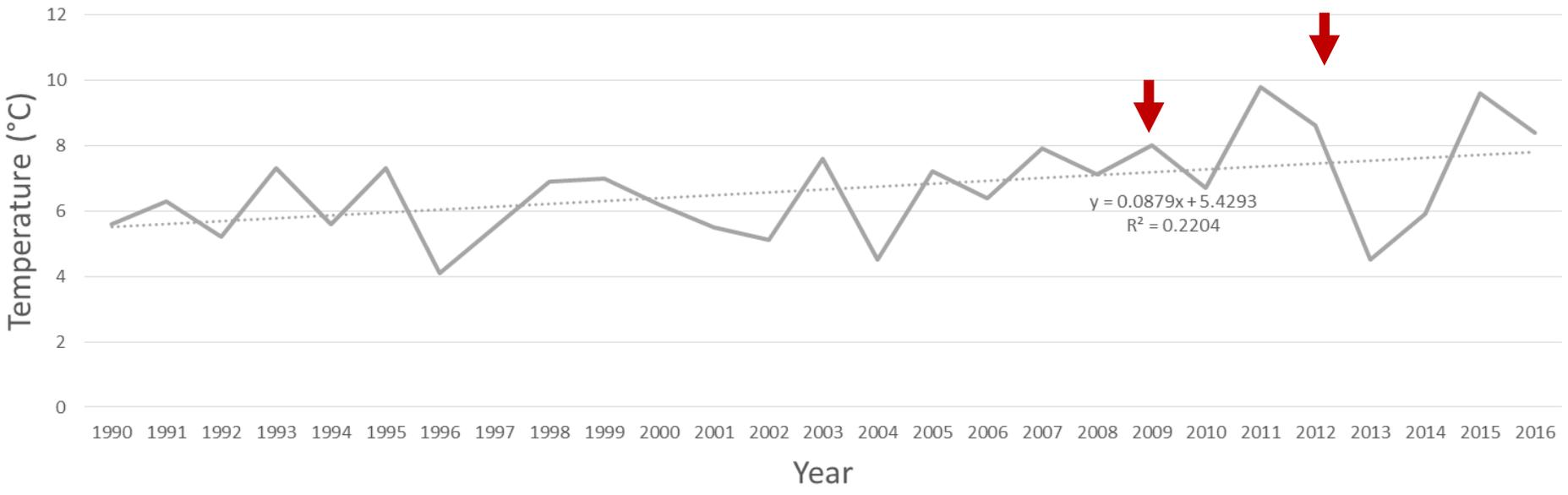


## Thaw Slump Monitoring: Slump frequency surveys

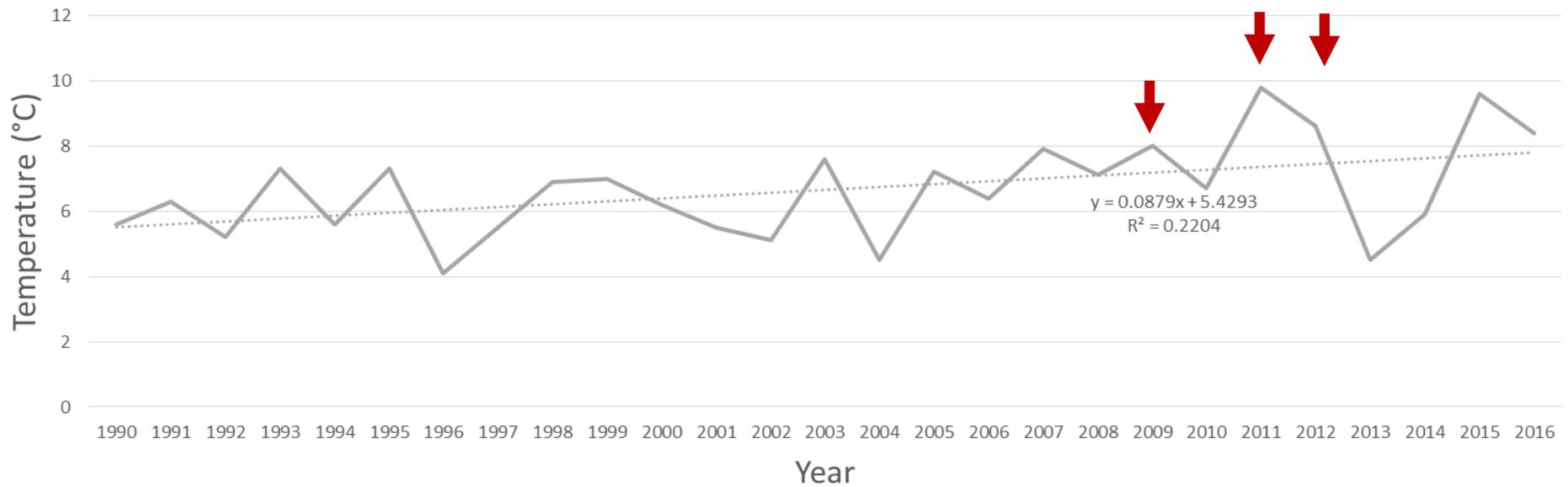


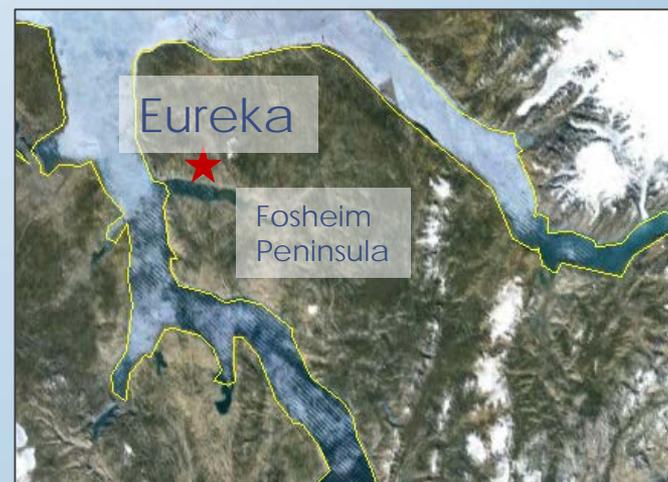
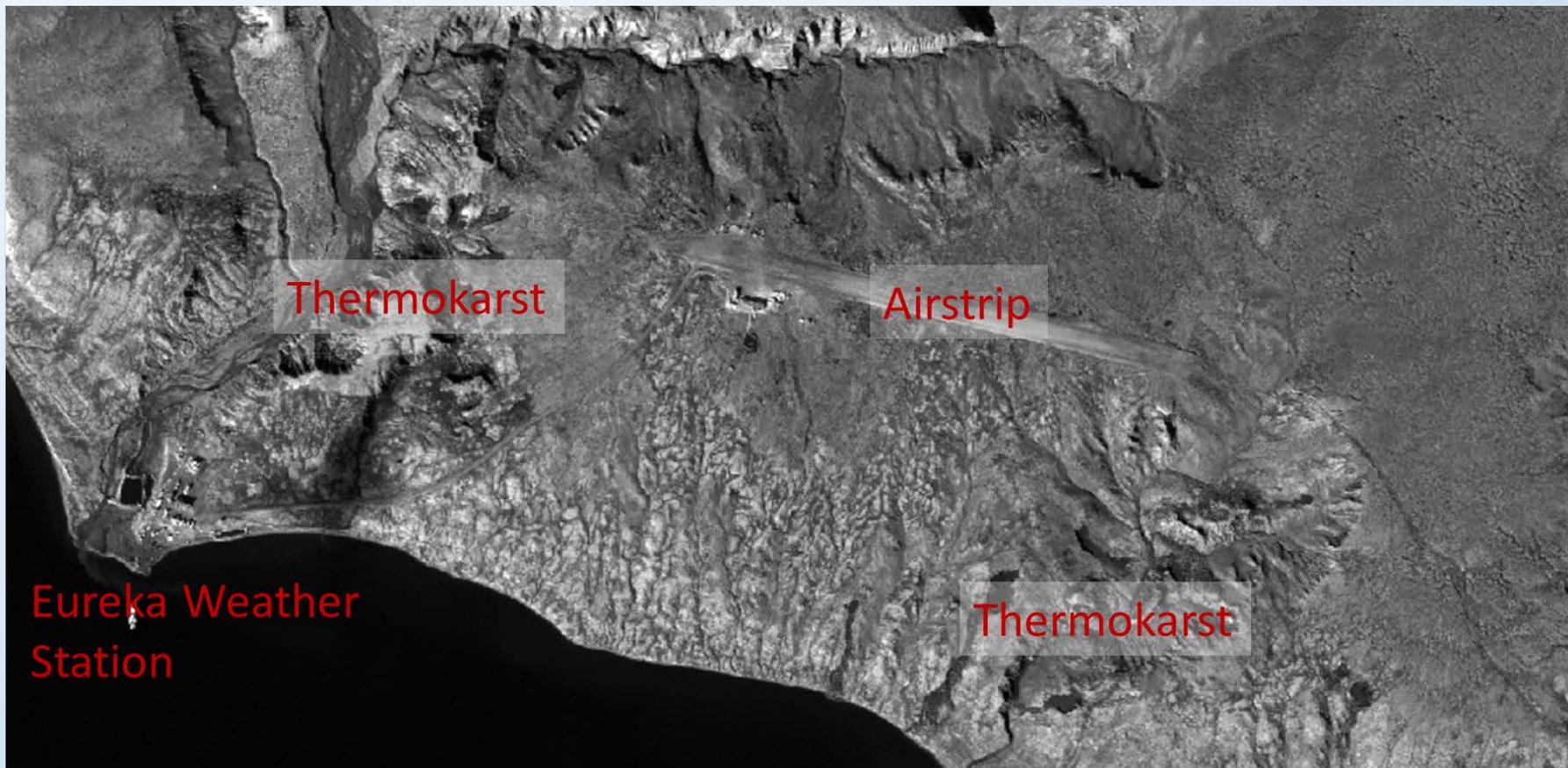
Annual slump surveys followed the same route, prior to 2010 slumps were clustered in 7 main concentrations

# Mean July Temperatures (°C) between 1990-2016 in Eureka, Ellesmere Island, Nunavut



# Mean July Temperatures (°C) between 1990-2016 in Eureka, Ellesmere Island, Nunavut







Airstrip

Thermokarst

Thermokarst

Eureka Weather Station

2009 WorldView 2 Image



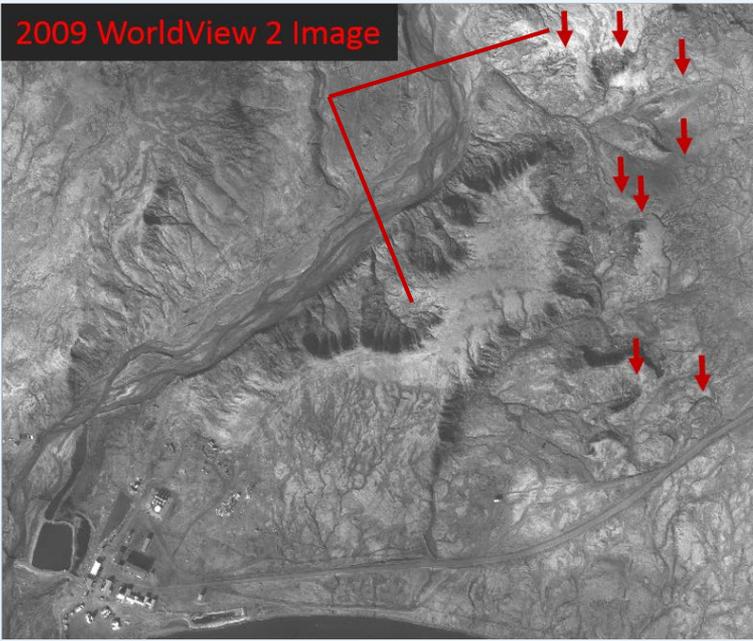
2012 WorldView 2 Image



Eureka Weather Station



2009 WorldView 2 Image



2012 WorldView 2 Image



Eureka Weather Station



2009 WorldView 2 Image



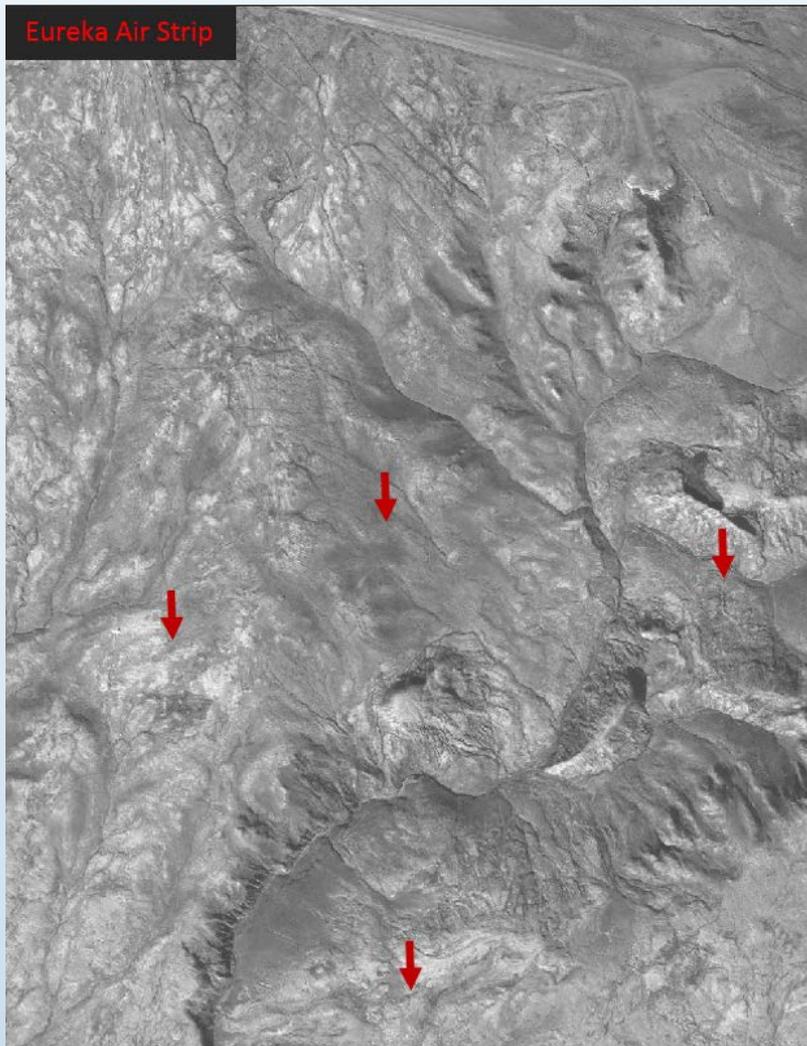
2012 WorldView 2 Image



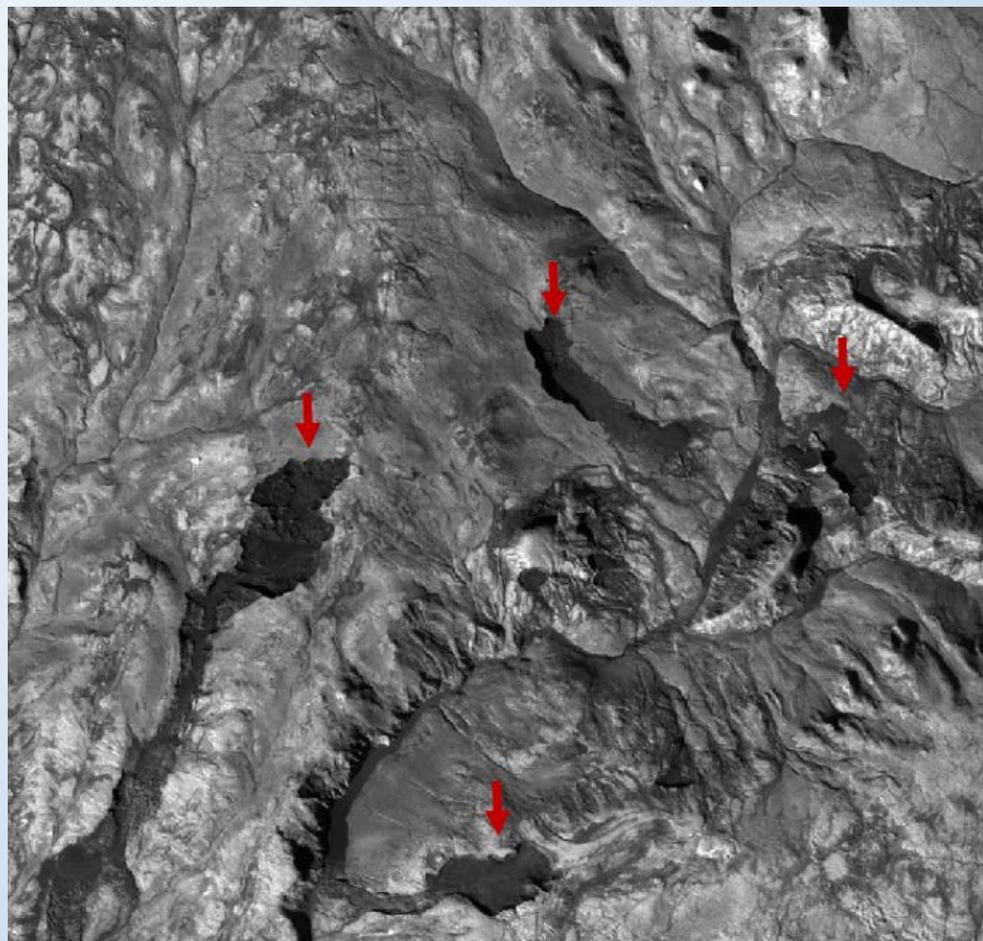
Eureka Weather Station



Eureka Air Strip



2009

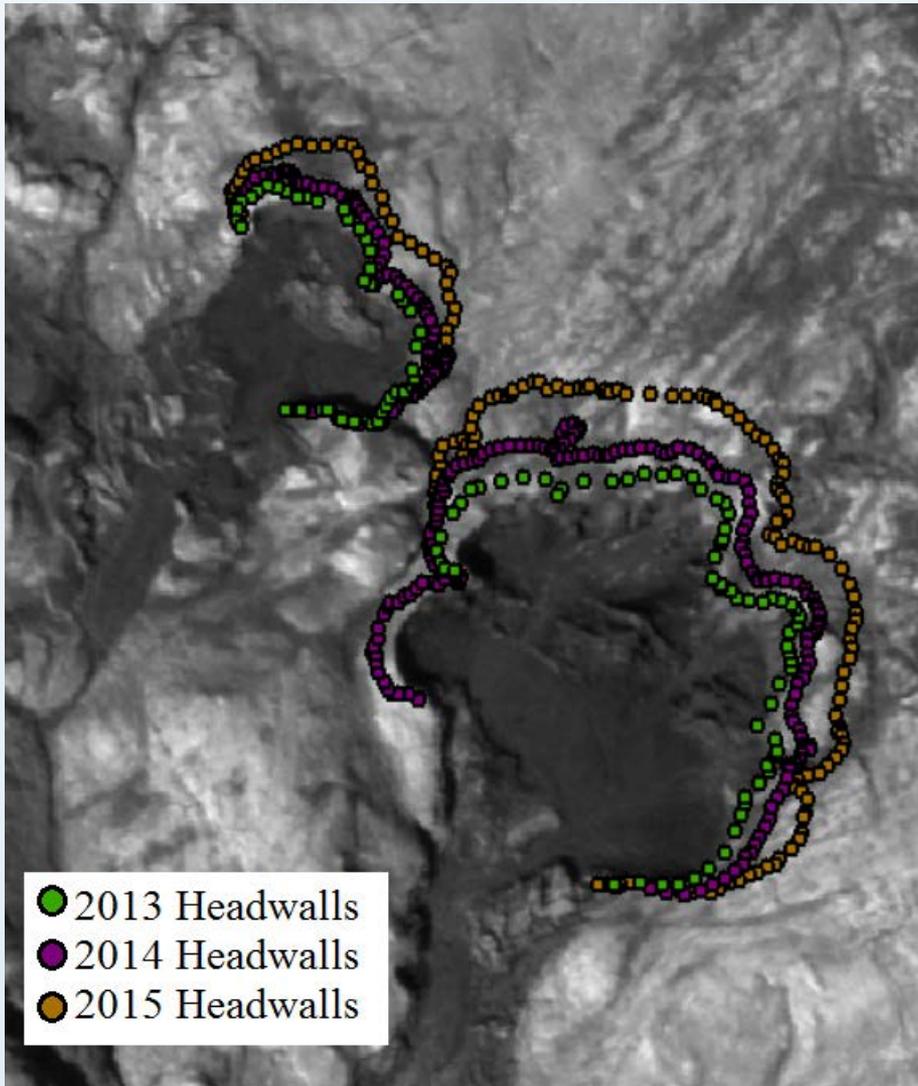


2012

Year of airphoto/satellite image*	Number of new slumps
1959	0
1974	2
1982	1
2009*	1
2012*	~30

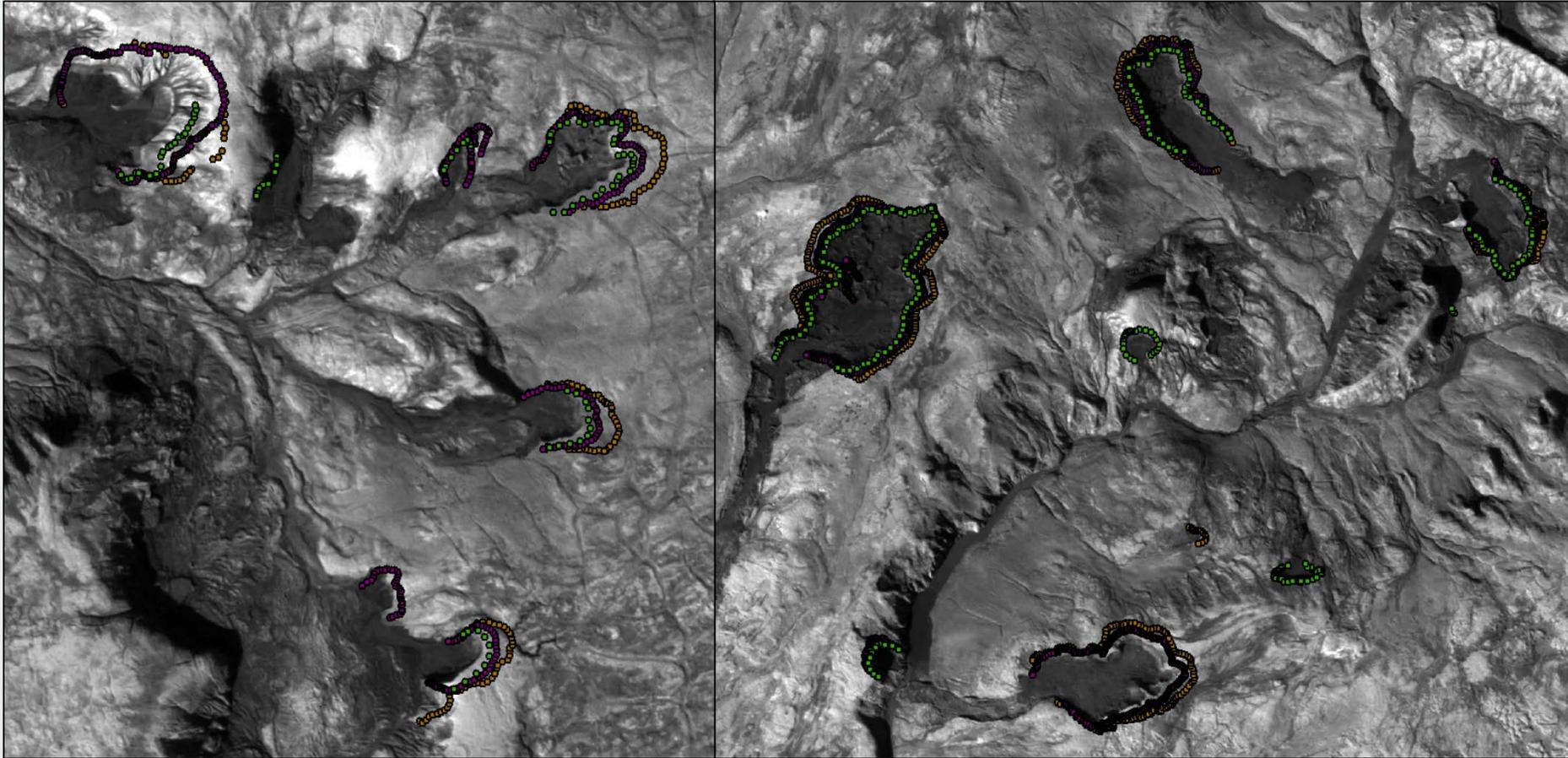


# Thaw Slump Monitoring: Headwall position over time

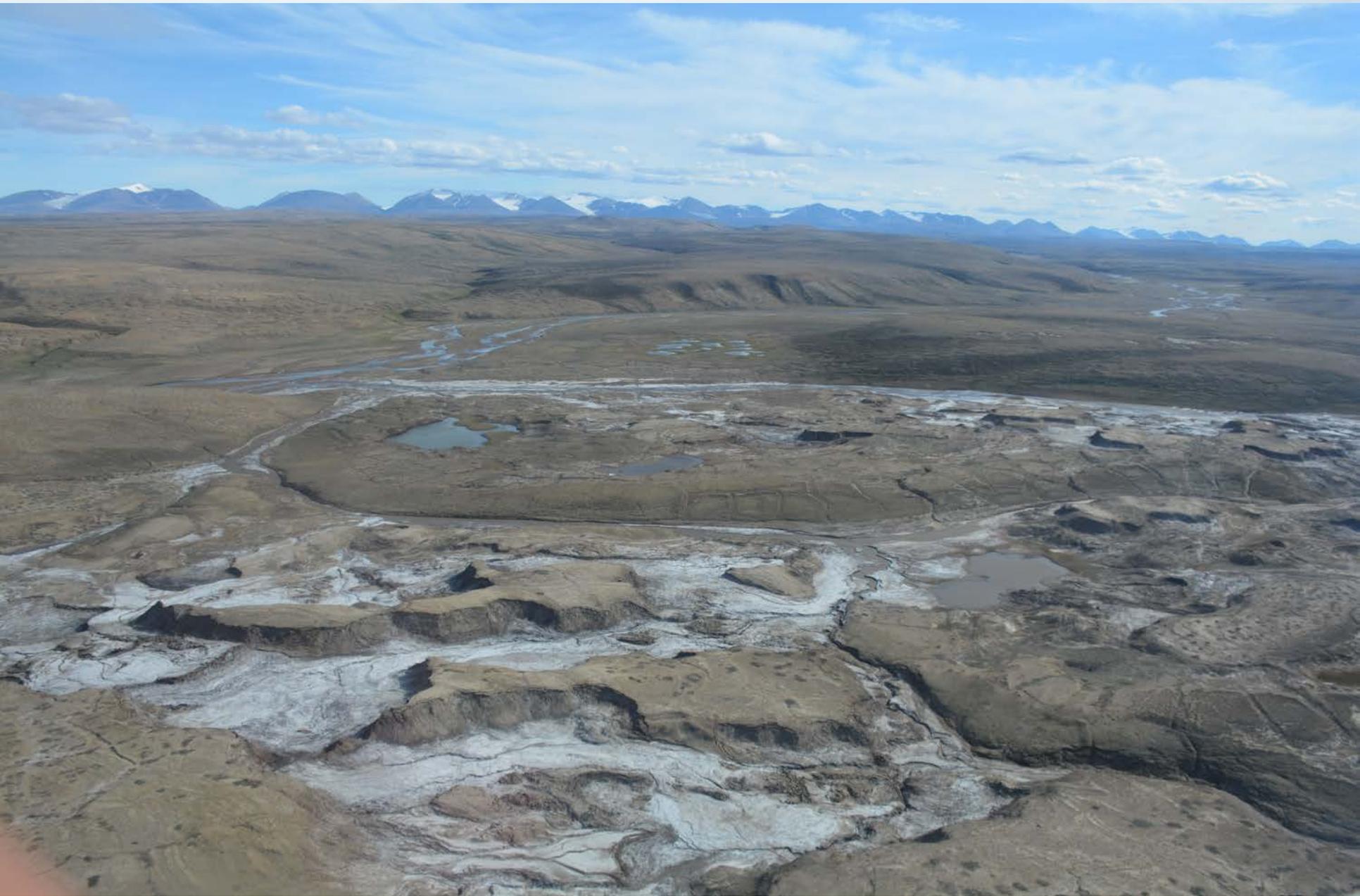


Trimble dGPS

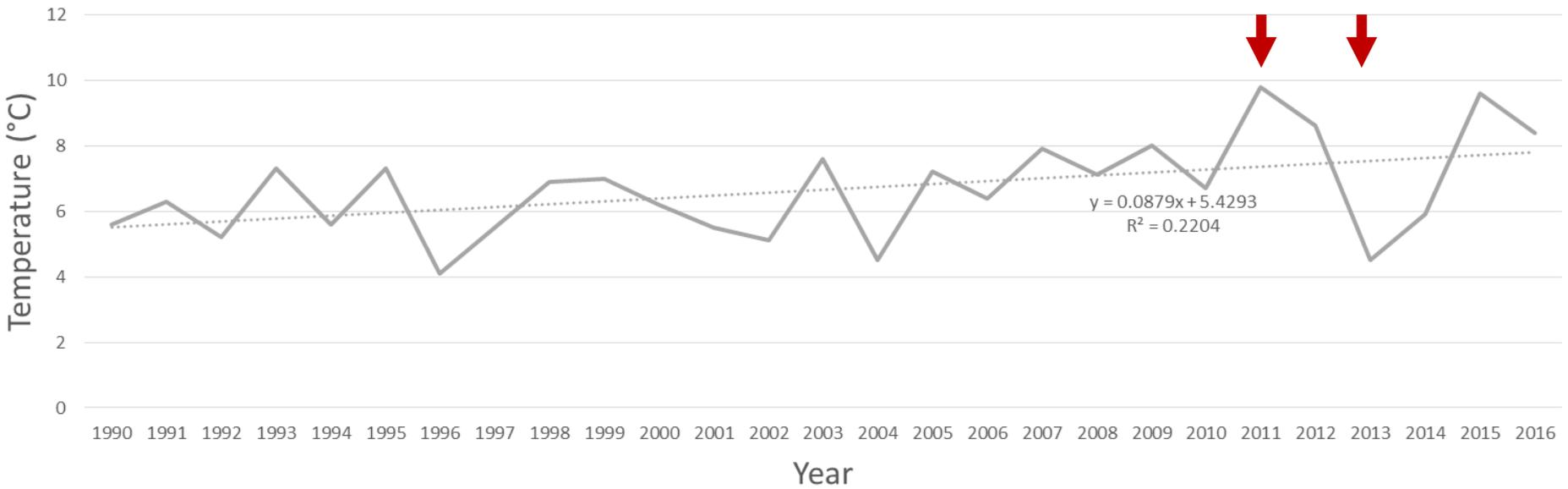
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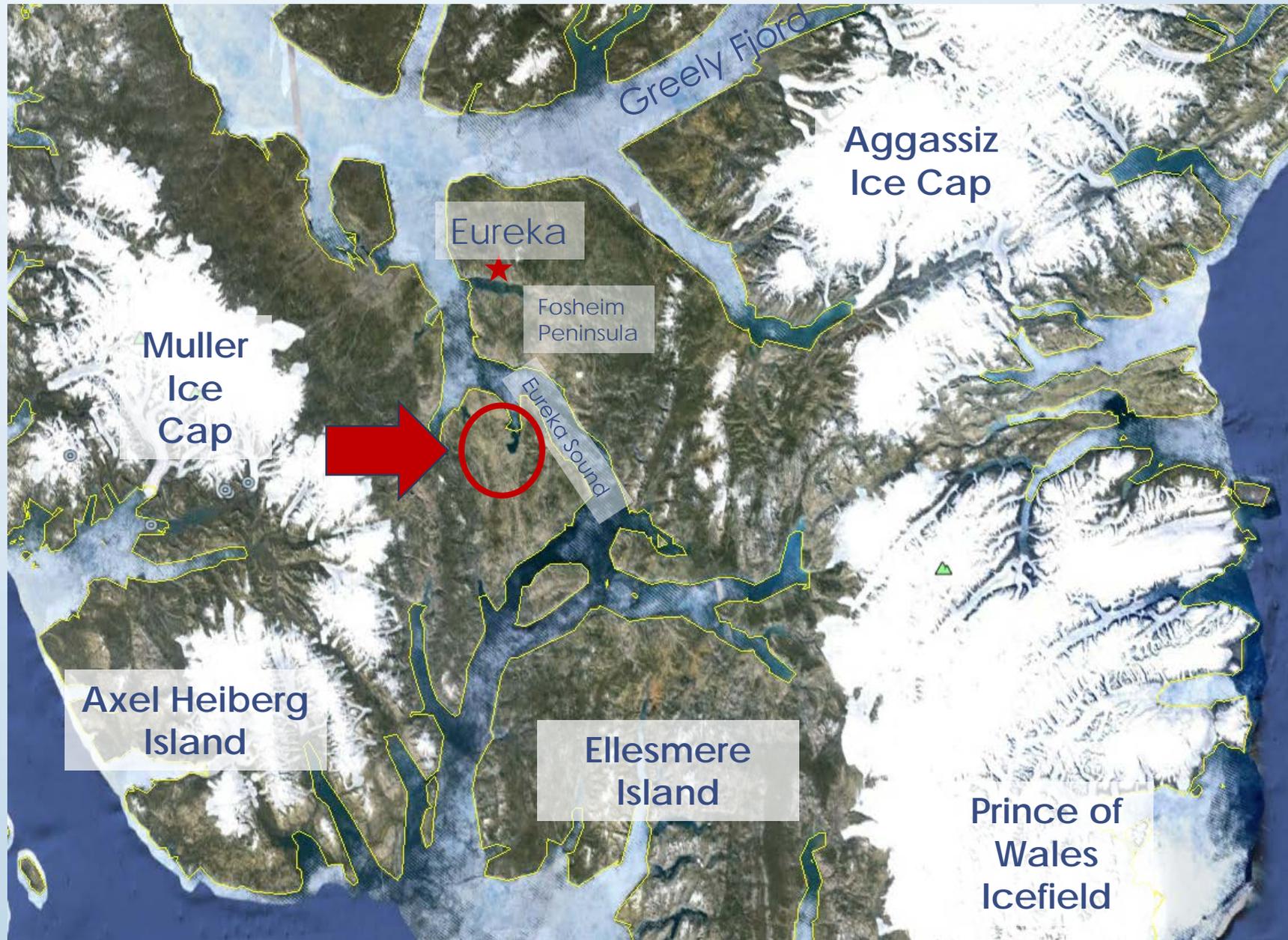
- 2013 Headwalls
- 2014 Headwalls
- 2015 Headwalls



# Mean July Temperatures (°C) between 1990-2016 in Eureka, Ellesmere Island, Nunavut











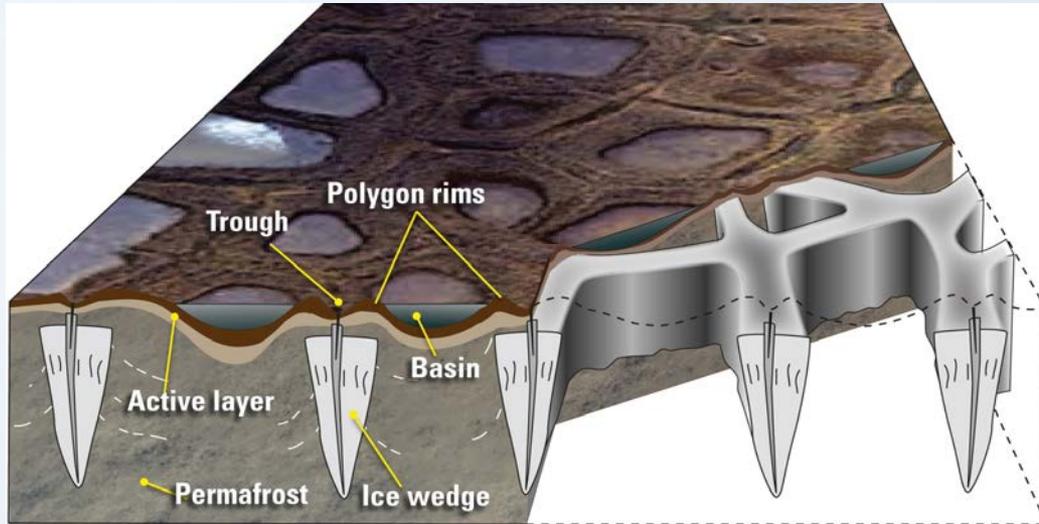
Eureka Weather Station



Eureka Weather Station



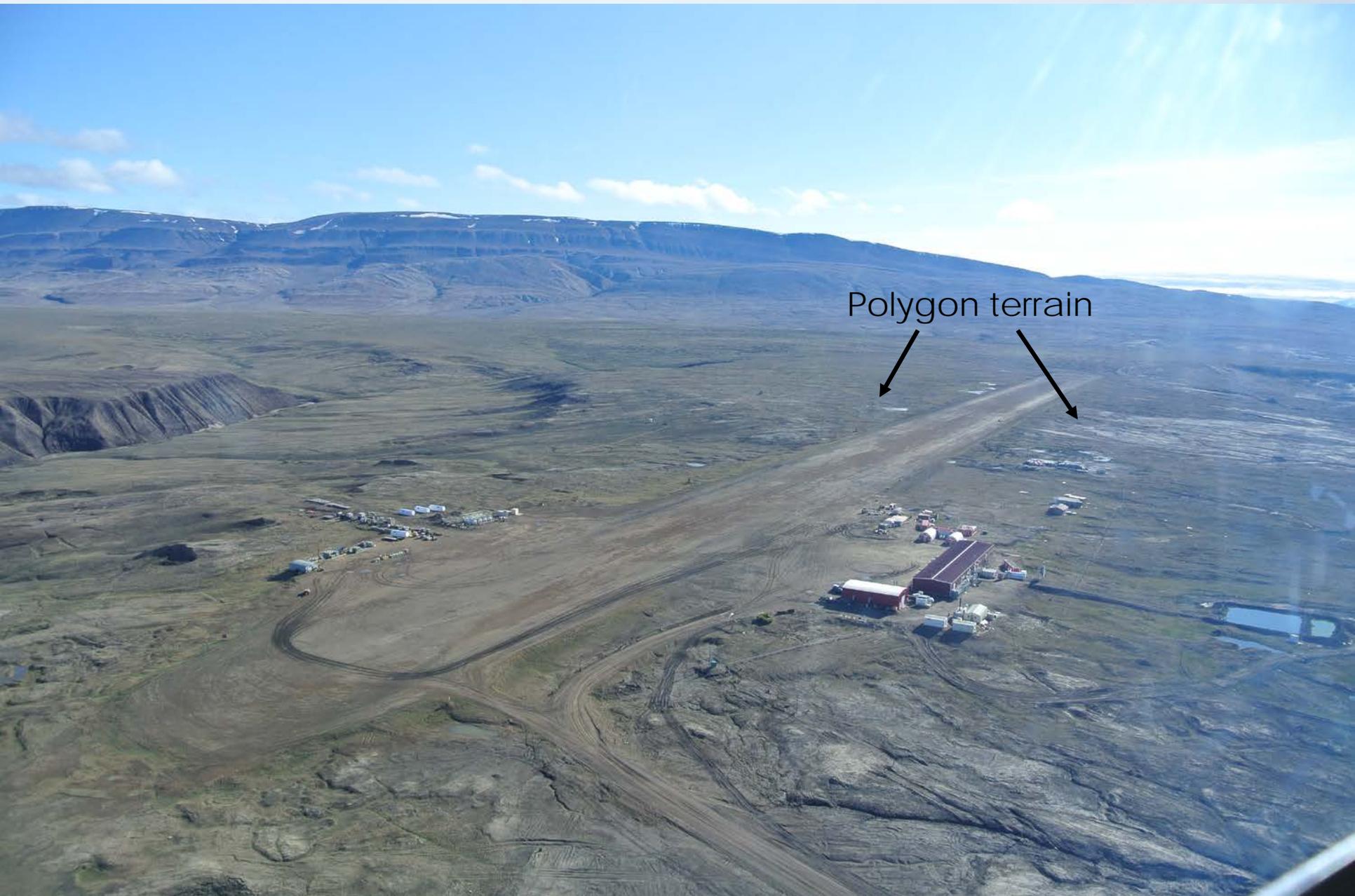
# Ice Wedges



# Thermokarst: Ice Wedges







Polygon terrain

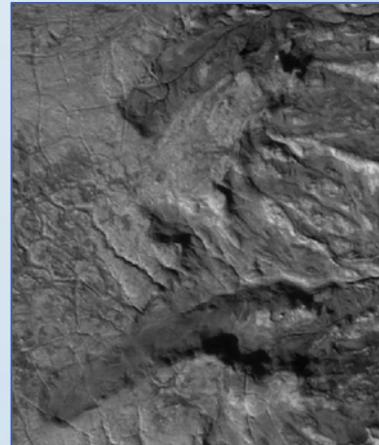






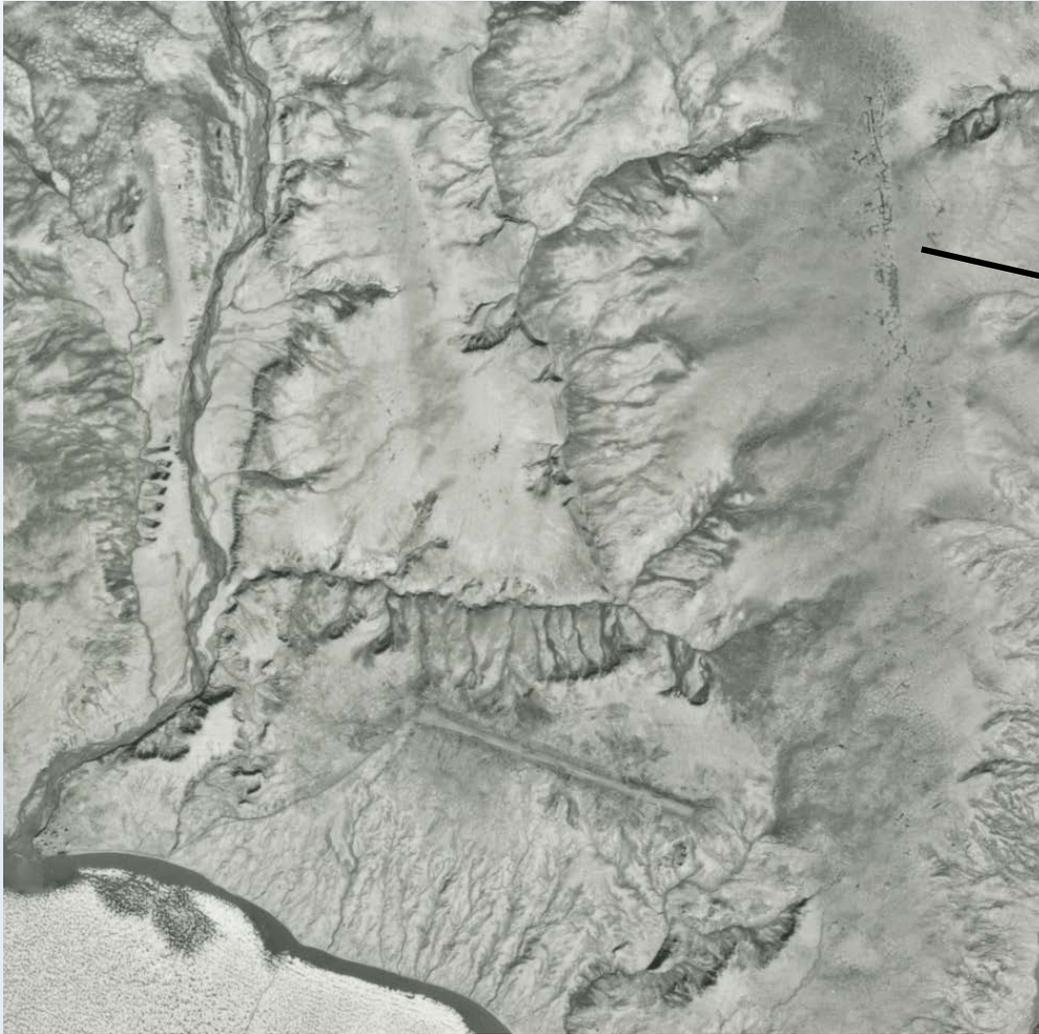




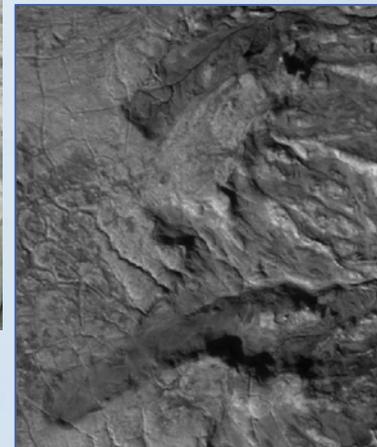
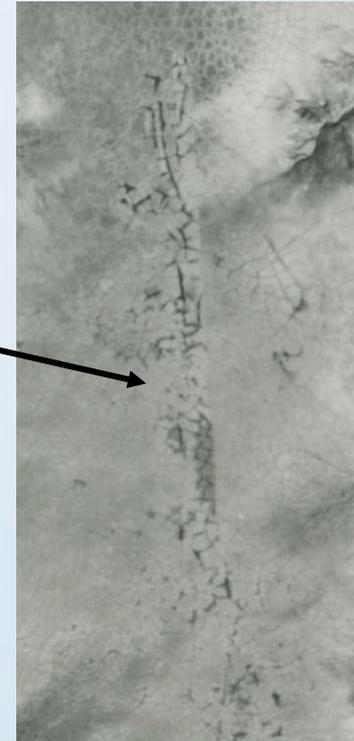


Worldview 2  
2012

# Slow disturbance recovery

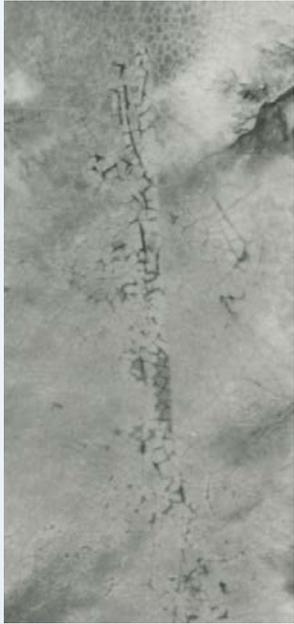


Air photo, 1959

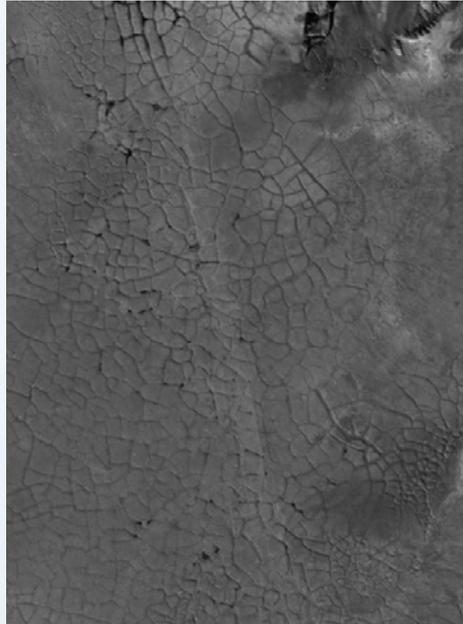


Worldview 2  
2012

# Slow disturbance recovery

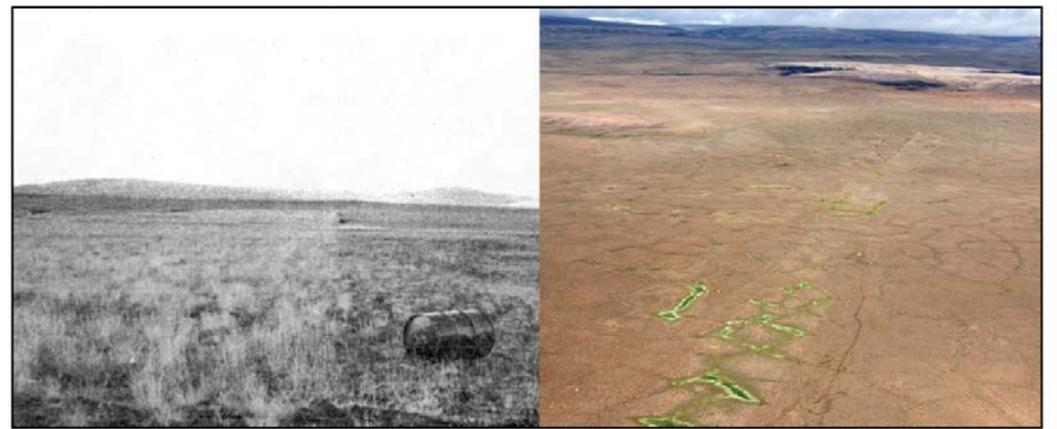


1959 Air photo



2012 Worldview2 Satellite Imagery

Source: Becker, 2015



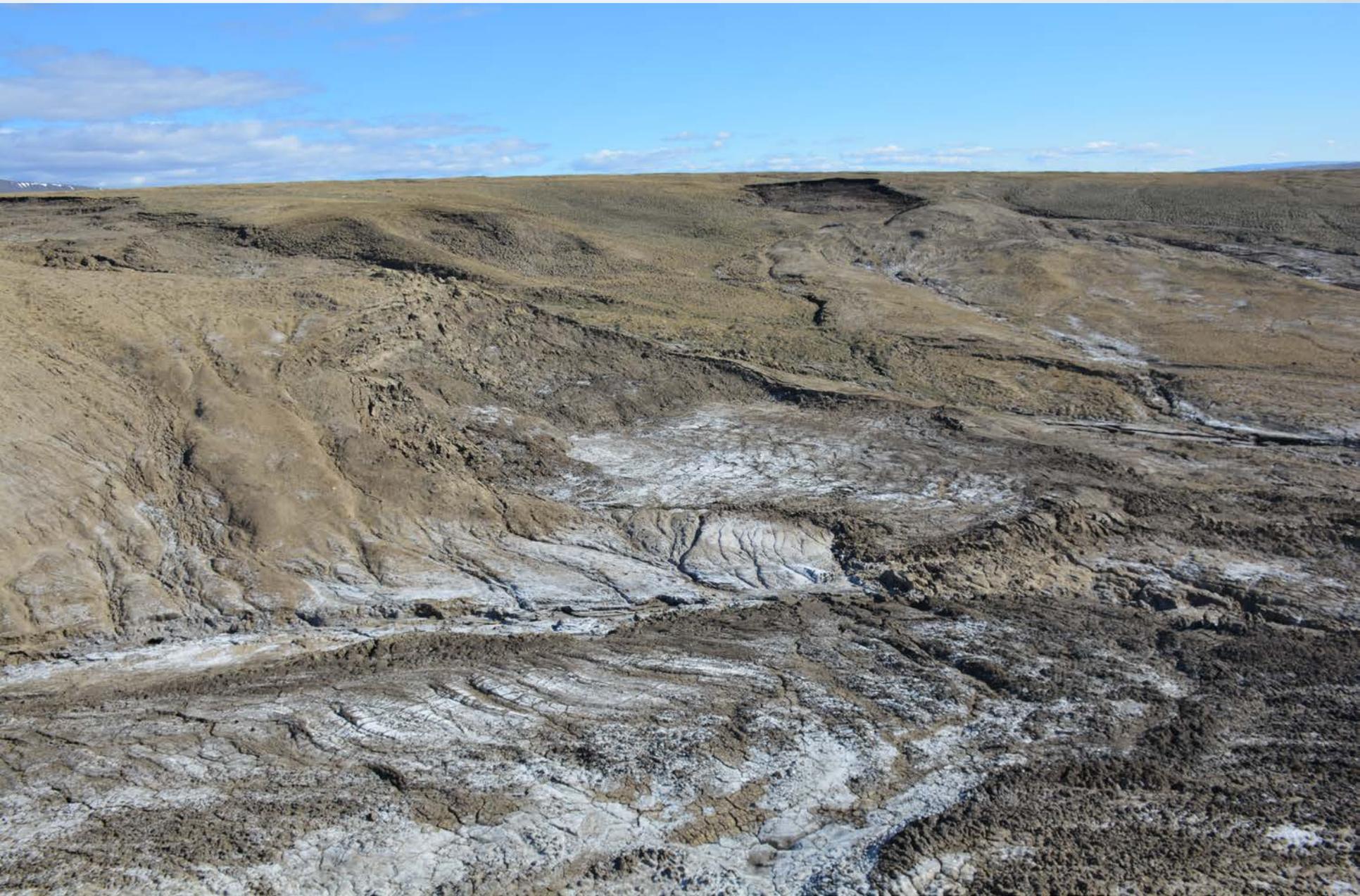
1960 photo

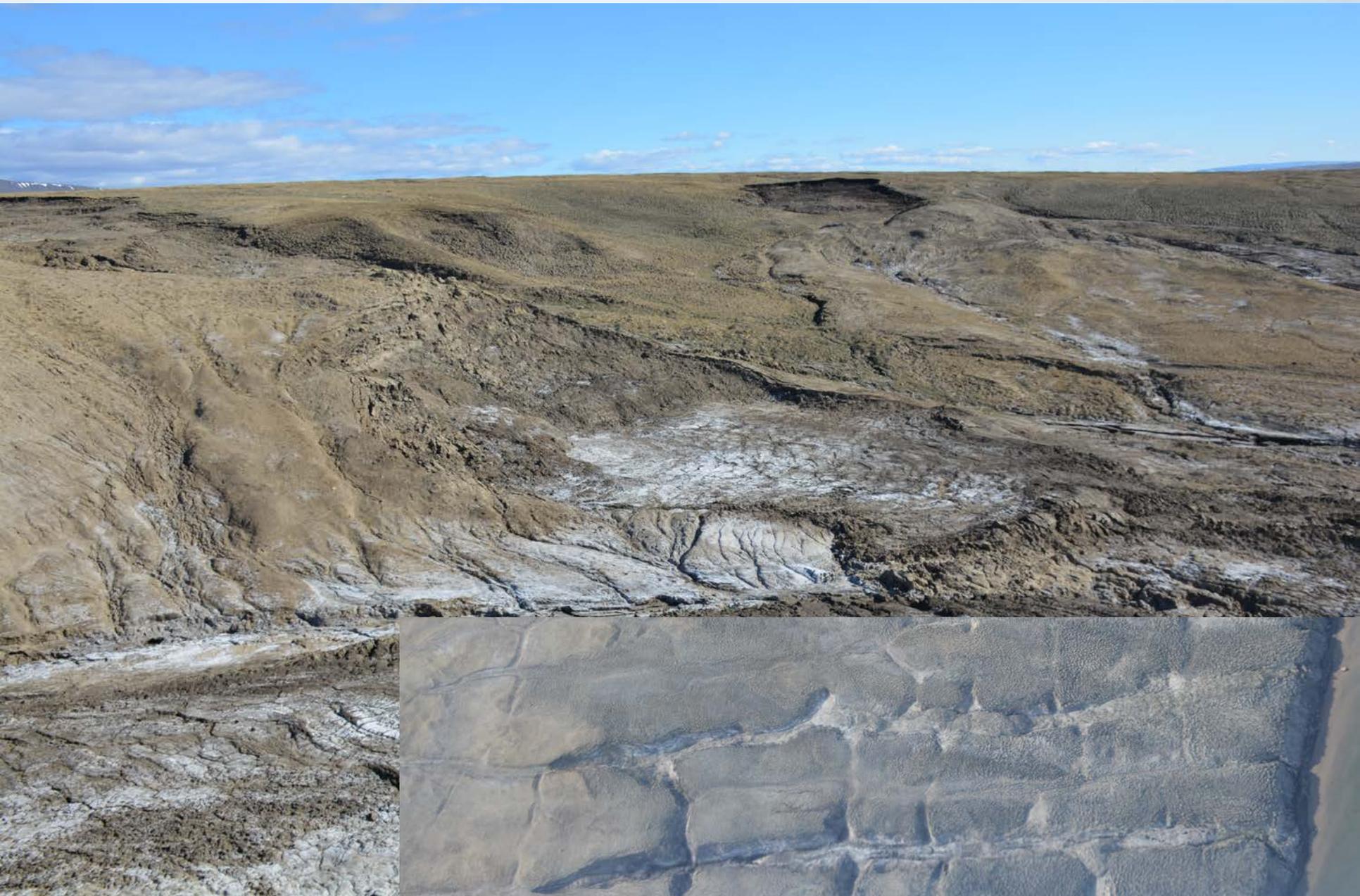
2012 photo











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