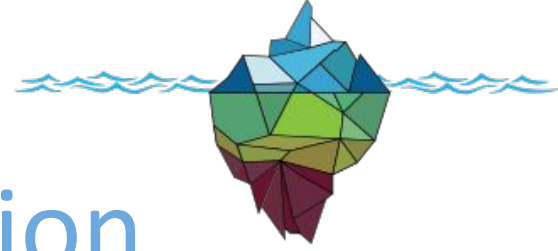




Glaciology

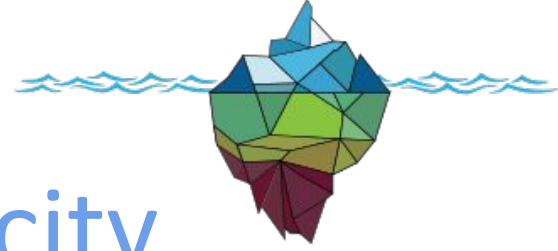
What is Glacier Surging?



Normal Glacier Motion

A glacier flows downhill through different mechanisms:

- “*Internal deformation*” of Ice (creep)
- “*Sliding*” at the glacier bed
- Deformation of basal sediments



Normal Glacier Velocity

Glaciers are slow!

- Normally, glaciers move just a few centimeters a day
- So slow, it looks like they aren't moving at all

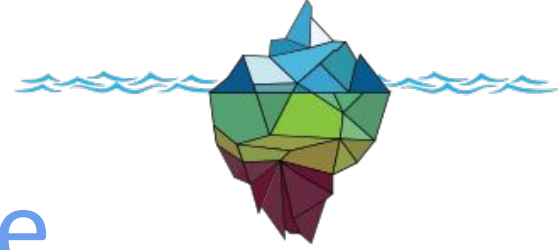


Iceberg from Jakobshavn Glacier. Washington.edu



What Are Glacier Surges?

- Surges are switches between slow and fast flow, with the fast flow occurring for a few years
- Surges are not directly triggered by external factors (e.g. climate), but instead are a combination of internal and external factors
- The velocity of the glacier can increase up to ten or more times the normal speed!



Example of a Surge

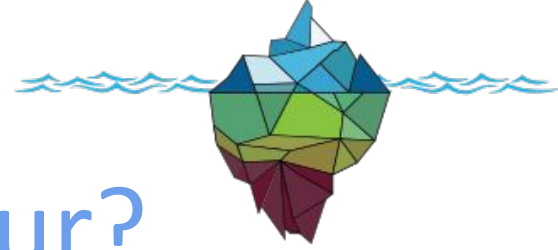


Left: Satellite image of Morsnevbreen glacier, Svalbard, May 2016.

Right: Satellite image of Morsnevbreen glacier, Svalbard, December 2017.

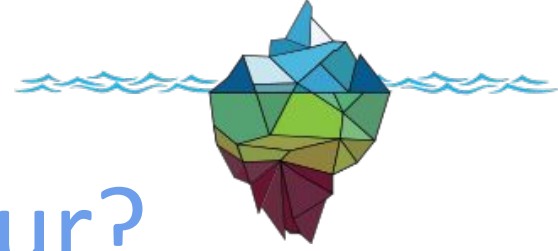
Images from R.Jones, University of St Andrews.



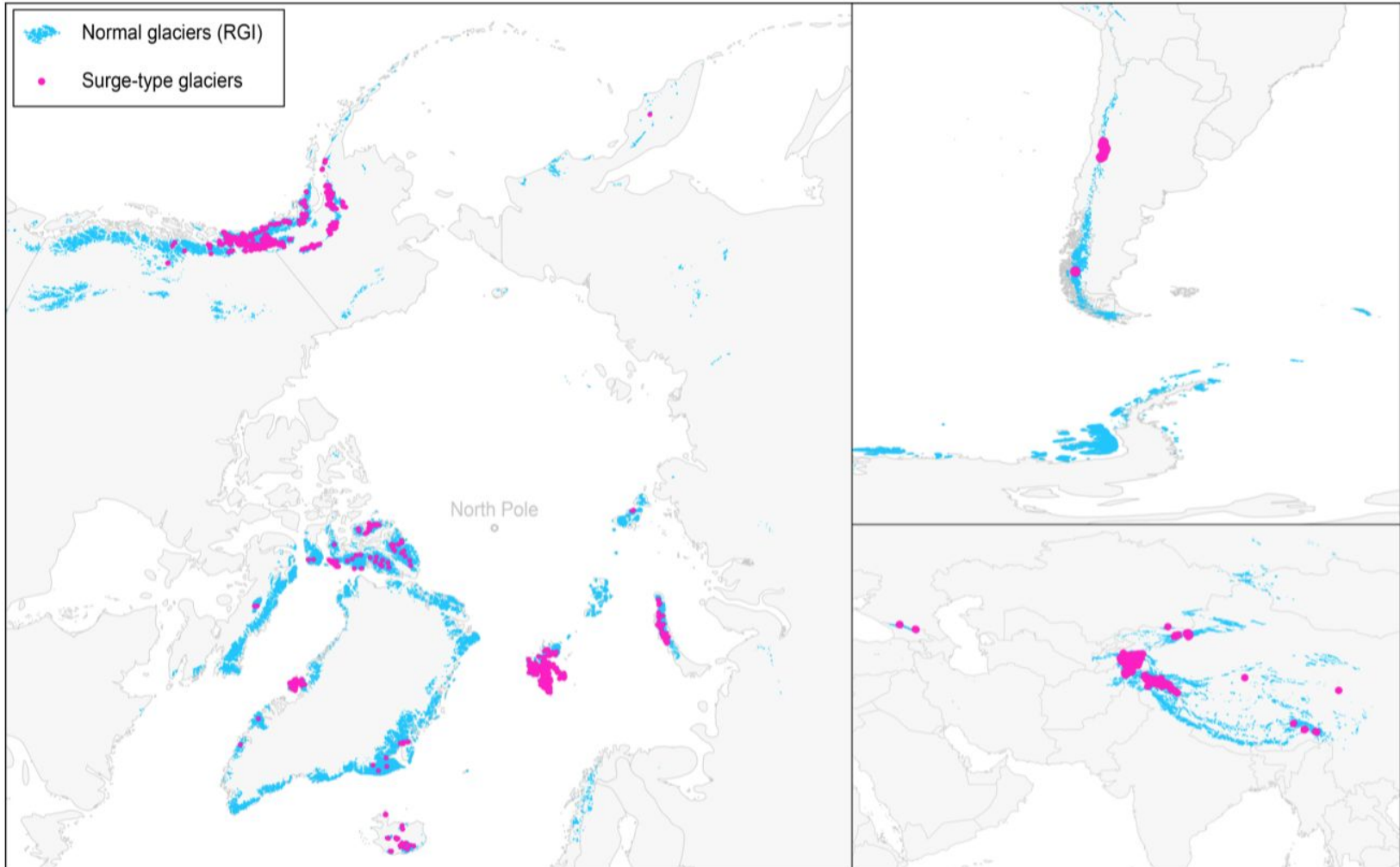


Where Do They Occur?

- Not all glaciers in the world surge, as certain conditions are required
- It is estimated that only ~1% of the global glacier population are of surge-type
- Surge-type glaciers are clustered within specific glaciated regions within the world

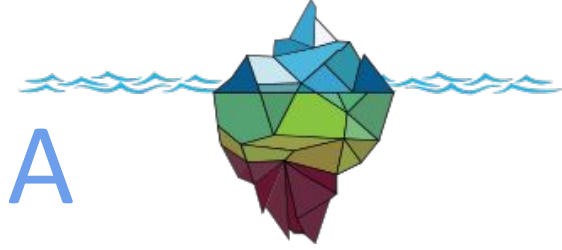


Where Do They Occur?

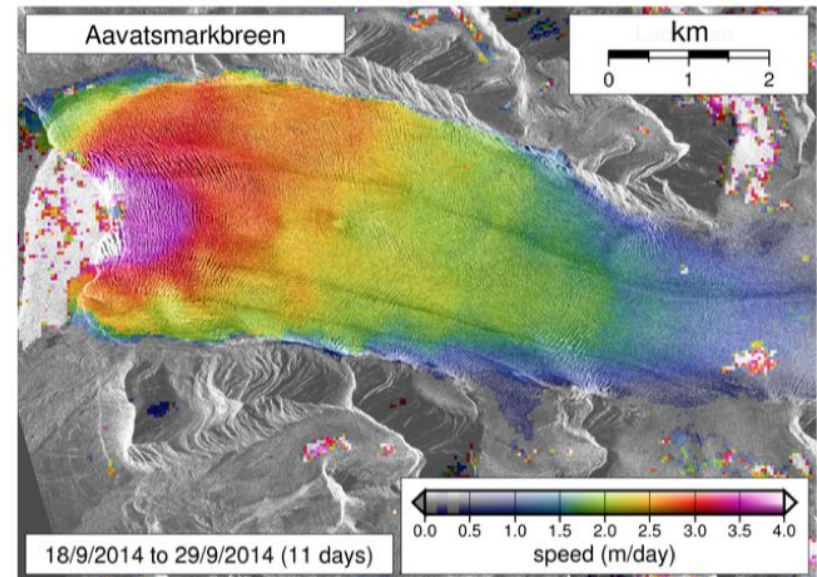
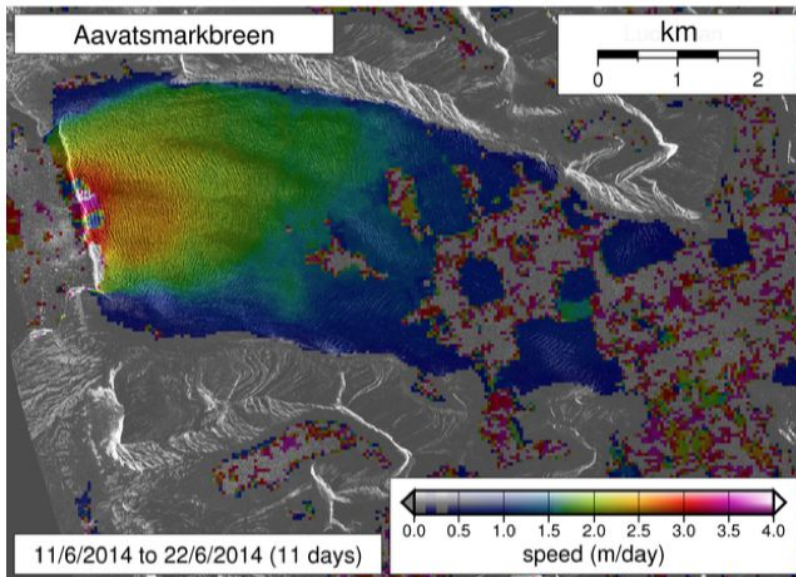


Map of Normal Glaciers (Blue) and Surge-Type Glaciers (Pink). Sevestre and Benn, 2015

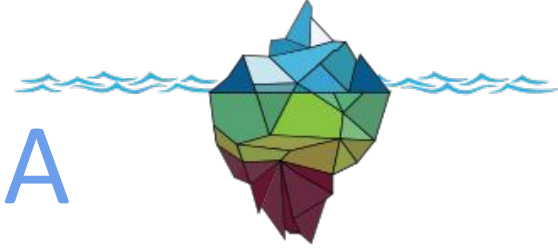
What Happens To A Glacier When It Surges?



- Rapid Speed Up
- Terminus (the “end” of the glacier) can advance by kilometers



What Happens To A Glacier When It Surges?

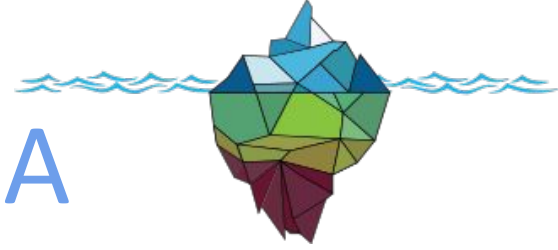


- Accumulation Zone Thinning



Glacier drawdown during a surge. D. Benn, University of St Andrews.

What Happens To A Glacier When It Surges?

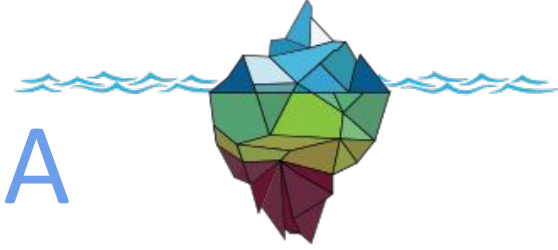


- Crevassing



Crevassing on a Variegated glacier, Alaska. Swisseduc.ch

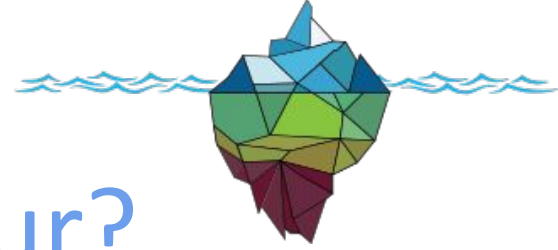
What Happens To A Glacier When It Surges?



- Eventual Melt and Thinning

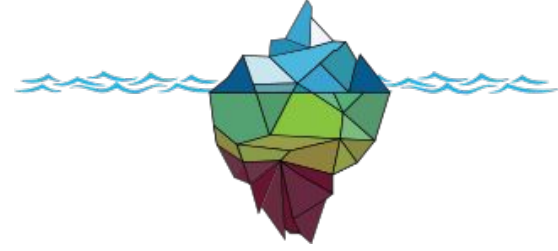


Photo - unis.no



Why Do Surges Occur?

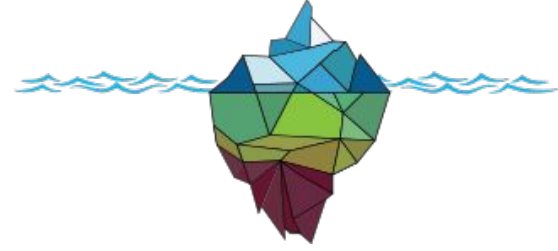
- Build up of water at the bed decreasing friction and causing an increase in glacier speed
- Increase in faster sliding and sediment deformation rate
- Research is still underway to try and work out why some glaciers surge but others do not



True or False

All Glaciers Surge?

True or False

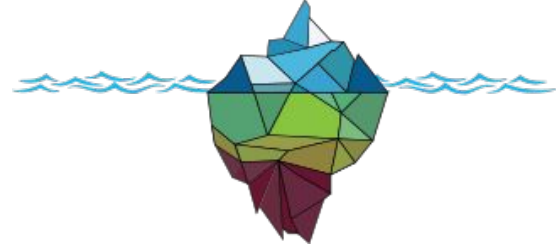


True or False

All Glaciers Surge?

~~True~~ or **False**

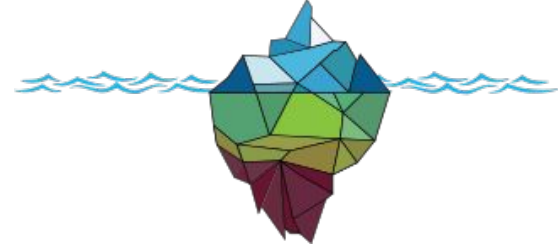
False! Only ~1% of global glaciers are thought to surge.



True or False

A surging glacier can increase in speed to over ten times its normal rate.

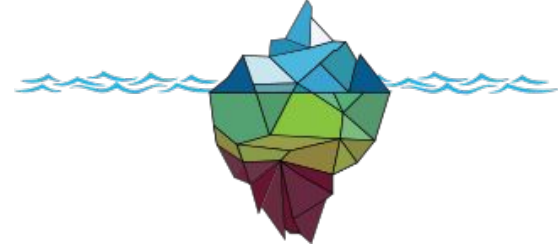
True or False



True or False

A surging glacier can increase in speed to over ten times its normal rate.

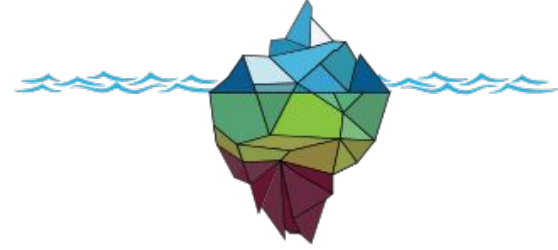
True or ~~False~~



True or False

When a glacier surges, the Accumulation Zone thickens and increases in size.

True or False



True or False

When a glacier surges, the Accumulation Zone thickens and increases in size.

~~True~~ or **False**

False! When a glacier surges, ice from the Accumulation Zone travels rapidly into the Ablation Zone which leads to thinning!

