Introduction to Safety on Glaciers in Svalbard

Content

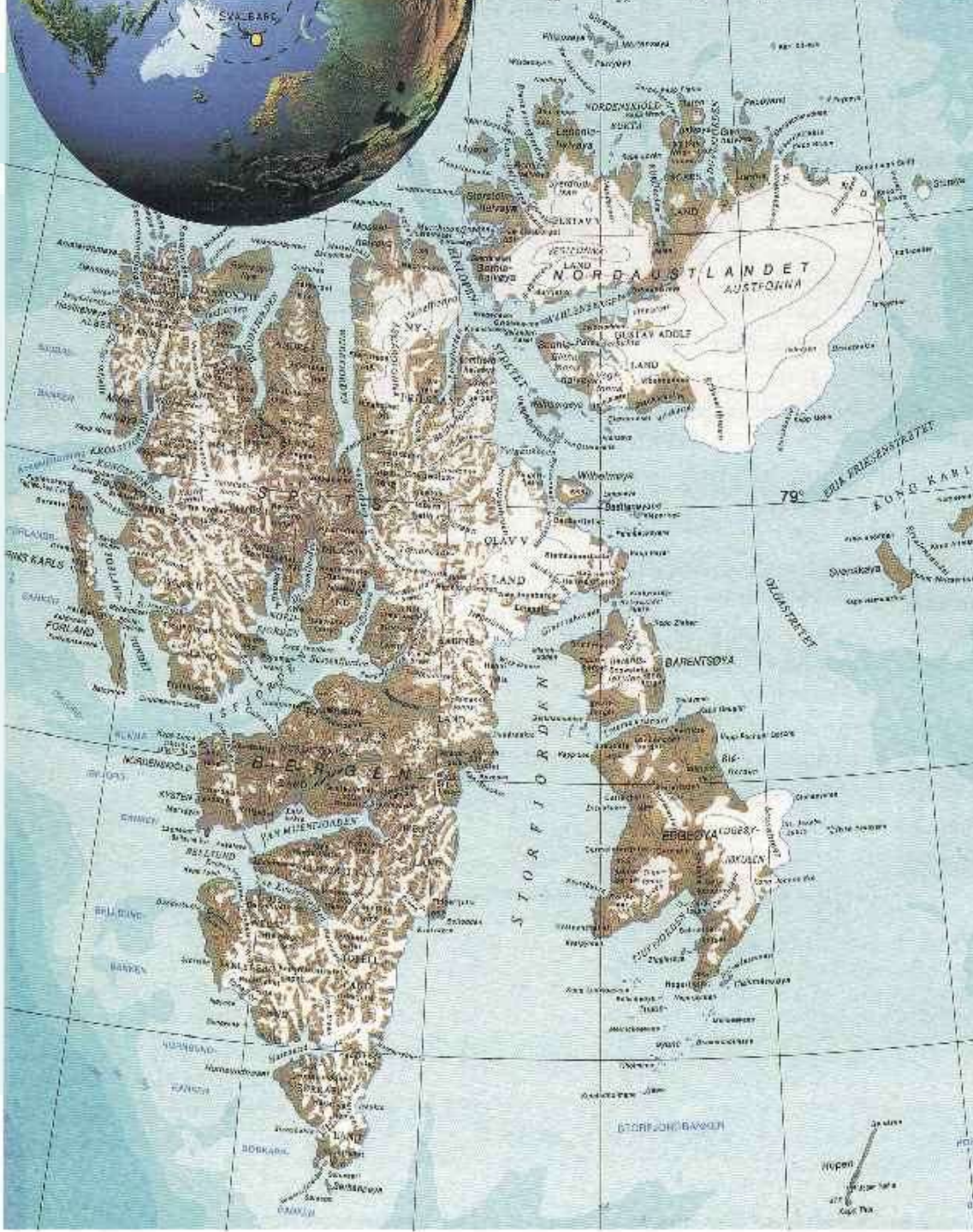
- Basic info on Svalbard glaciers
- Risk aspects when travelling on glaciers
- Safe travel on glaciers
- UNIS safety & rescue equipment
- Companion rescue in crevasse accidents

Some basic Info

- **60 % of Svalbard is covered by glaciers**
- **Distribution:**
  - **Most glacier terrain in North-East**
  - **Also lot in Southern and North-West side**
  - **Least around Longyearbyen**

→ **Differences in weather, amount of precipitation**

- Many snowmobile routes cross over glaciers – you need to use them if you want to travel longer distances
- Very nice and flat terrain to use with snowmobiles and skis
- Fascinating terrain



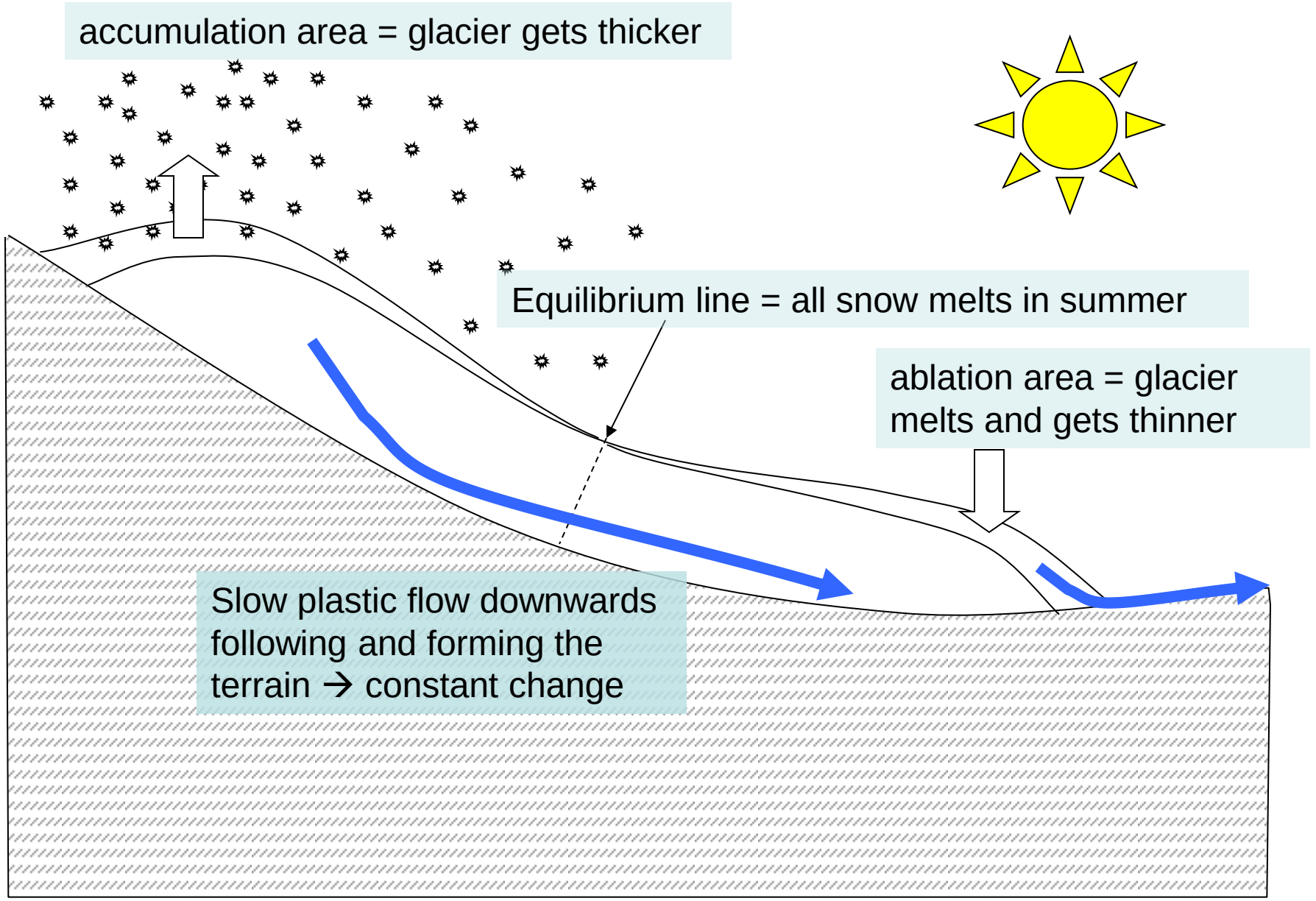
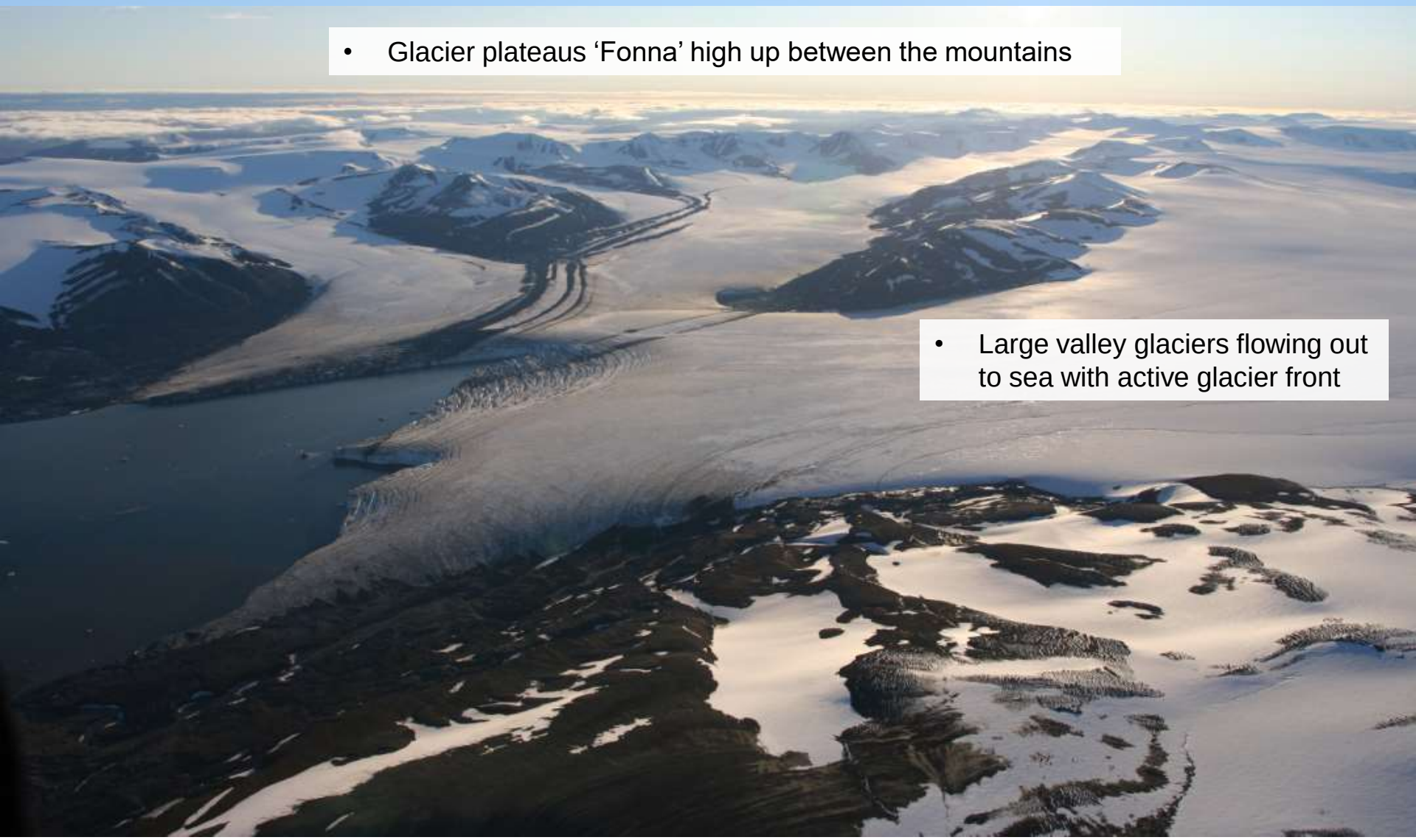


Illustration: K. Bælum

Glacier basics

Glaciers – different types

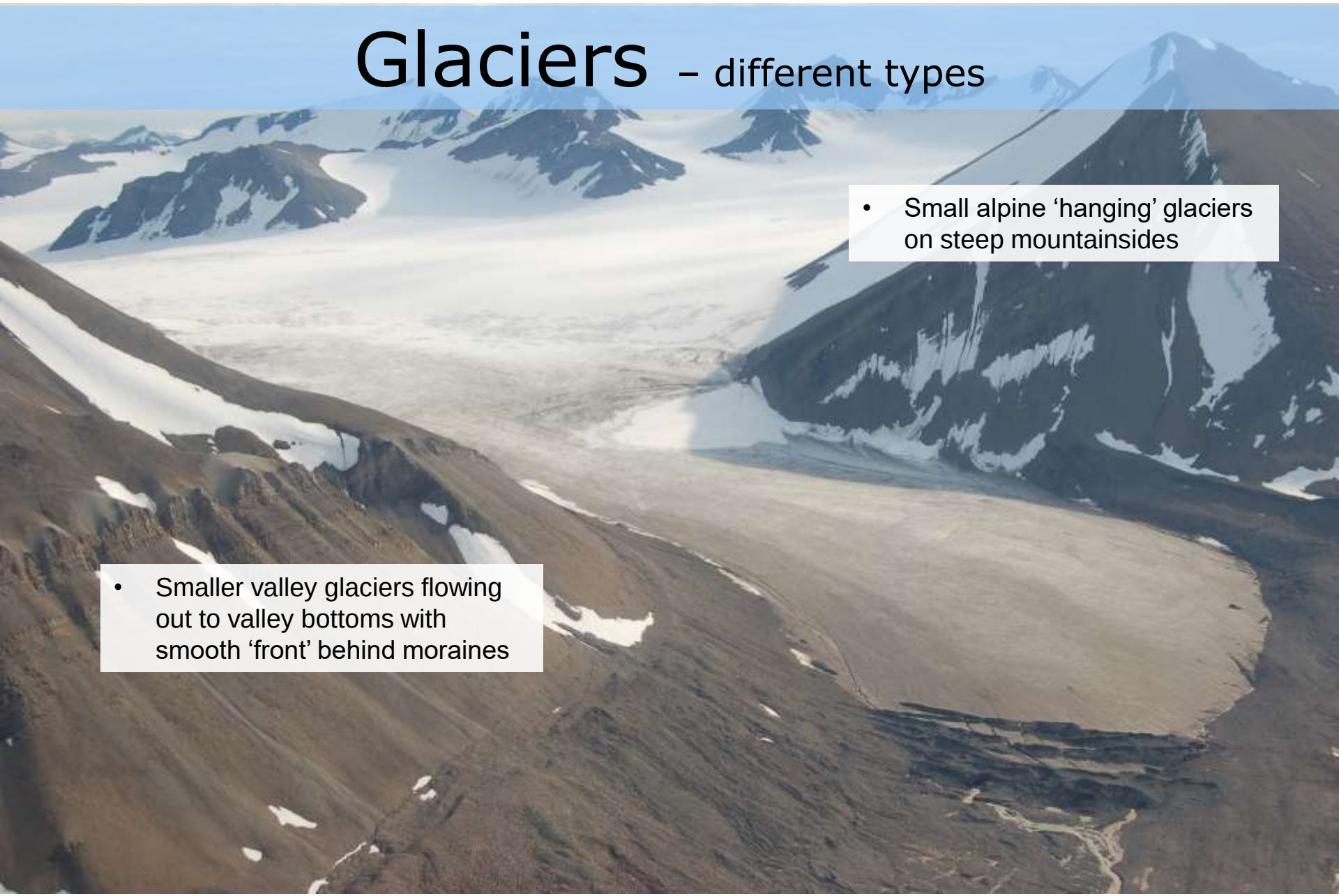


- Glacier plateaus ‘Fonna’ high up between the mountains

- Large valley glaciers flowing out to sea with active glacier front

Nordenskiöldbreen in Billefjorden

Glaciers – different types



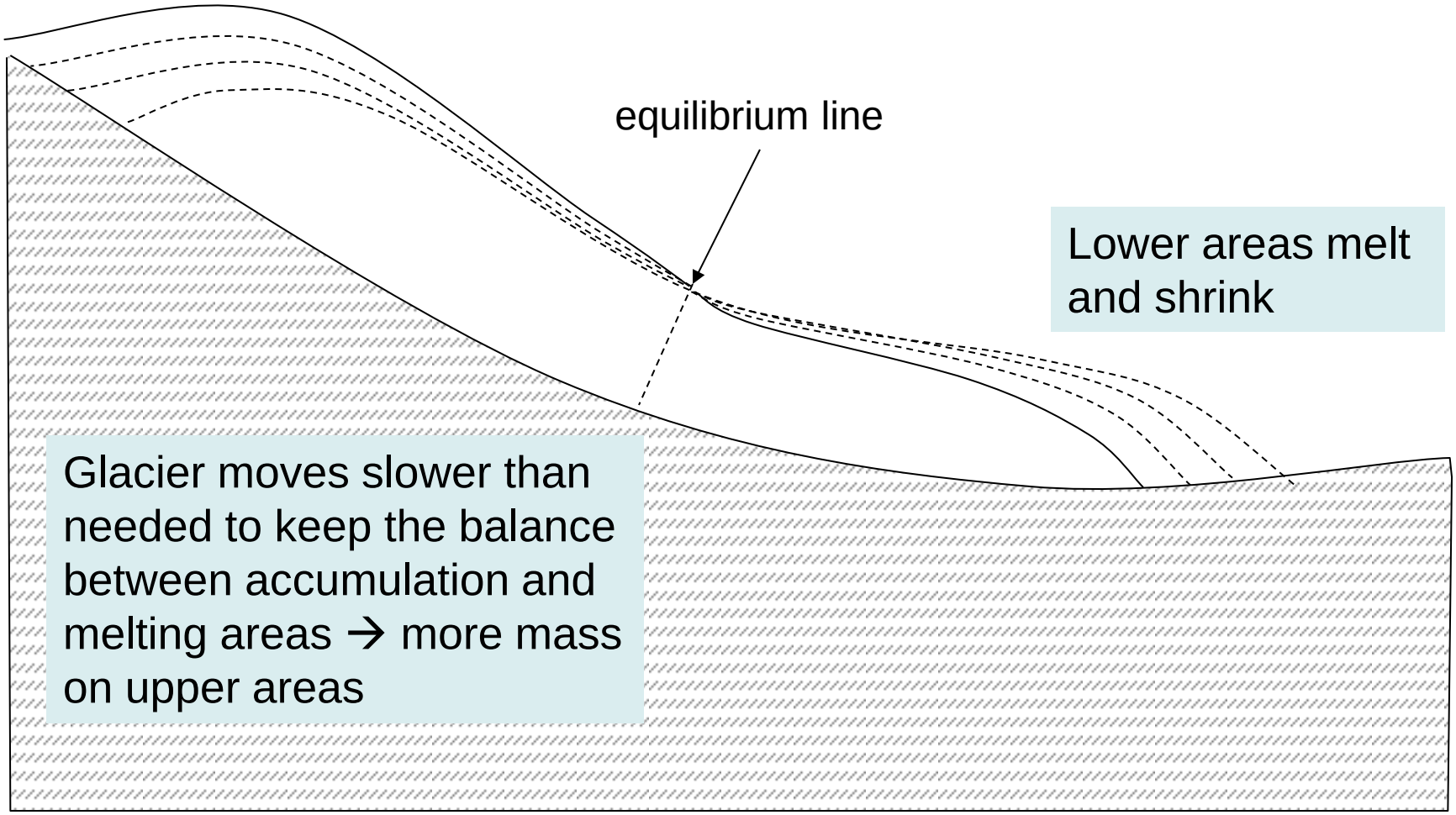
- Small alpine ‘hanging’ glaciers on steep mountainsides

- Smaller valley glaciers flowing out to valley bottoms with smooth ‘front’ behind moraines


Longyearbreen

Surging glaciers

More ice & mass builds up



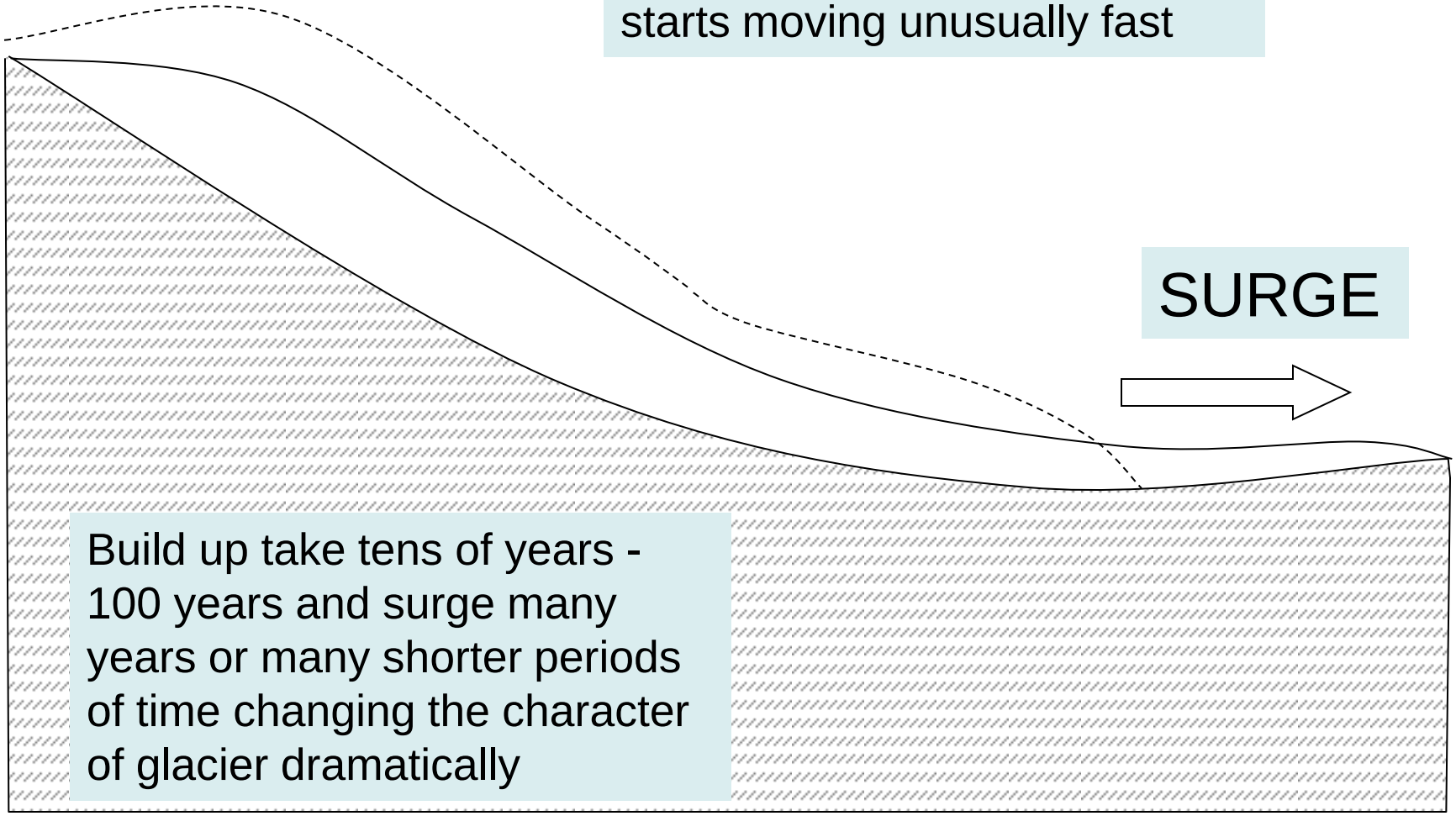
Lower areas melt and shrink

Glacier moves slower than needed to keep the balance between accumulation and melting areas → more mass on upper areas

Illustration: K. Bælum

Surging glaciers

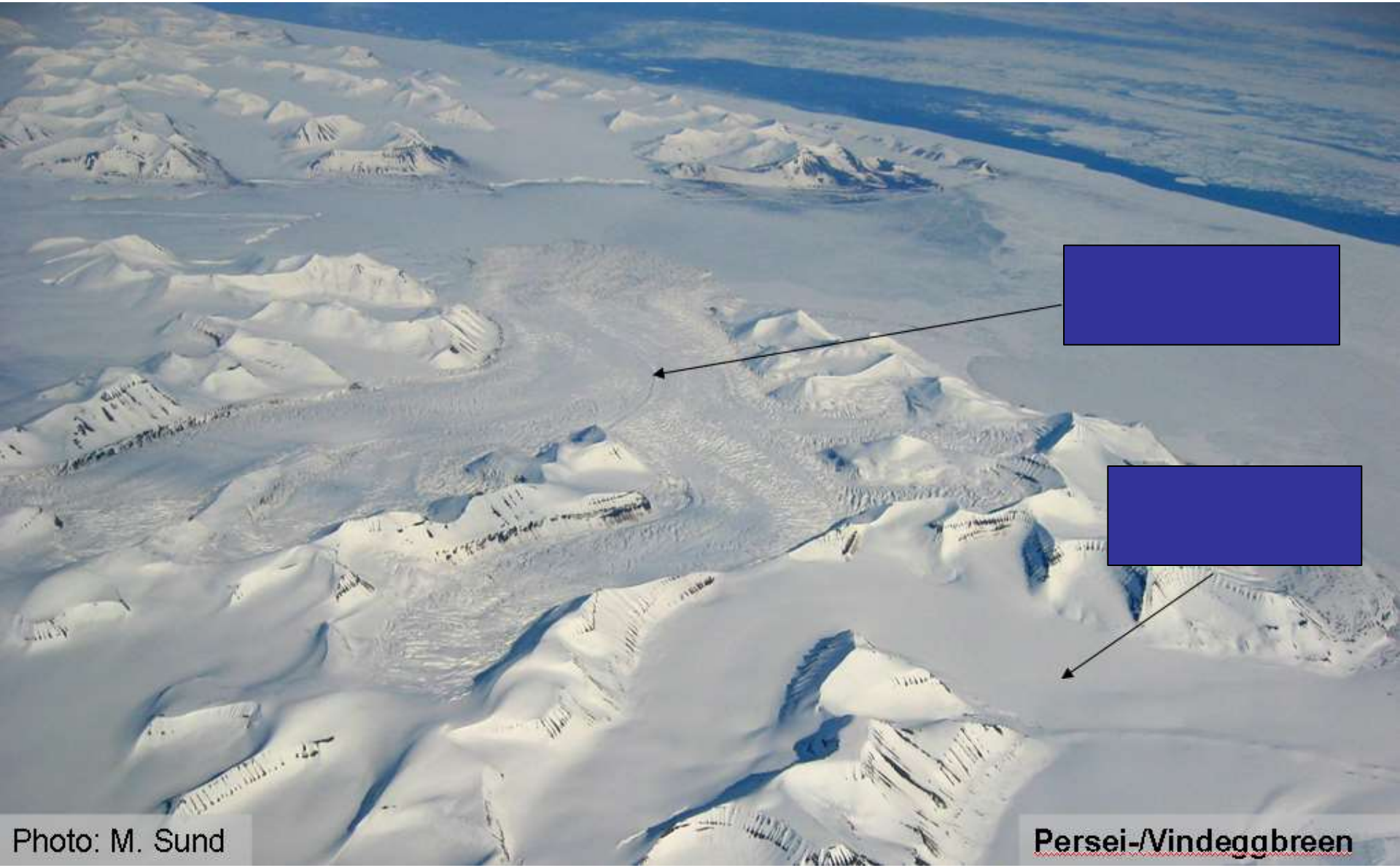
At some point the unbalance gets too big and the glacier starts moving unusually fast



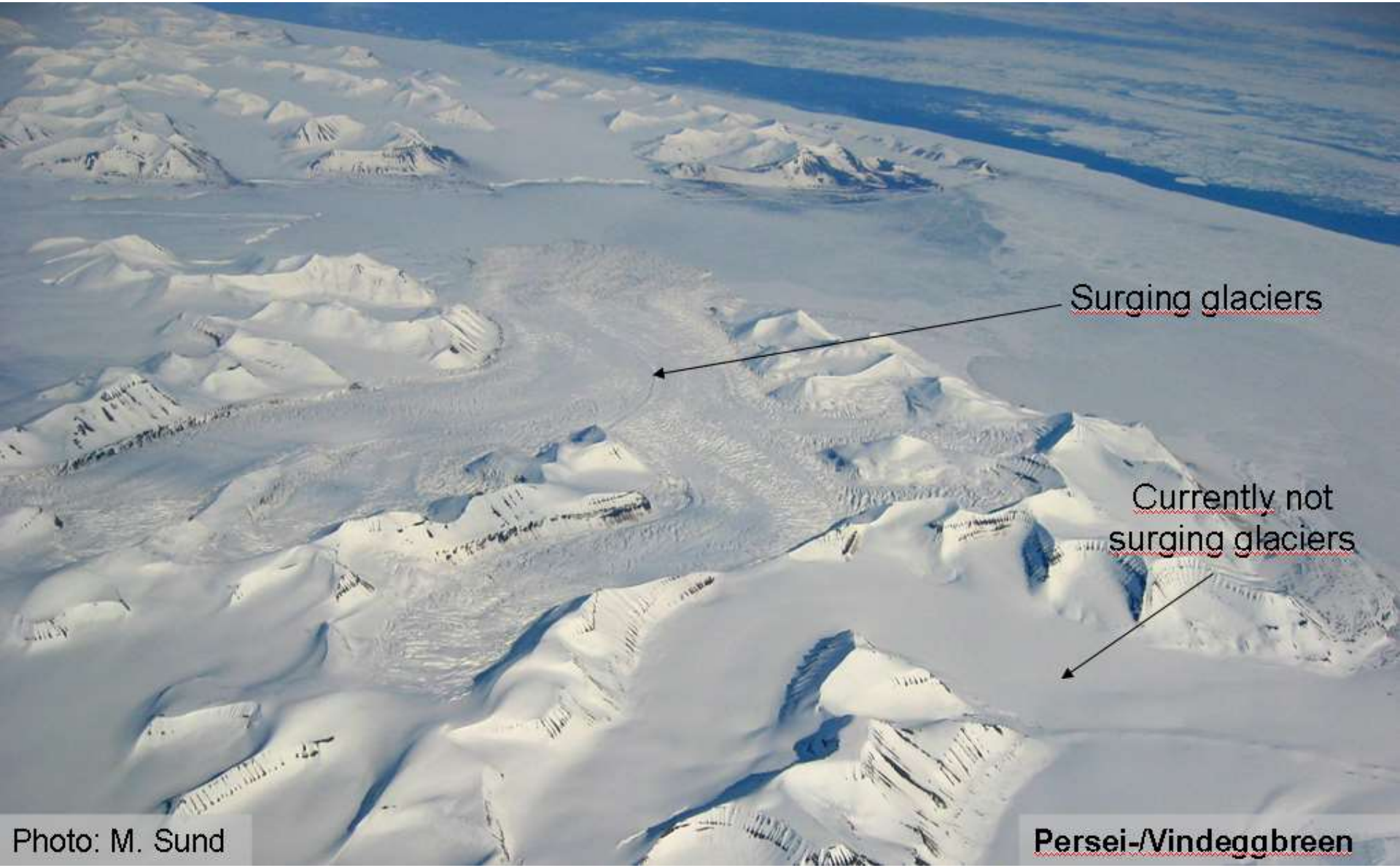
Build up take tens of years - 100 years and surge many years or many shorter periods of time changing the character of glacier dramatically

Illustration: K. Bælum

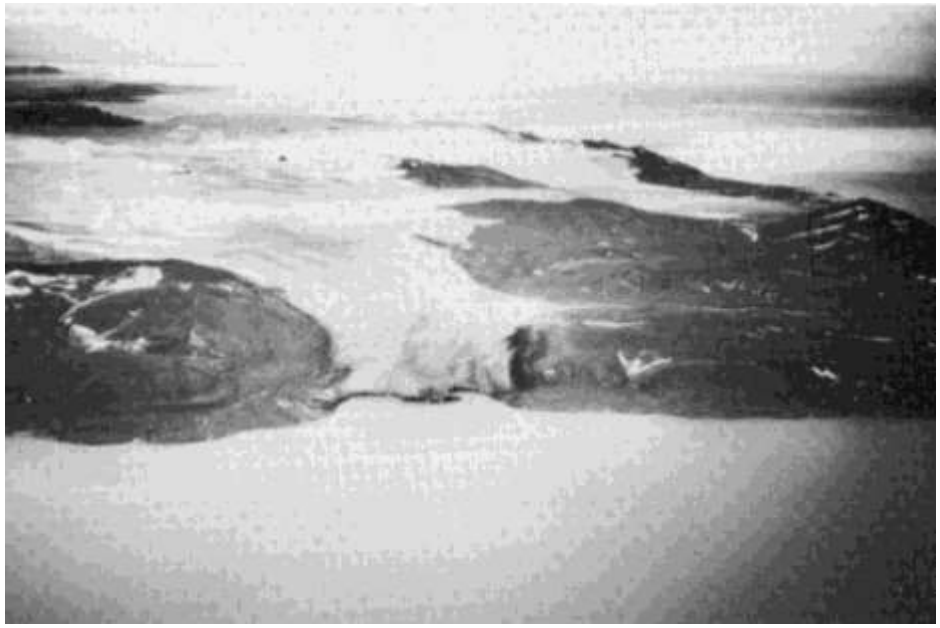
Surging glaciers



Surging glaciers



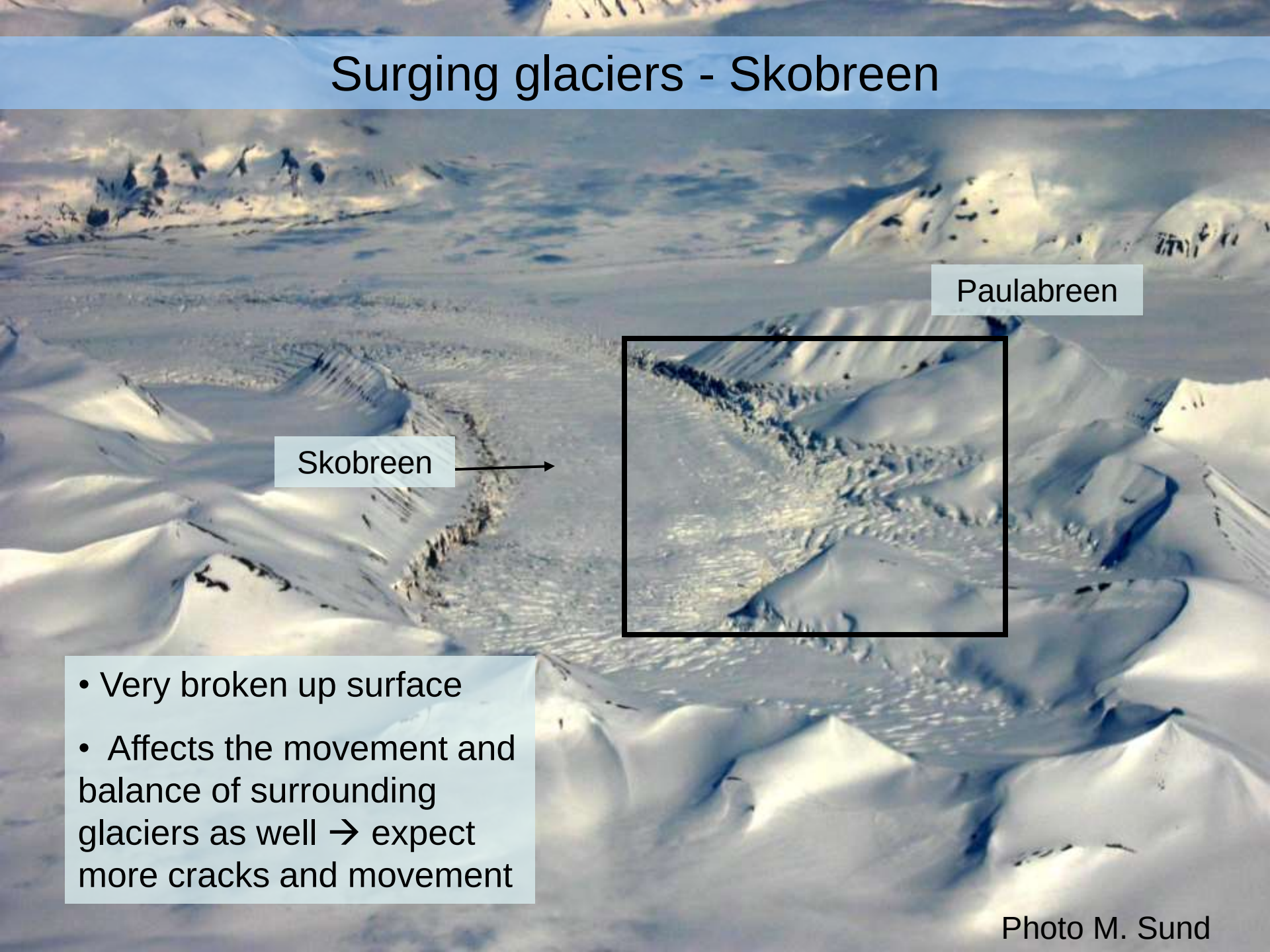
Surging glaciers - Freemanbreen



1936

1956

Surging glaciers - Skobreen



- Very broken up surface
- Affects the movement and balance of surrounding glaciers as well → expect more cracks and movement

Photo M. Sund

Risk aspects on glaciers

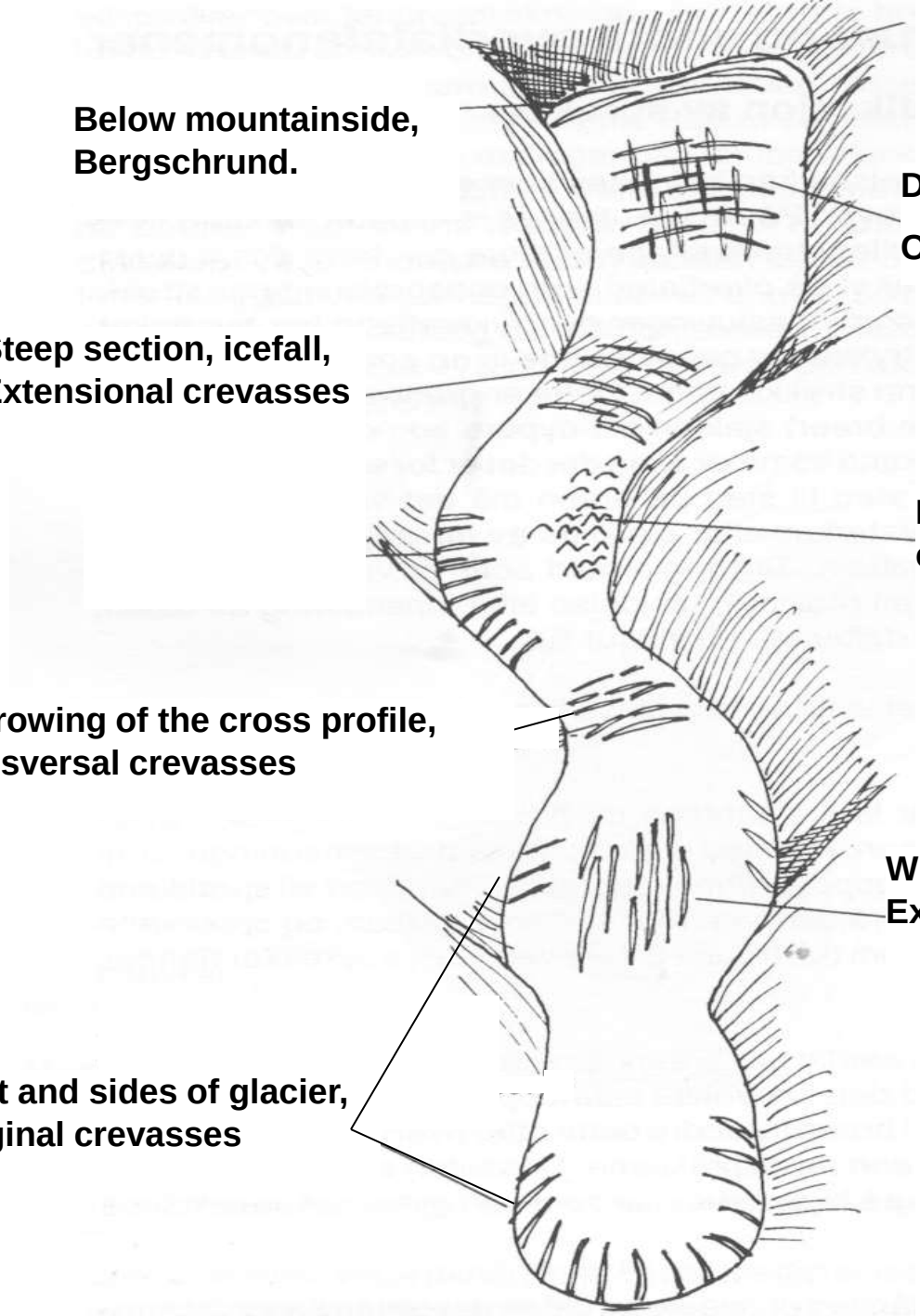
Risk aspects on glaciers

1. Crevasses (cracks on the surface)

Crevasses (cracks on the surface)

• Glacier ice is huge plastic mass moving slowly over underlying terrain
– this causes stresses, forces and different speeds in the ice surface when the contours of underlying terrain changes and also when glacier changes direction

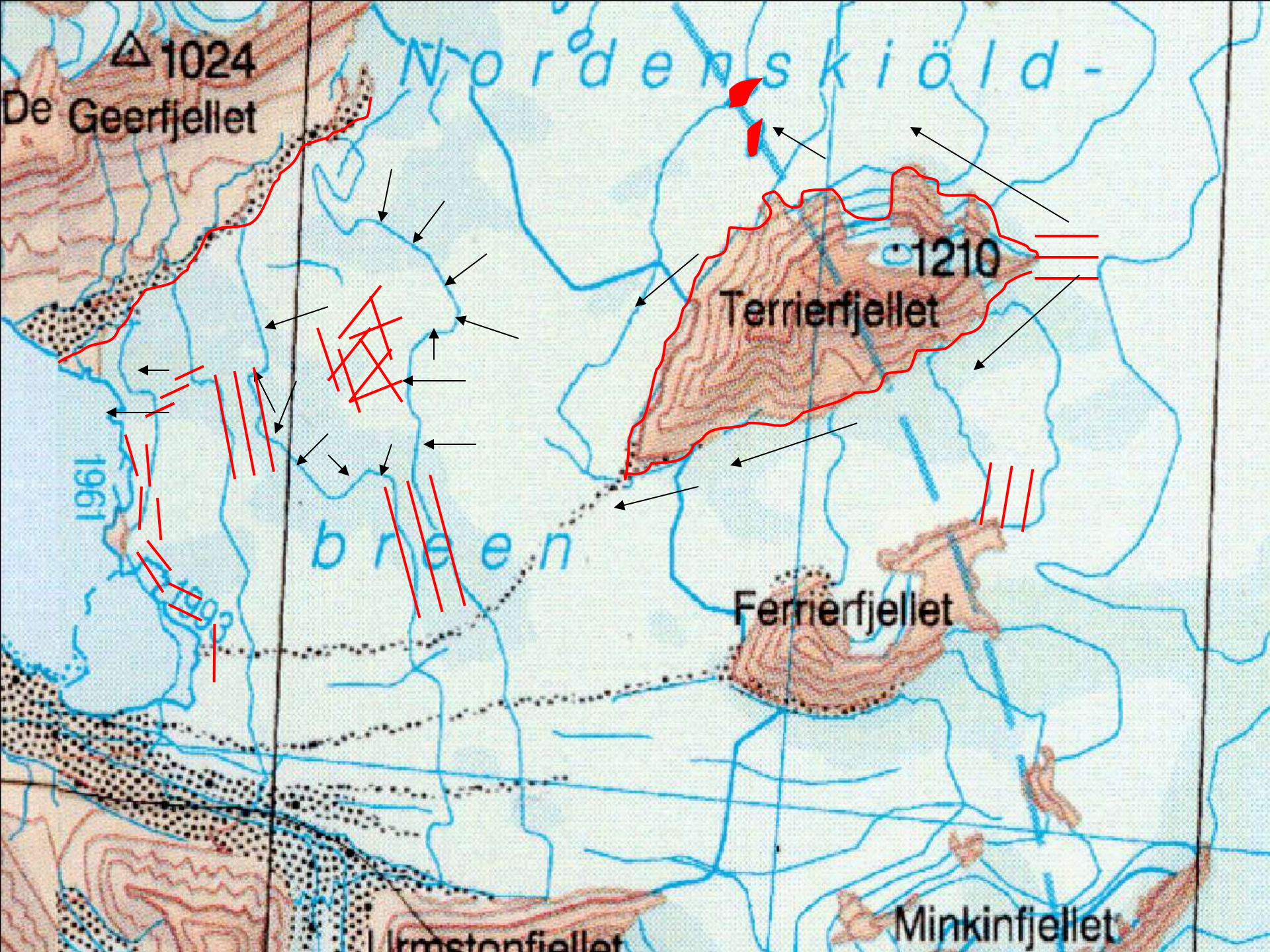
Photo: K. Bælum


Below mountainside,
Bergschrund.
Dome on the bed rock, uplift.
Chaotic crevasse pattern
Steep section, icefall,
Extensional crevasses
Inside of turn,
crevasses
Narrowing of the cross profile,
transversal crevasses
Widening of the cross profile.
Extensional crevasses along flow lines
Front and sides of glacier,
marginal crevasses

Some possible crevasse risk areas

- **Most crevasses on places where glacier changes its character considerably** – fronts, steeper, convex, curve, get narrow, widens up, splits in two, by mountainsides

- **Safest on flat areas high up away from glacier fronts and mountain sides** (no stress on ice, most snow)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De Geerfjellet
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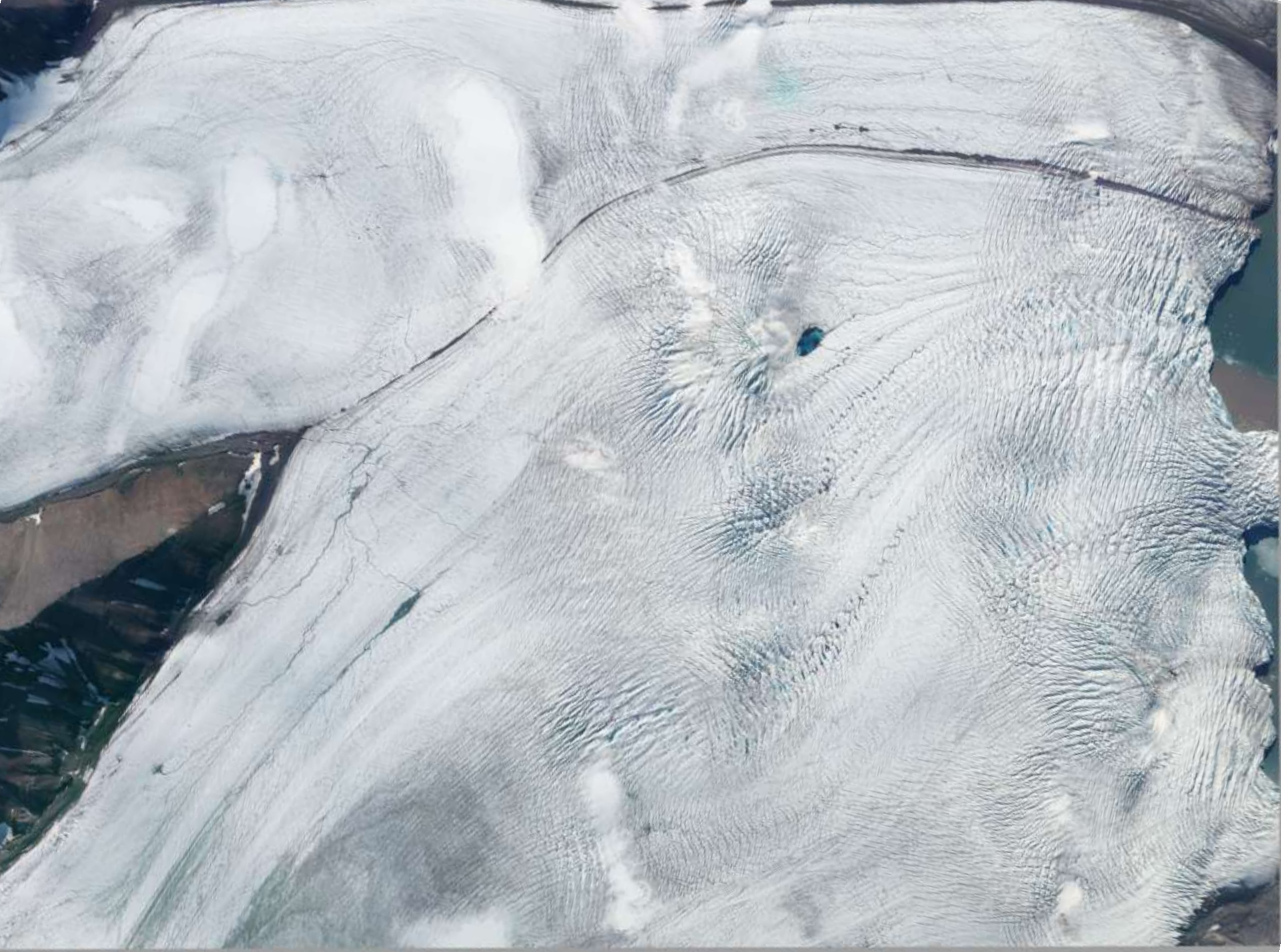
breen
Ferrierfjellet
Minkinfjellet



Front in Tunabreen

Calving active glacier fronts also in winter

Calving Tunabreen March 201

Large calving can break the sea ice

Calving Tunabreen March 2014. Sea ice 50-60cm thick, cracked up 200m away from the front in deep water – 600m away in shallow parts because of waves created by calving.

Risk aspects on glaciers

2. Melt water channels

- Svalbard glaciers have melt water channels on surface – very often on the sides, following moraine ridges etc.
- Large and deep close to glacier fronts + terminal moraine
- Large changes from year to year

Melt water channels

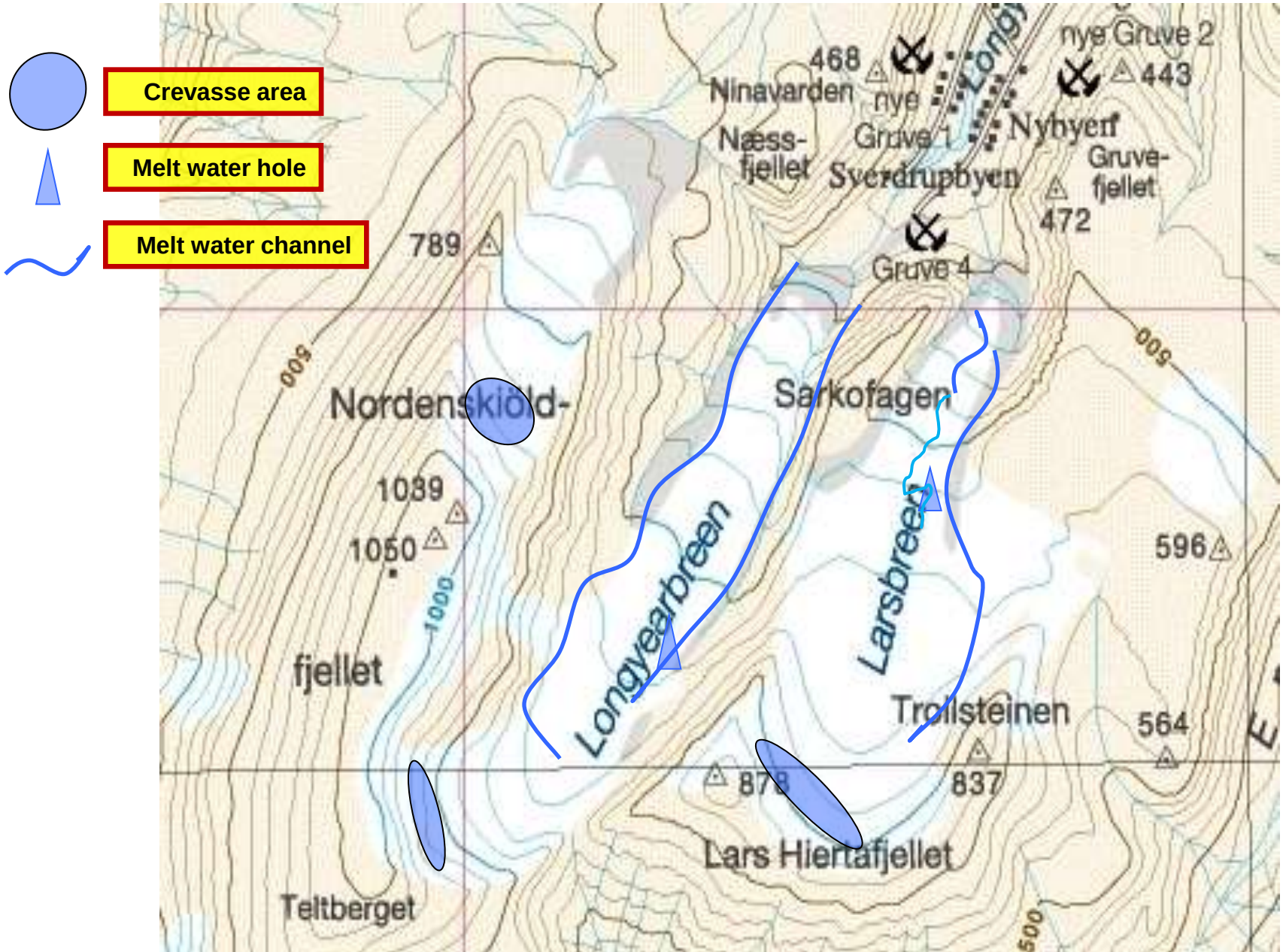
Melt water channel following moraine feature


Melt water channels following moraine features

Collapsed melt water channel/cave feature

→ Large changes from year to year

Glacier risk areas by Longyearbyen



Glacier melt water channels in Longyearbreen

Channels along sides of Longyearbreen; some places 5-10m deep

Crevasse and melt water channels on Larsbreen

Crevasses below Nordenskiöldtoppen

Ice caves in Glaciers

- Part of melt water channels
- Mostly dry in winter
- Accessible in many glaciers:
  - Longyearbre, Larsbre, Tellbre..
- Big changes every year

Possible risks

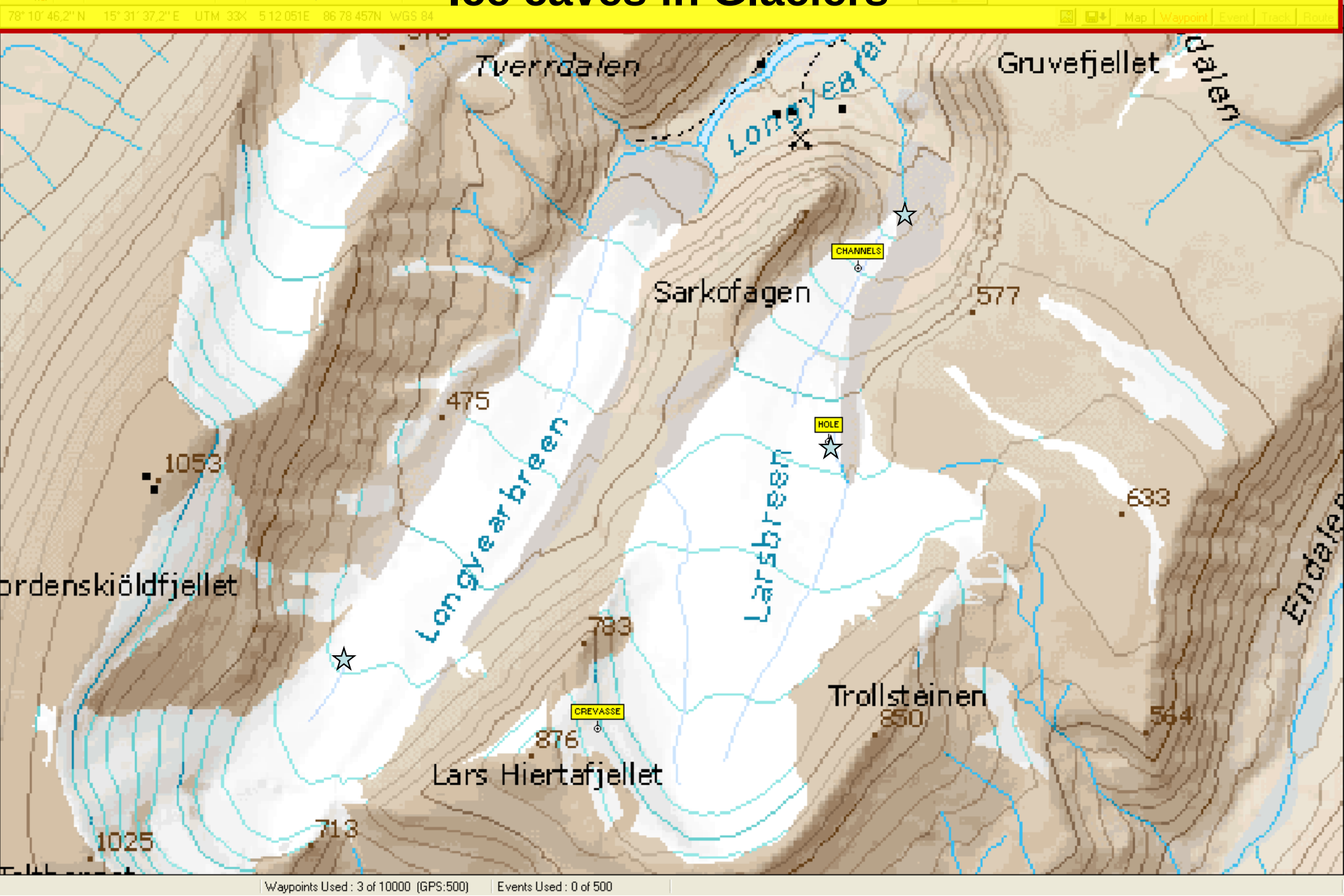
- Collapsing parts of wall, roof, floor
- Slippery, sliding and hitting yourself
- Falling

→ Calling for help difficult

→ Rescue work very difficult

2011 large collapse in Longyearbreen cave, unstable conditions in many others

Ice caves in Glaciers



Ice caves in Glaciers

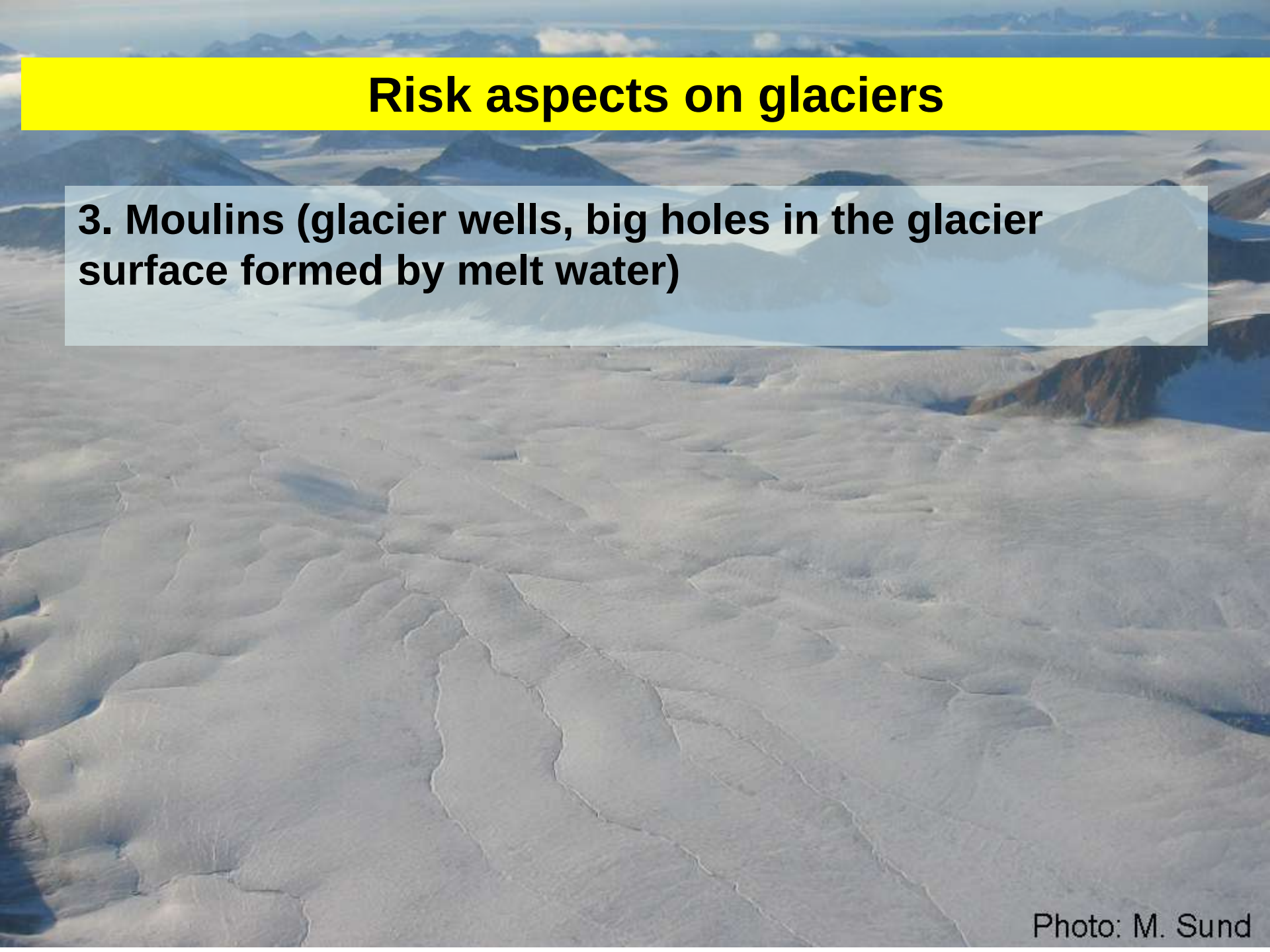
Safety measures

- Check conditions → some caves and some years need to use ropes and other gear to get safely down into caves and up again
- Use helmet
- Bring with you crampons

- Look around for cracks, loose parts of ice on the walls and roof
- Also pay attention to the floor → floor can be in several thinner layers

Risk aspects on glaciers

3. Moulins (glacier wells, big holes in the glacier surface formed by melt water)



Small Moulin

Large Moulin

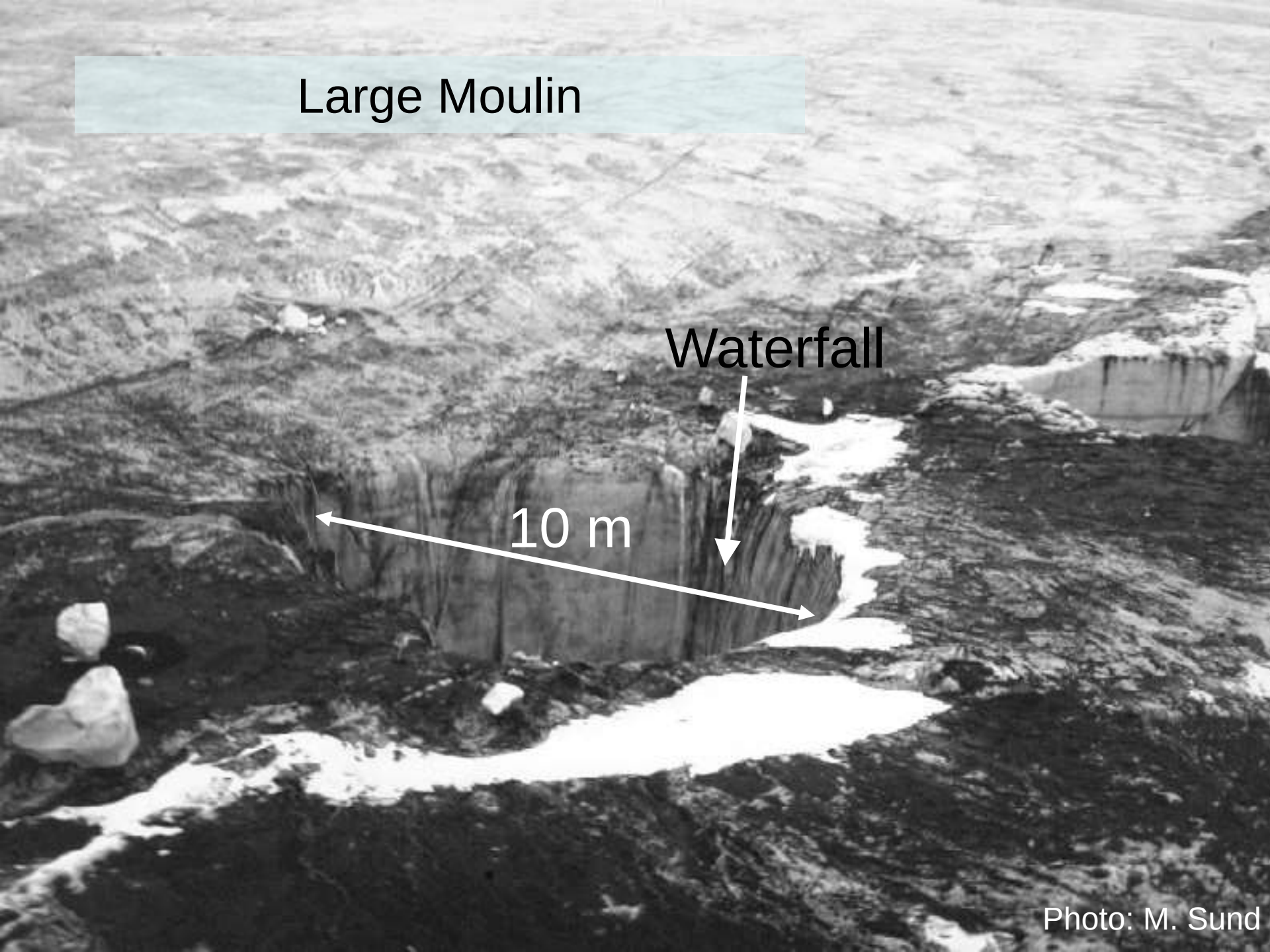


Photo: M. Sund

Large Moulin in winter

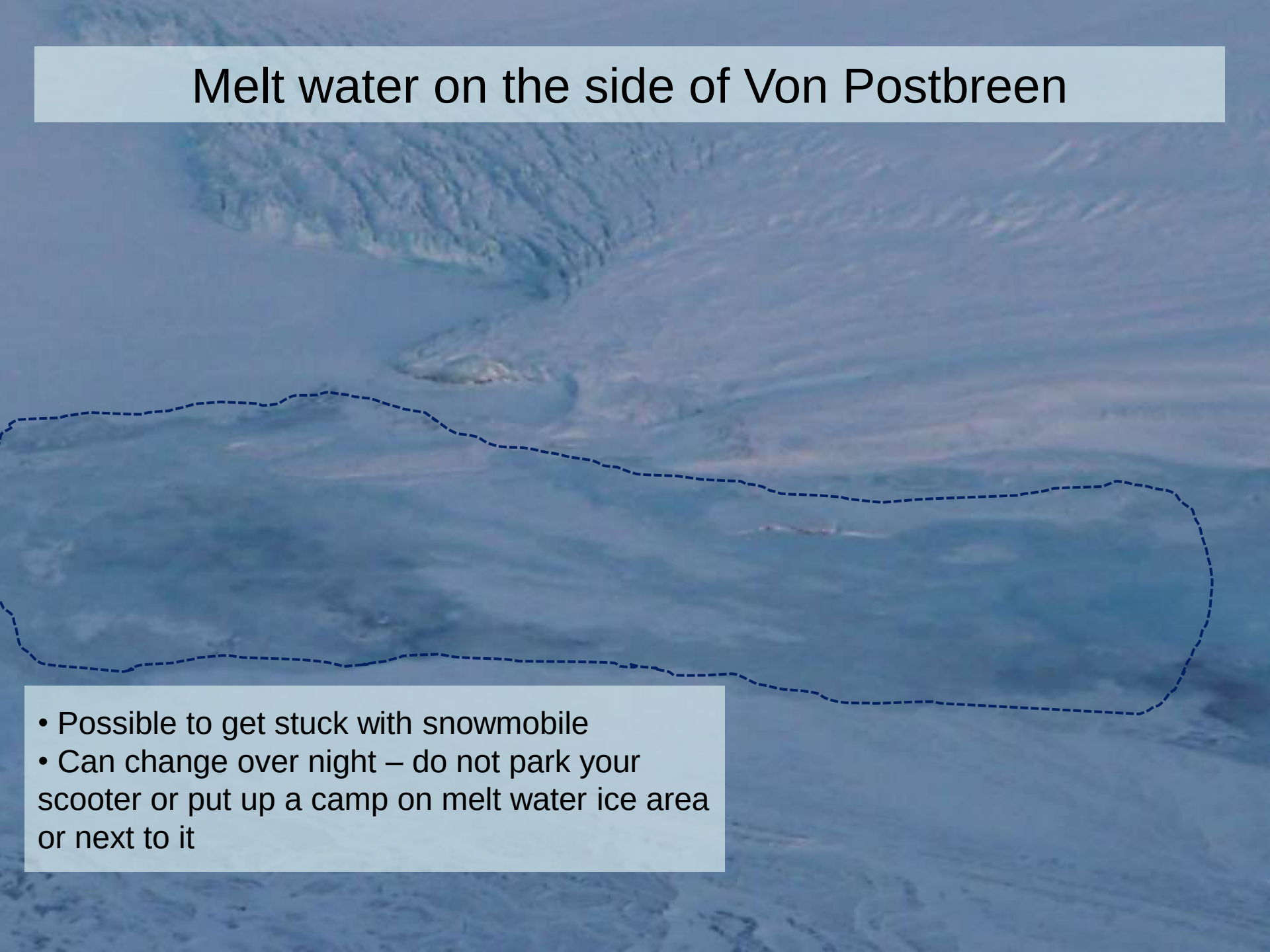
Risk aspects on glaciers

4. Melt water/ Icings in front of the glacier

- Found in front of glaciers
- They can occur even at very low temperatures
- Some of the water may be frozen, but liquid water may also be covered by snow or a thin ice layer.

Photo: M. Sund

Melt water on the side of Von Postbreen



- Possible to get stuck with snowmobile
- Can change over night – do not park your scooter or put up a camp on melt water ice area or next to it

Risk aspects on glaciers

5. Bad weather – bad visibility - white out conditions on glaciers

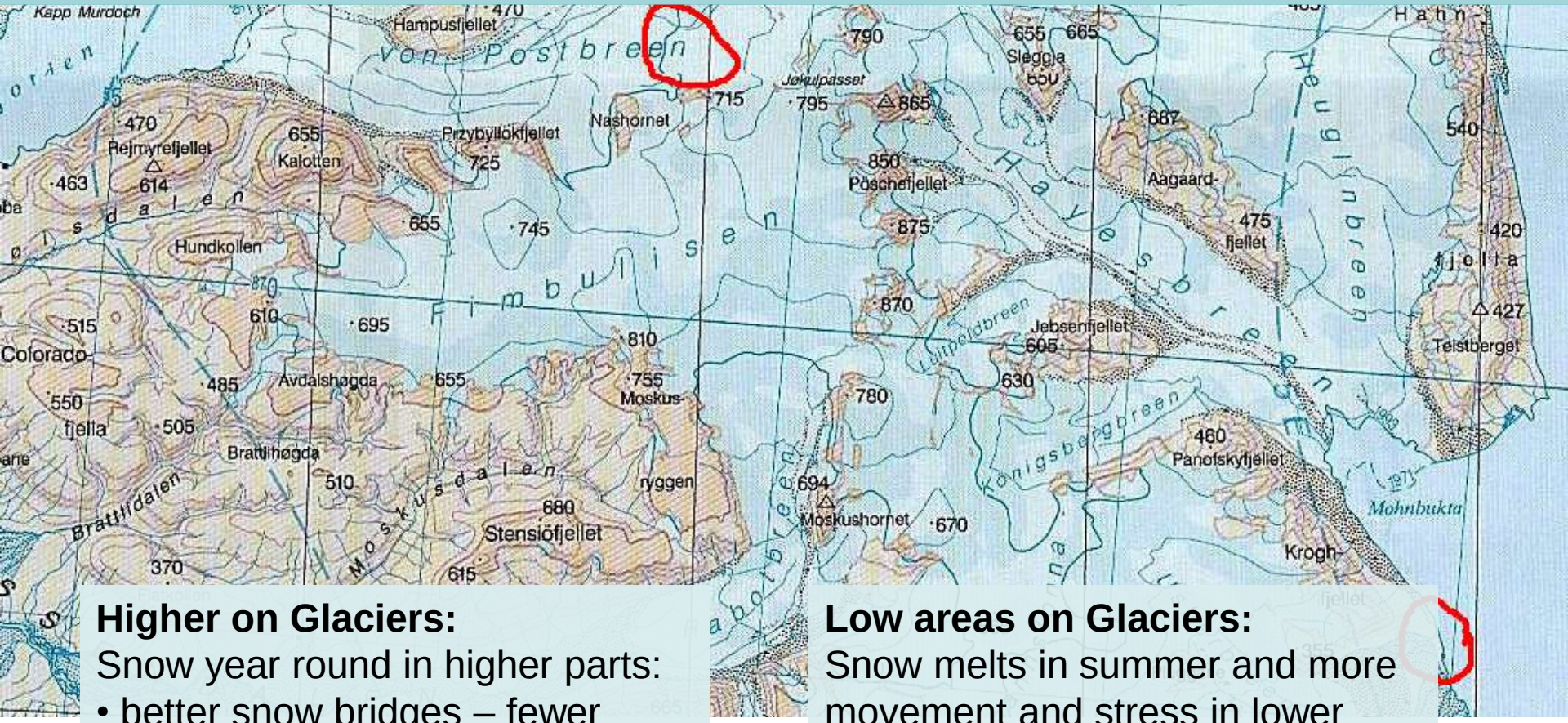
→ navigation problems

→ higher risk to end up in risky terrain

→ Get stuck in storm

• Accumulation of huge amount of snow in a snowstorm – problems with tent camp + moving further

Glacier risks: high versus low terrain



Higher on Glaciers:

Snow year round in higher parts:

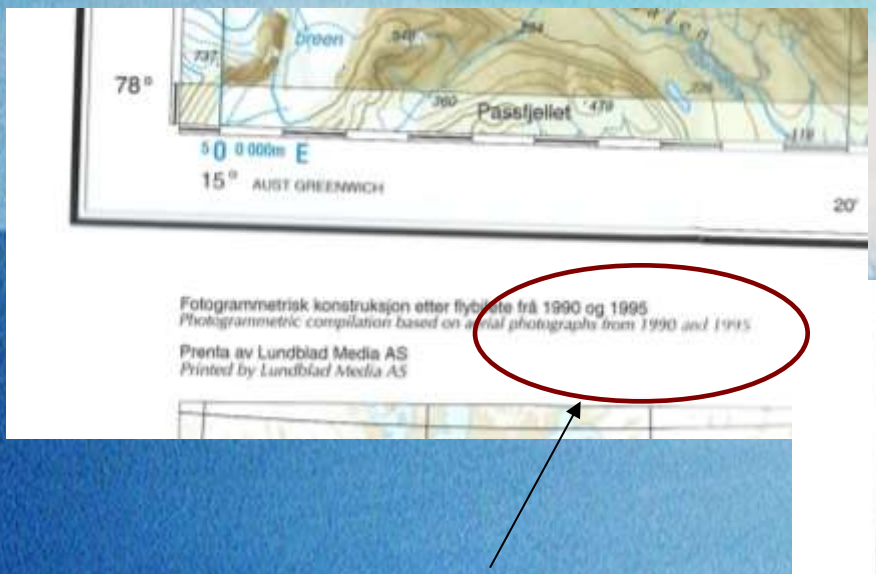
- better snow bridges – fewer open crevasses
- less melting → less melt water channels
- little change between years
- higher risk for bad weather and whiteout

Low areas on Glaciers:

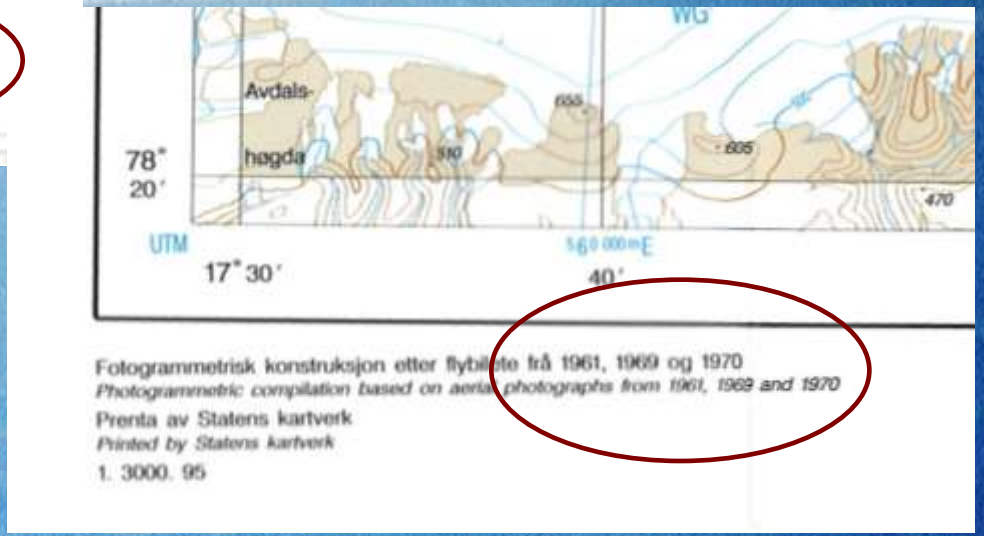
Snow melts in summer and more movement and stress in lower parts:

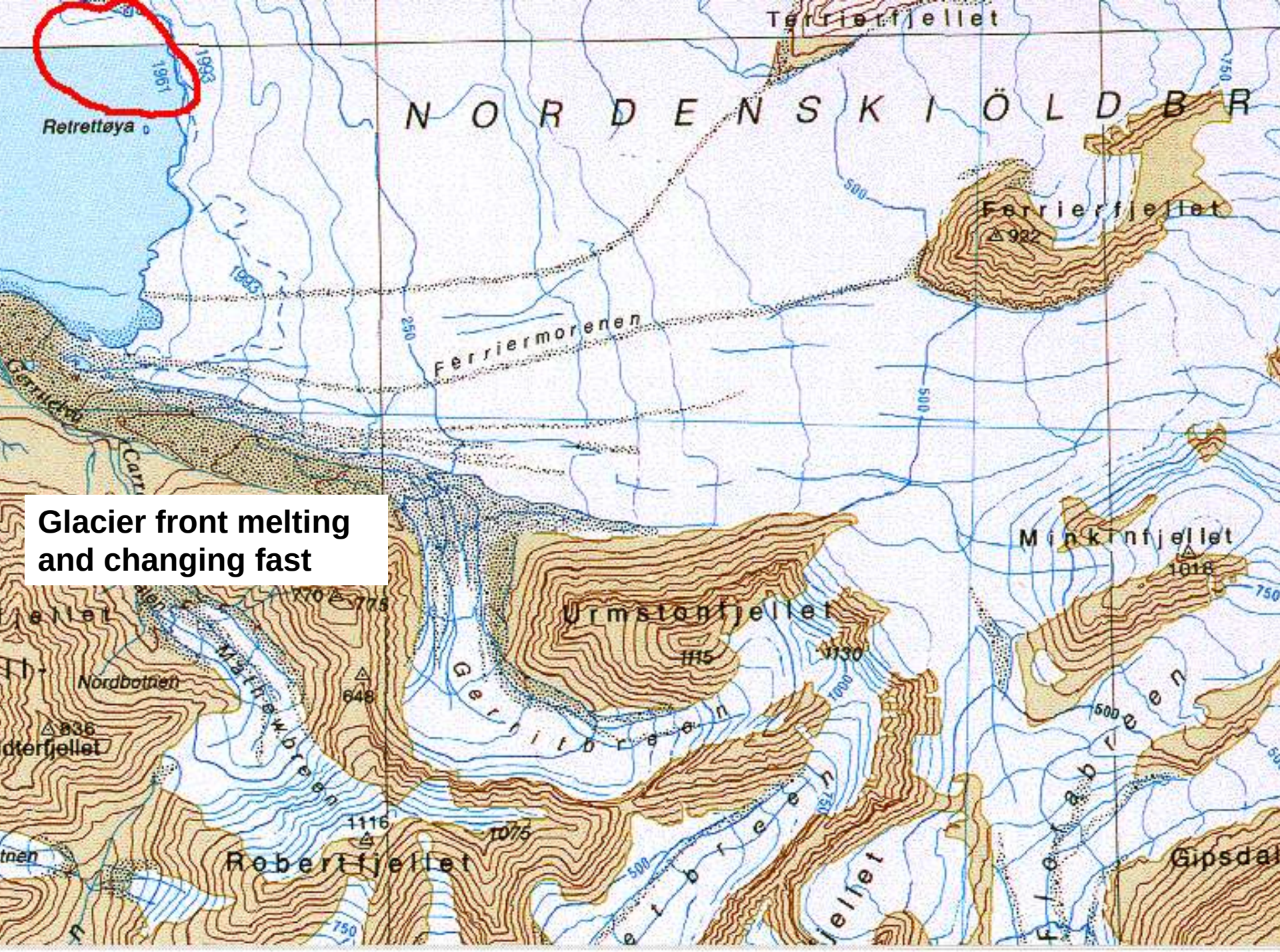
- more open crevasses, takes more time to build up snow bridges
- more change between years
- melt water channels and Moulins

Svalbard maps are partly based on old aerial photos – the glaciers could have changed a lot during this time (especially surges) !



Choose latest map updates when buying maps and checking terrain to find routes on glaciers.





Glacier front melting and changing fast

Nordenskiöldbreen in Billefjorden

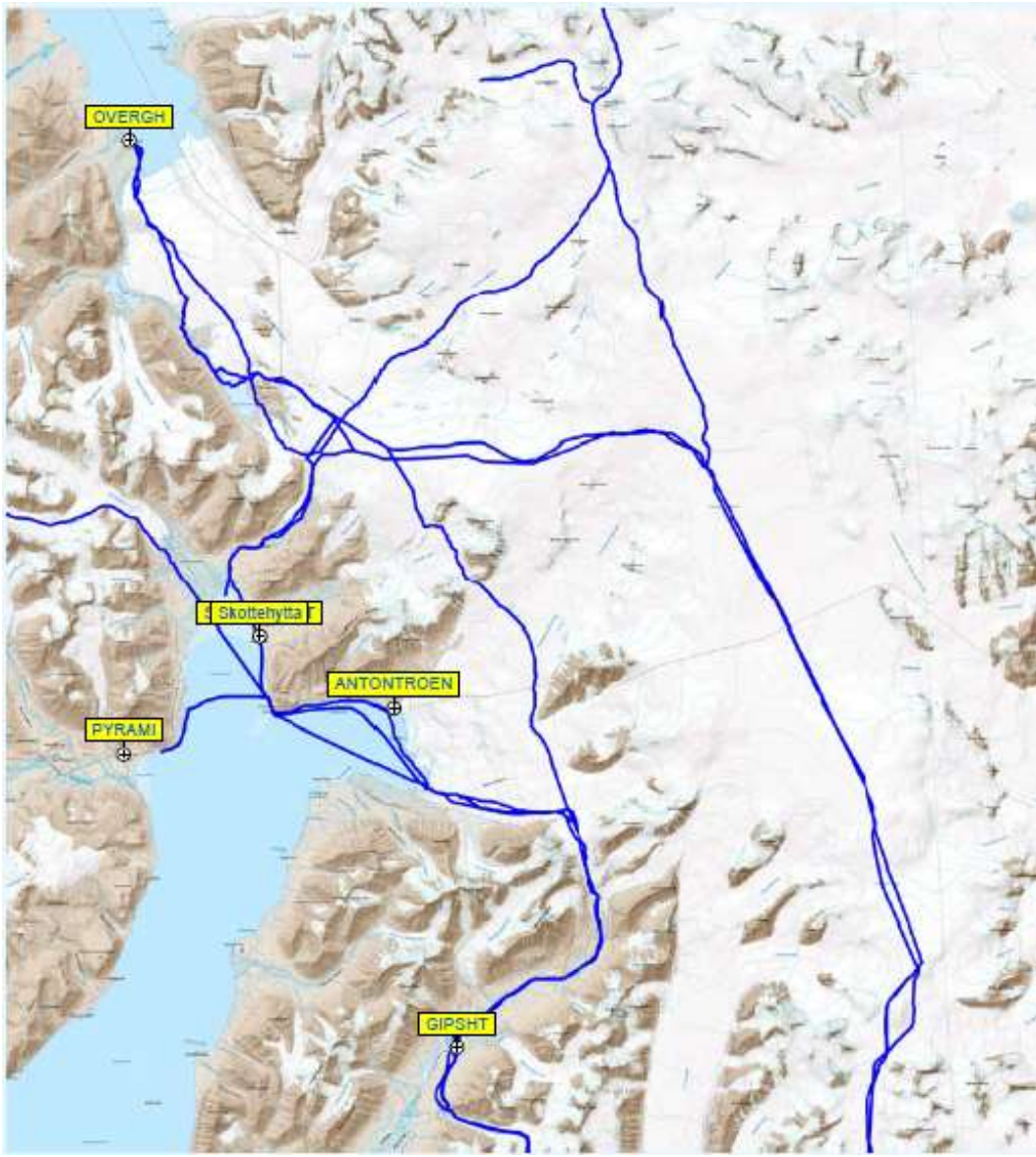
Photo: K. Bælum

Safe travel on glaciers

Glacier safety measures

Safe travel on glaciers

- **Follow known routes and GPS tracks on well known glaciers**
  - Ask experienced people
  - Map studies
- **Avoid always terrain close to glacier fronts**
- **Avoid places where glacier terrain/contours change considerably**
- **Follow flattest and smoothest parts of terrain**
- **If unsure – avoid**
- **Bring safety gear**
- **Check the weather and keep an eye on it → turn back in time if needed**

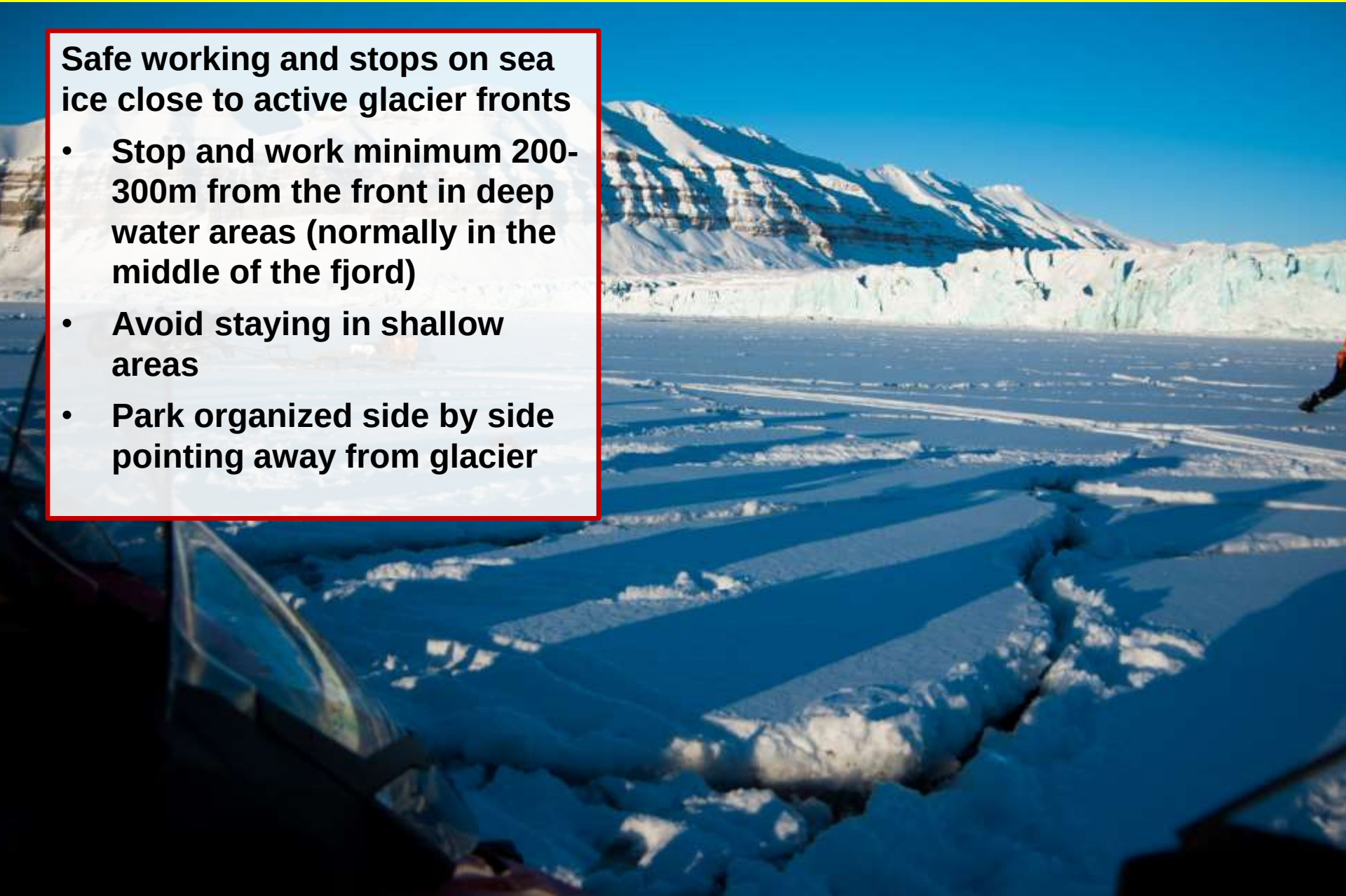


Glacier safety measures

Safe travel on glaciers

- **Stop before you move up to glaciers:**
  - **Check weather**
  - **Brief the group**
  - **Make a plan and make decision**
- **Keep the speed, drive organized, watch around, stay on GPS track**
- **No stopping in uncertain areas**
- **If stopping in uncertain area – stay on your scooter/sledge – probe the area to test it's safe before you walk around. Stay in line with some distance.**
- **Do not head up to glaciers in bad weather**– zero visibility, exposed → easy to get lost and drive into dangerous areas
- Bring glacier rescue gear kit – have it further back in the group

Glacier front safety measures



Safe working and stops on sea ice close to active glacier fronts

- **Stop and work minimum 200-300m from the front in deep water areas (normally in the middle of the fjord)**
- **Avoid staying in shallow areas**
- **Park organized side by side pointing away from glacier**

Crevasse accident safety

Stay on your scooters and in the sledges!

1.Stop, Think, Evaluate

2.Use emergency beacon - Call for help – early warning

3.Your safety – rest of the groups safety → move to safe area

- **Use probe** to test that there are no crevasses before you start walking around

4.Organize the group

- Safe area, rescuers, back up helpers (tent, first aid etc.)

Your own safety first!

Crevasse accident safety

5. **Try to get into contact with the fallen person if you can**
   - Build an anchor
   - Use harness & rope for safety
   - Use probe to test there are no crevasses while moving

6. **Call in update to search and rescue**

7. **Crevasse rescue ONLY if you can** – keep it safe and simple!
   - As few persons as possible

Your own safety first!

Remember your own safety first!

Start rope rescue ONLY if you feel 100% SAFE and SURE about what you are doing