



Monitoring Climate-Change Effects on the Barton Peninsula, King George Island, Antarctica: Evidence of Accelerated Active Layer Thickening

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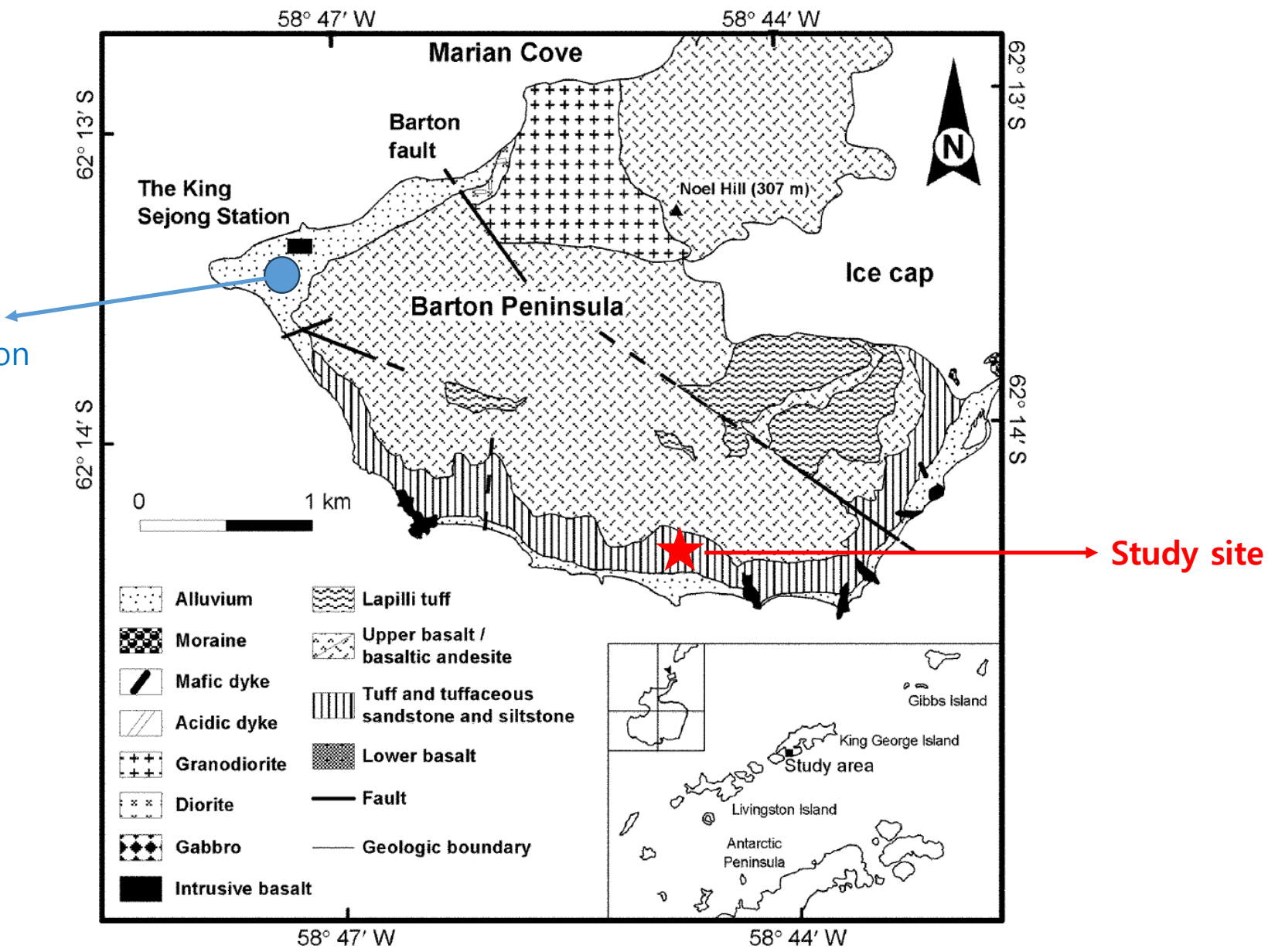
- 1) Korea Polar Research Institute
- 2) Chungbuk National University, South Korea

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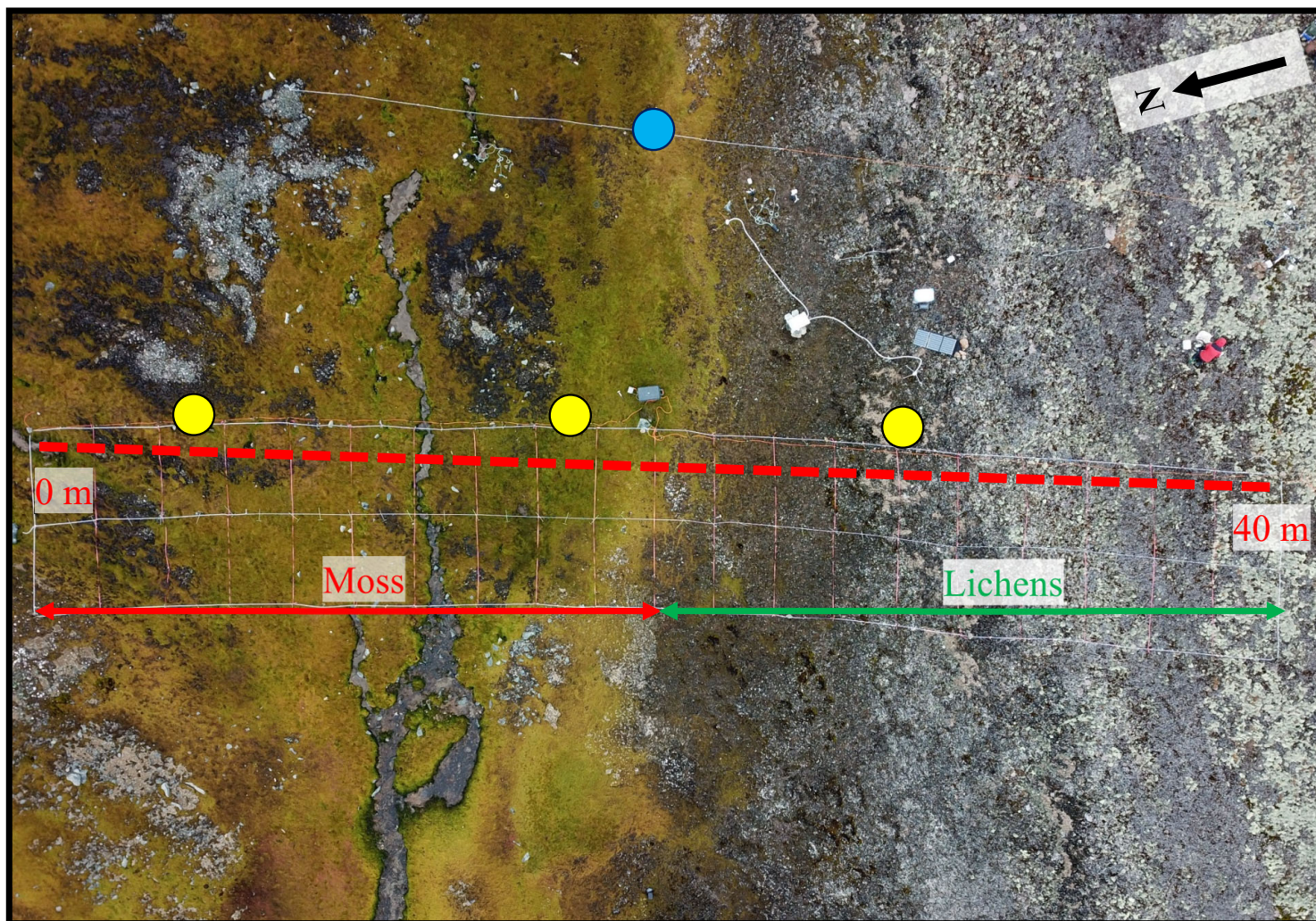
1. Study area
2. Snow drift
3. Meteorological data and soil temperature
4. Satellite data
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Geological map

Automatic weather station (AWS)



Study site

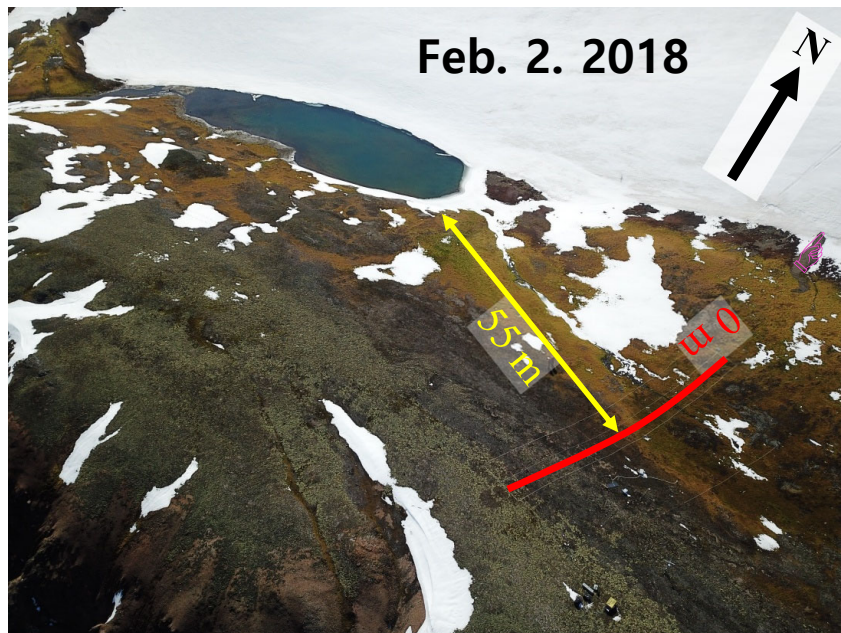


● : Soil temperature sensor

----- : Geophysical survey line

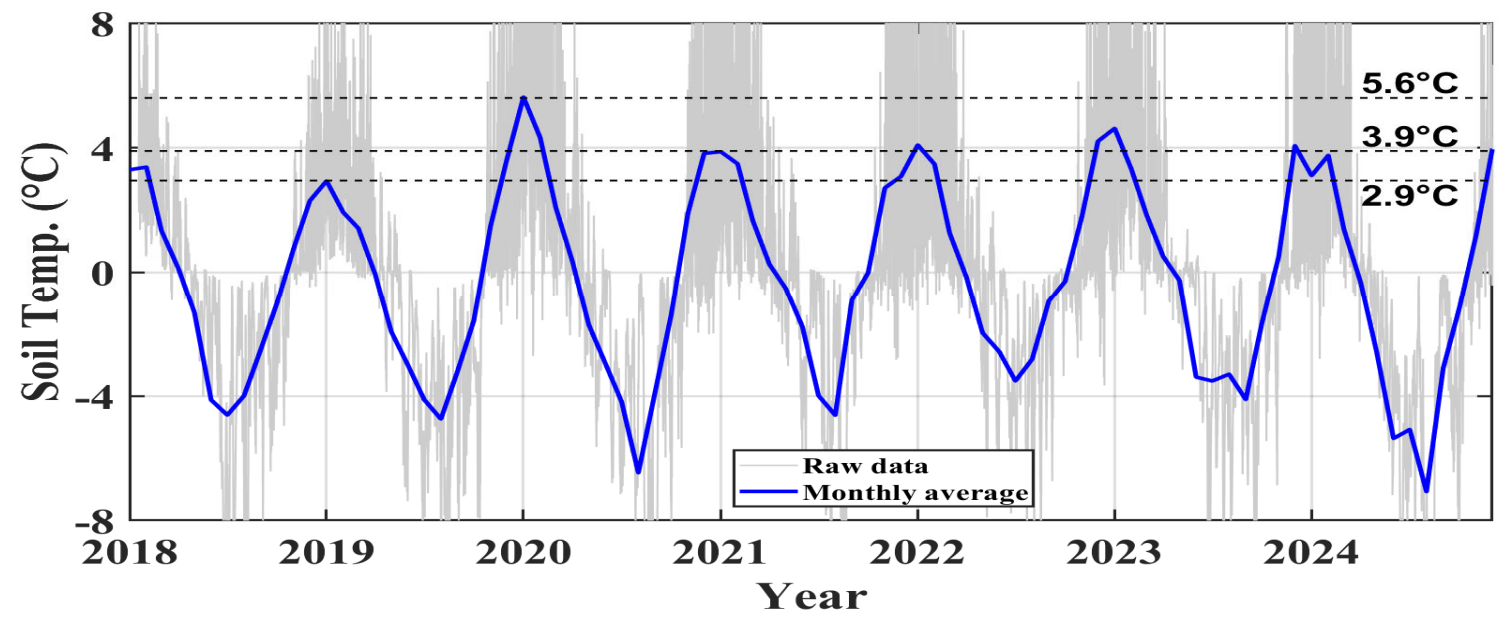
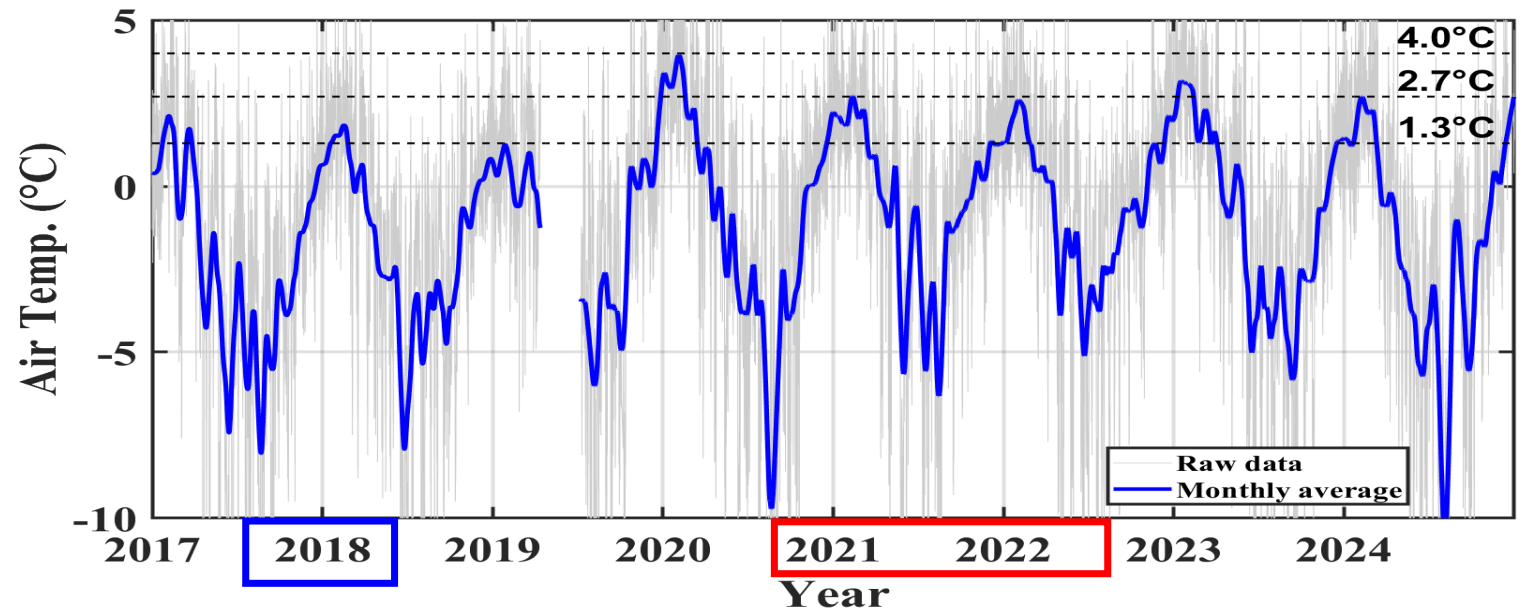
● : Digging point

Snow drift



Temperature data

YEAR	T(°C)
2018 :	-1.80
	↓
2019 :	(-1.36)
	↓
2020 :	-1.19
	↓
2021 :	-0.59
	↓
2022 :	-0.62
	↓
2023 :	-0.93



Temperature data (in summer season)

(15 Oct. ~ 15 Apr.) Days (0°C ↑)

2018-2019: **102**



2019-2020: **138**



2020-2021: **139**



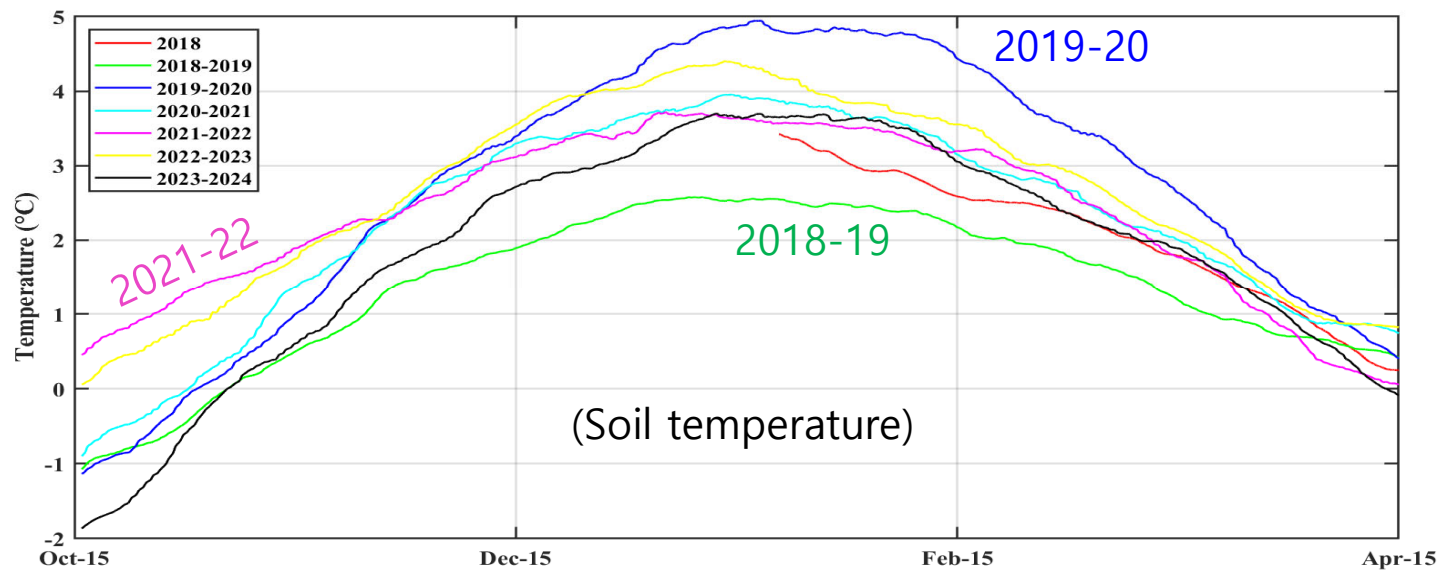
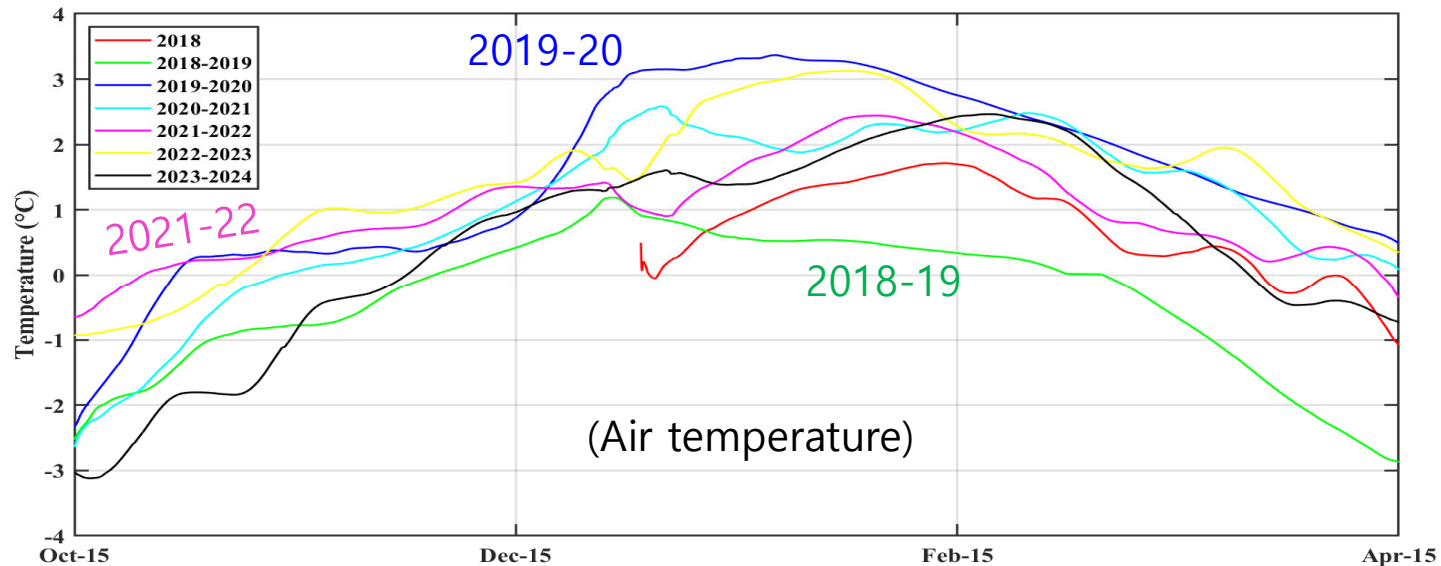
2021-2022: **151**



2022-2023: **150**



2023-2024: **129**



PERMAFROST

Why is the permafrost so important?

Long period of frozen soil inhibits carbon decomposition



Accumulation of over 1000 Pg C of soil organic carbon

Global warming



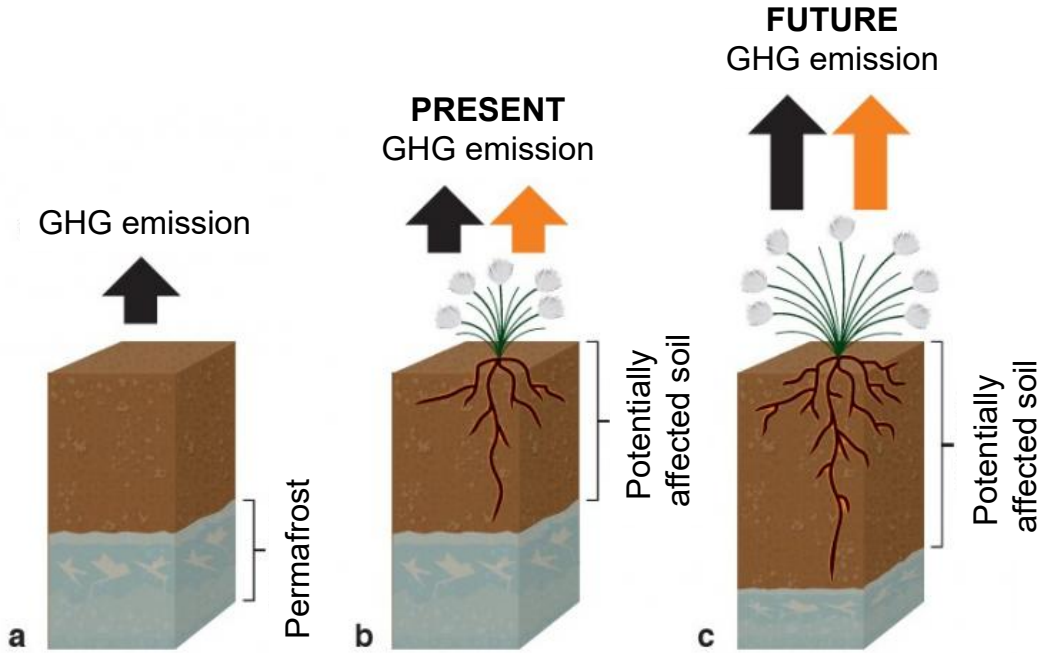
Climate change



Thawing



Emitting carbon

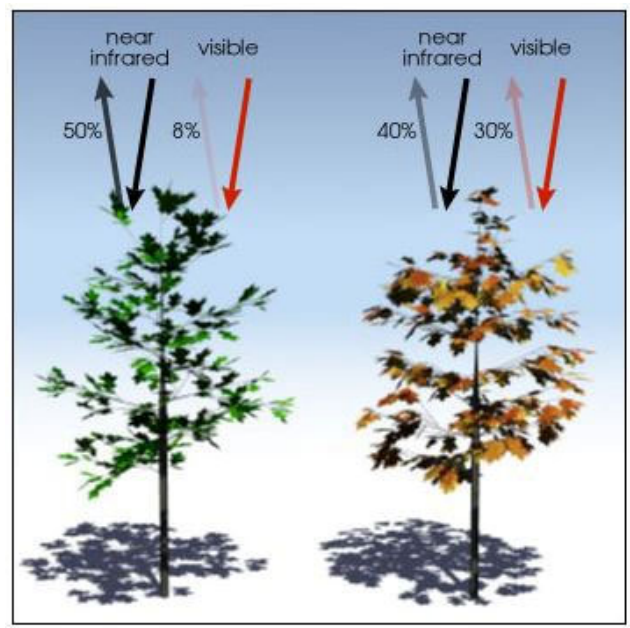


- (a) Greenhouse gas emission (GHG) from permafrost soil.
- (b) GHG emission from permafrost soil under present conditions.
- (c) Future scenario considering climate warming; faster growing plants; deeper thaw of the permafrost surface in summer; deeper rooting depth.

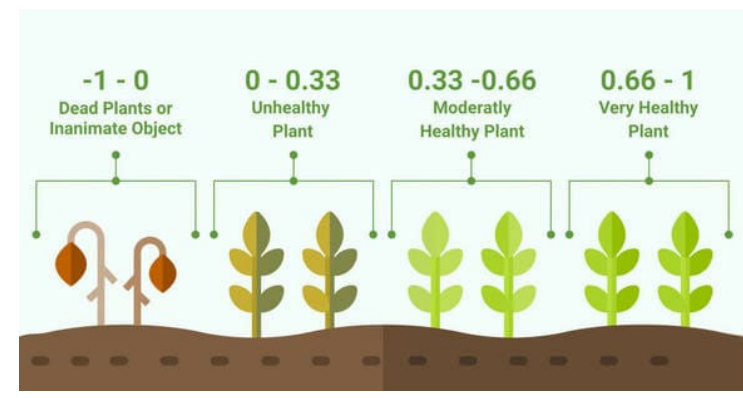
NDVI (Normalized Different Vegetation Index)

$$\ast NDVI = \frac{NIR - RED}{NIR + RED} \quad (\text{Range: } -1 \sim 1)$$

- NIR(Near Infrared): dominant wave band is $0.86 \mu m$
- RED(Red Light): dominant wave band is $0.66 \mu m$



Healthy Plant Unhealthy Plant

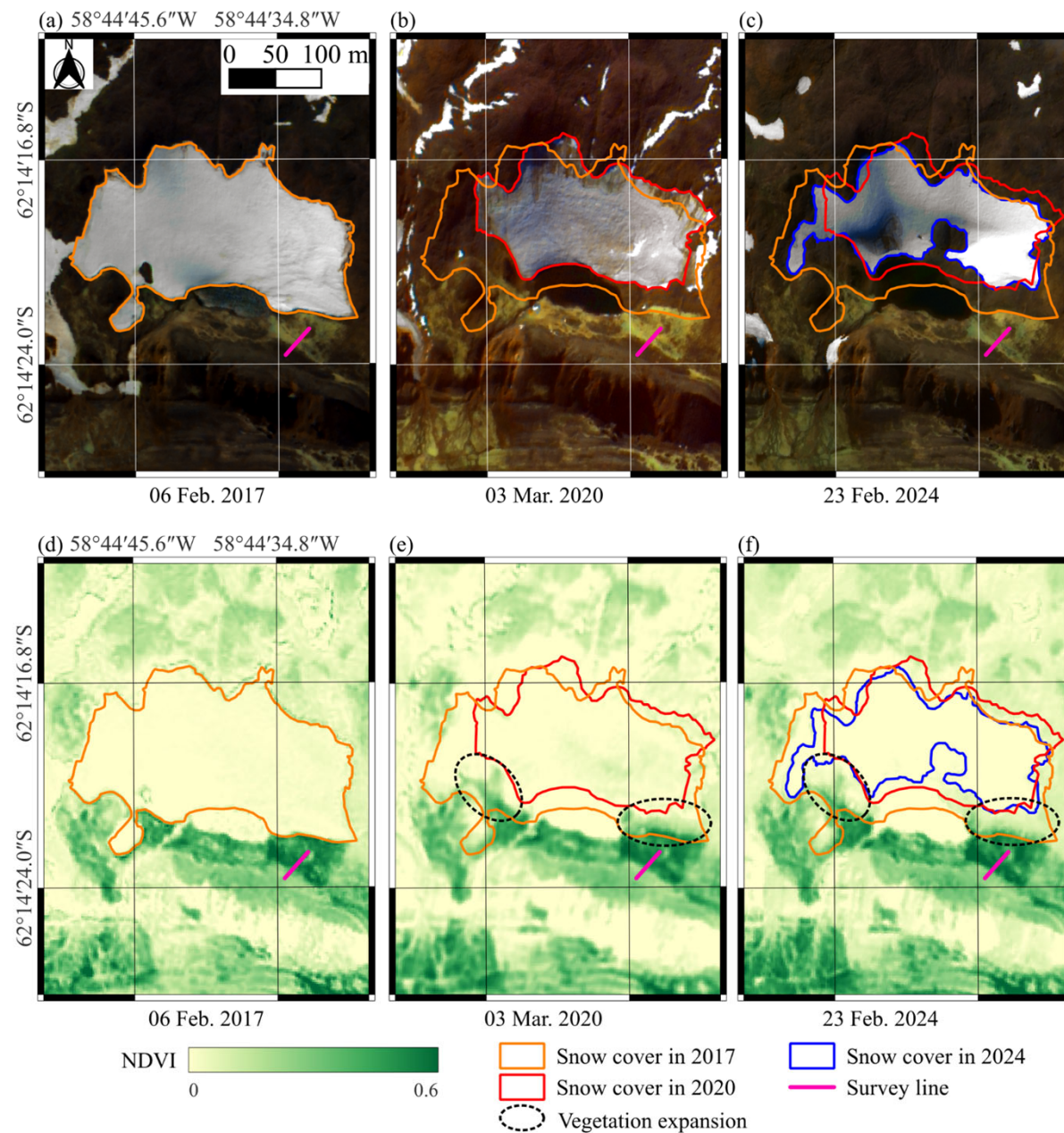


Satellite data

KOMPSAT-3A (Korea Multipurpose Satellite-3A)

– launched on Mar. 2015

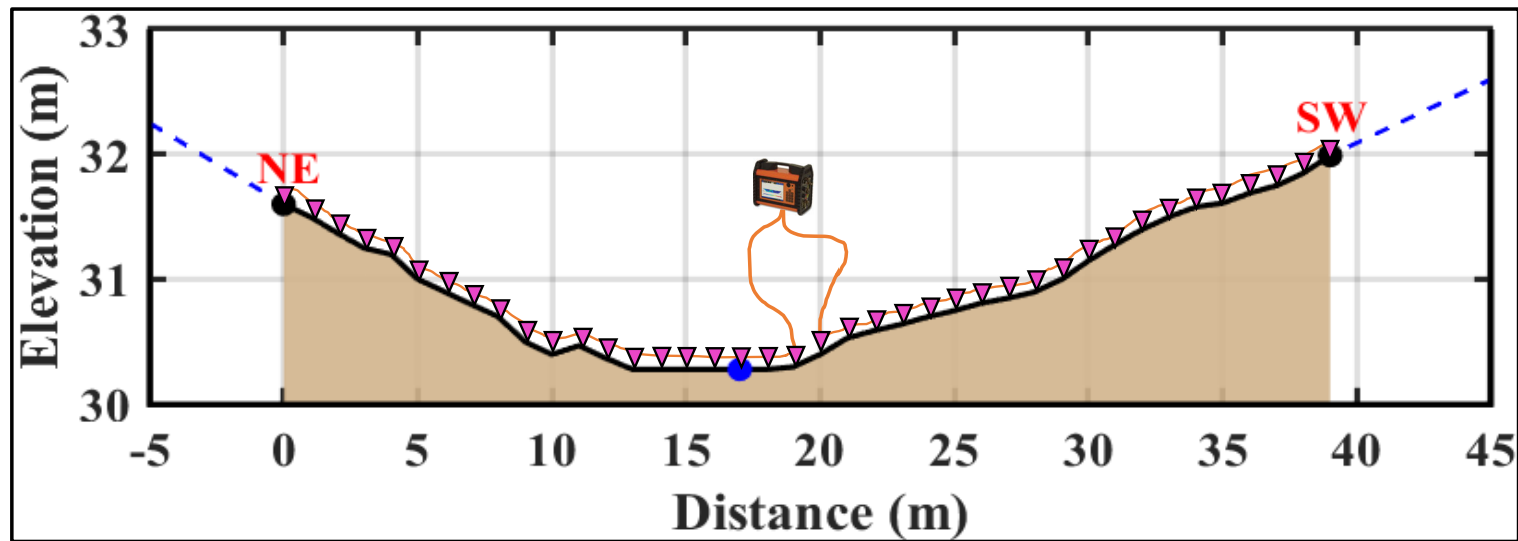
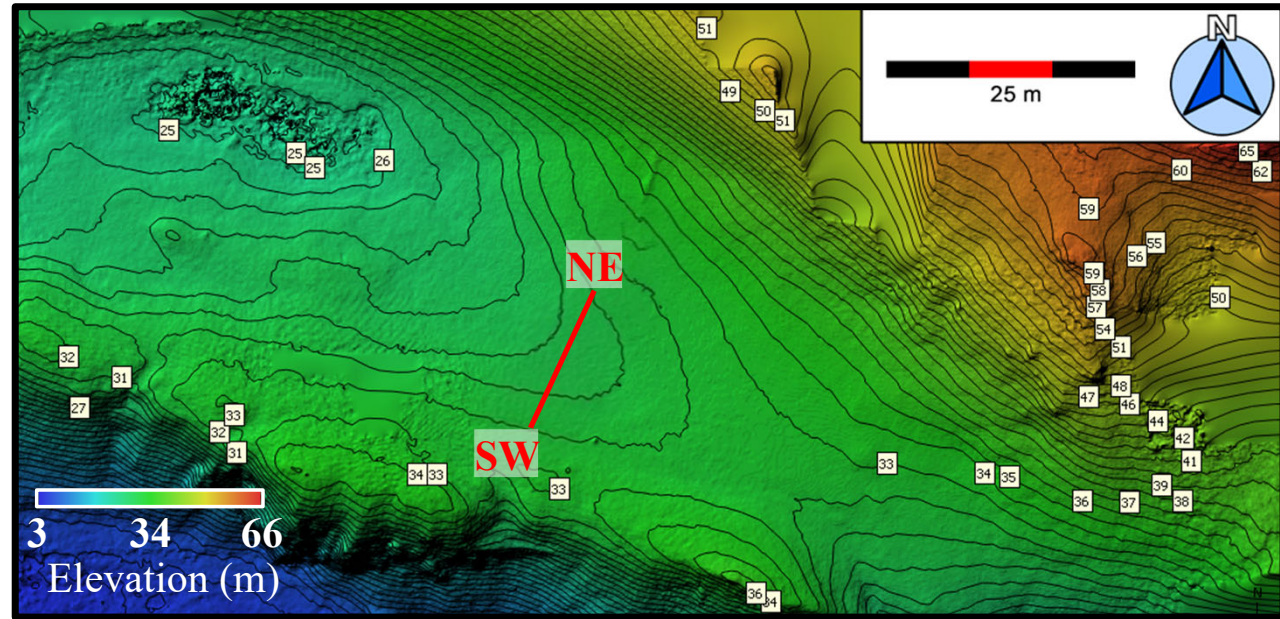
- Spatial resolution: 0.55 m



DEM(Digital elevation model) data



(processing)
→



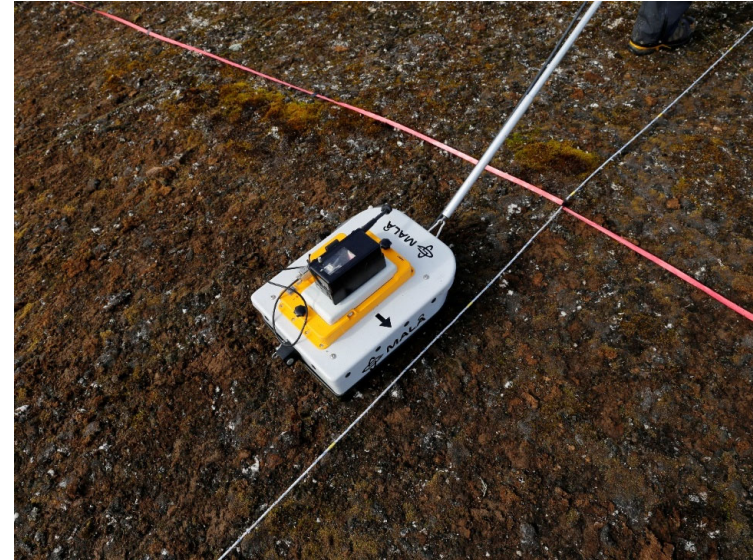
Geophysical survey

<Electrical Resistivity Tomography (ERT)>



System: ABEM, IRIS Co.
Electrodes: **40 channels**
Spacing: **1 m**
Array: **Wenner**
Measuring Depth: **5 m**
Program: Res2Dinv.

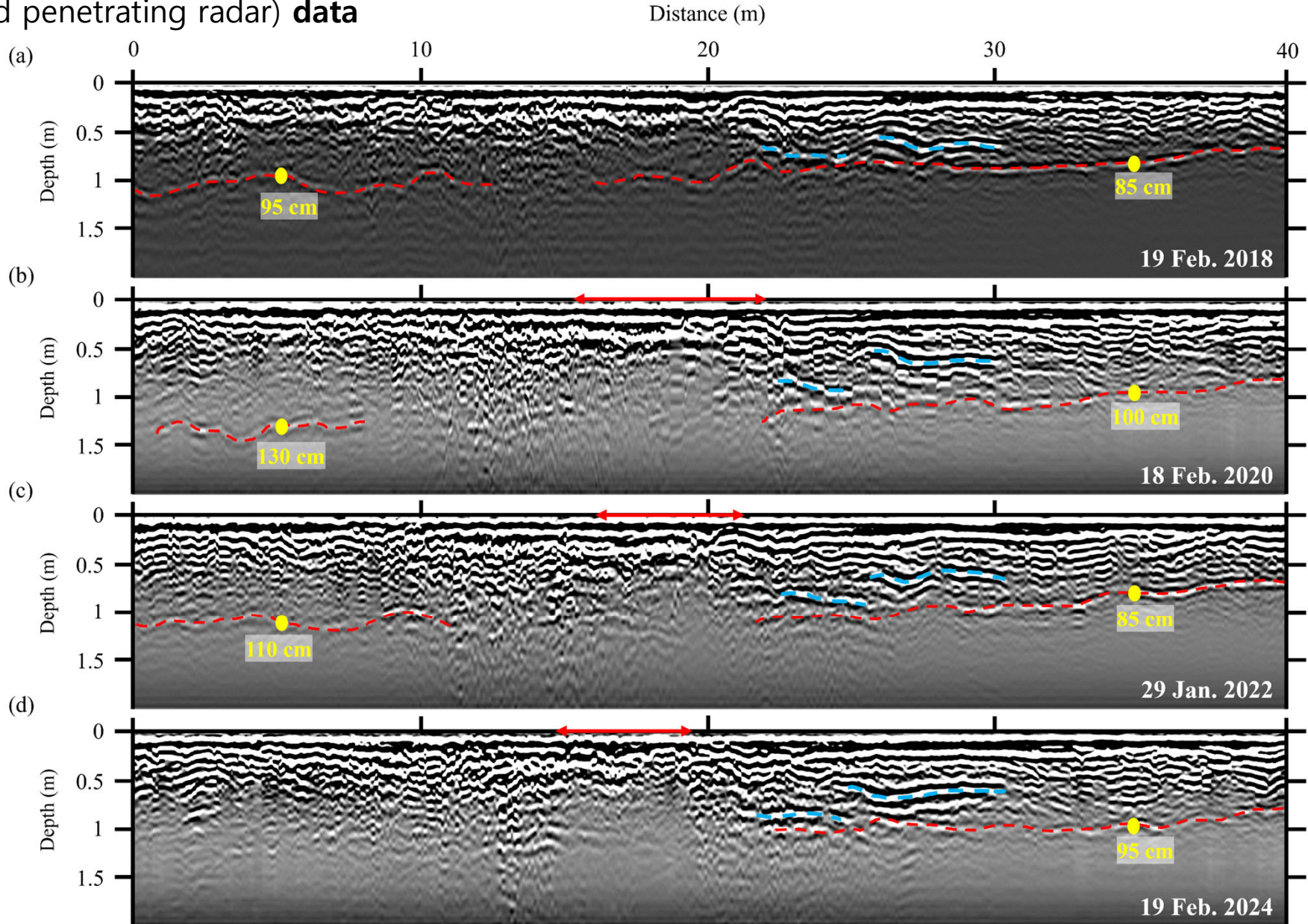
<Ground Penetrating Radar (GPR)>



System: MALA ProEX
Frequency: **500 MHz**
Mode: **Step**
Interval: **0.1 m**
Measuring Depth: **2 m**
Program: Reflexw

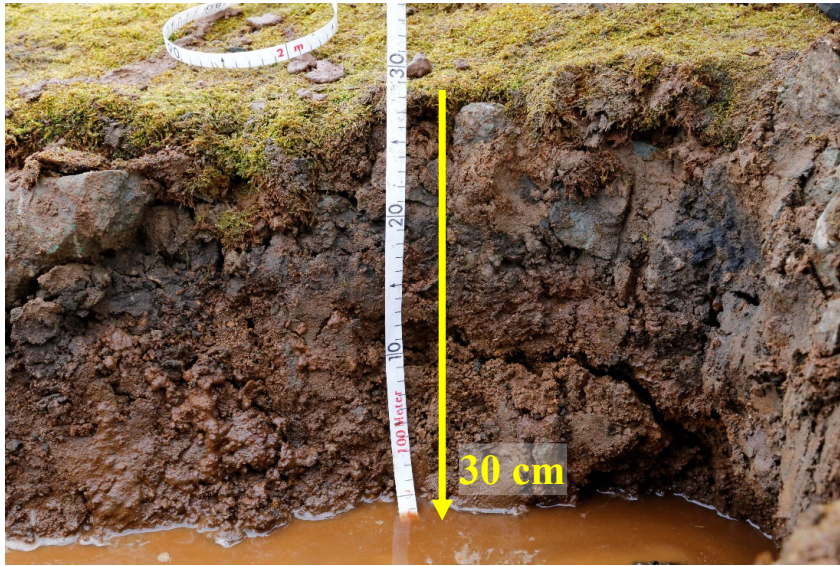
Date: Summer season in 2018, 2020, 2022 and 2024

GPR (Ground penetrating radar) data



Digging

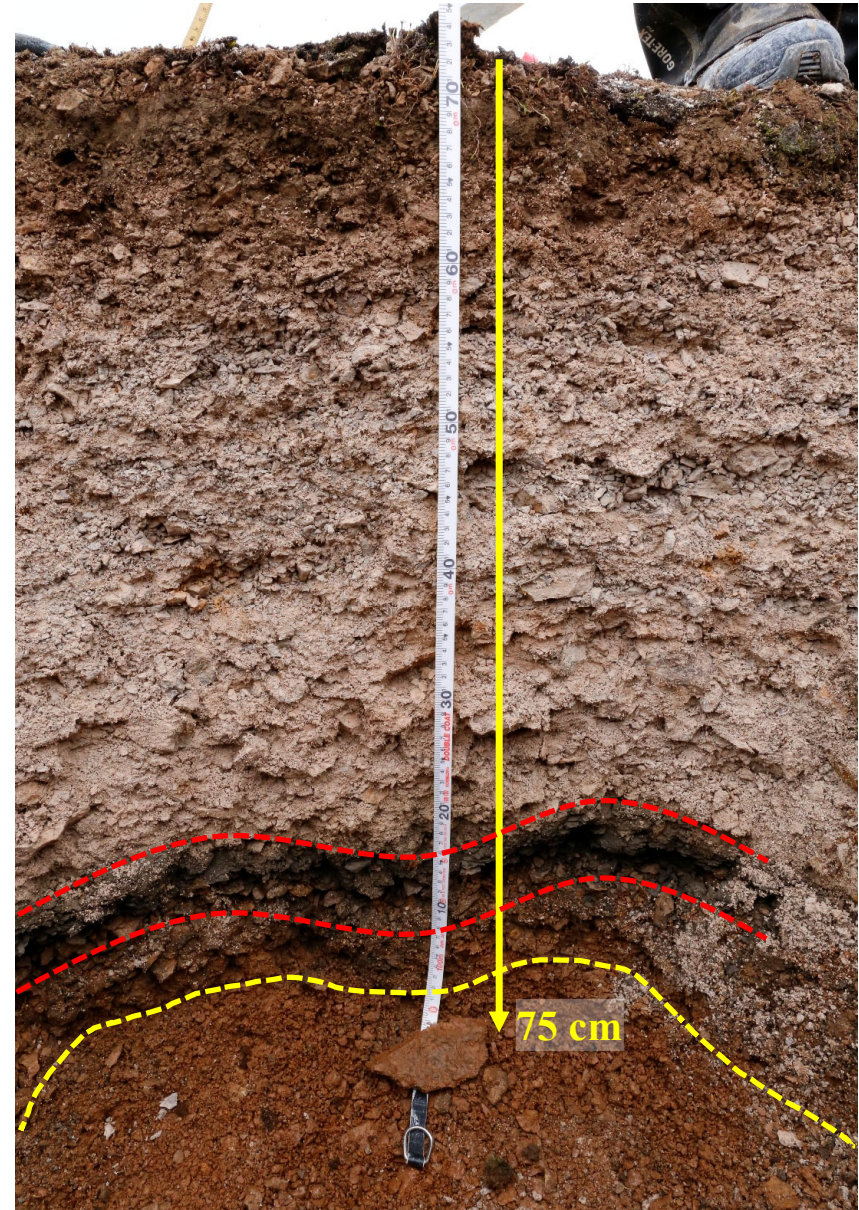
At 5 m



At 17 m

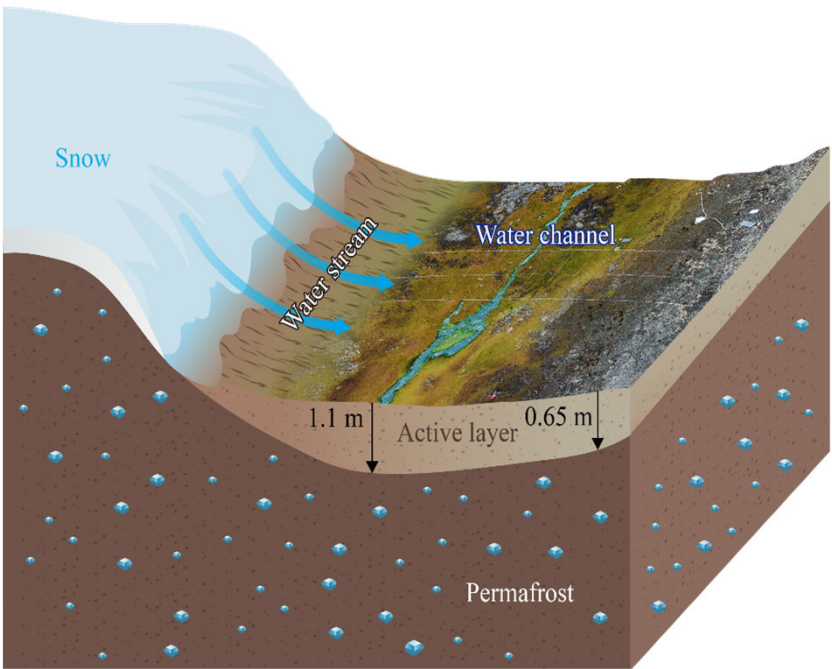


At 28 m



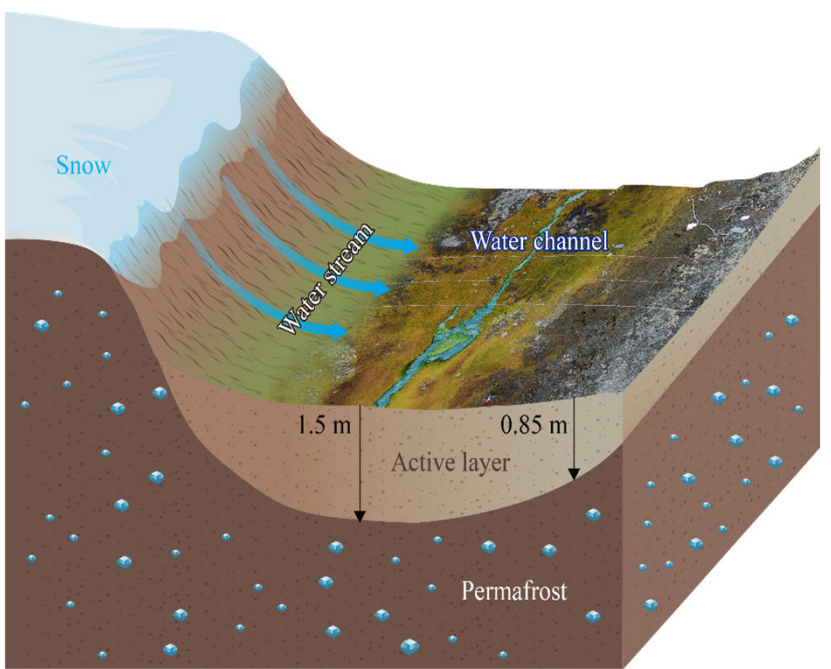
Summary and Conclusions

Annual average air temperature: -1.8°C
Active layer thickness: $0.65\sim 1.1\text{ m}$

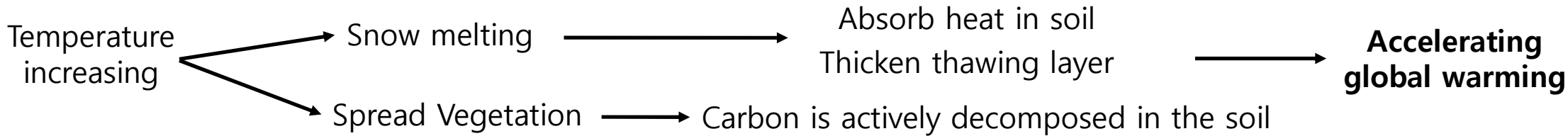


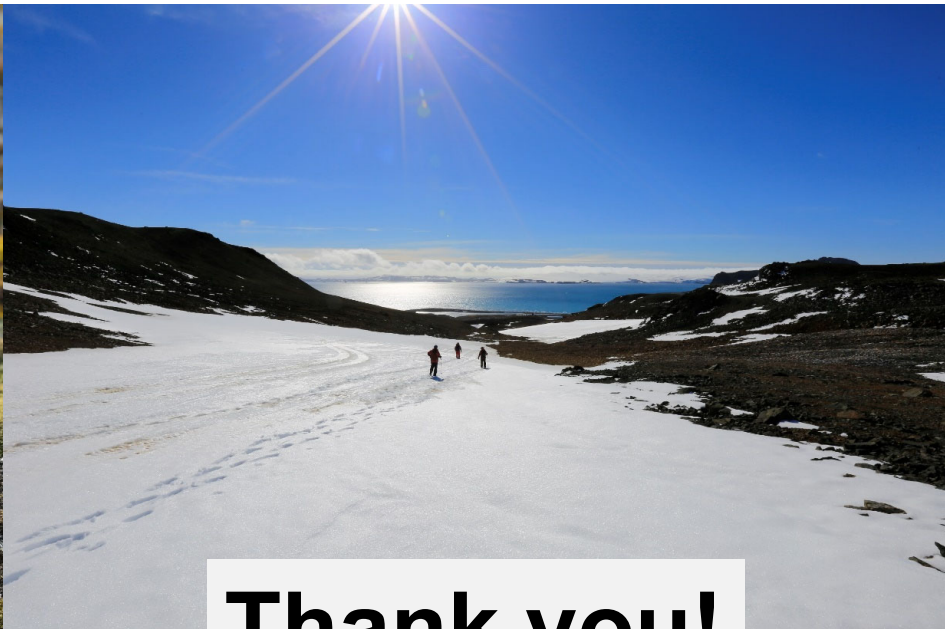
2018 summer

Annual average air temperature: -0.93°C
Active layer thickness: $0.85\sim 1.5\text{ m}$



2024 summer





Thank you!

