

Small-loop surface NMR and high resolution ERT soil evolution monitoring at the Midtre Lovénbreen glacial forefield in Ny-Ålesund, Svalbard

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Sensors UNder snow Seasonal Processes in the evolution of ARctic Soils (SUN-SPEARS)

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NATURAL ENVIRONMENT RESEARCH COUNCIL



Organisations

MontanaTech



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Svalbard, Arctic Circle

Research questions

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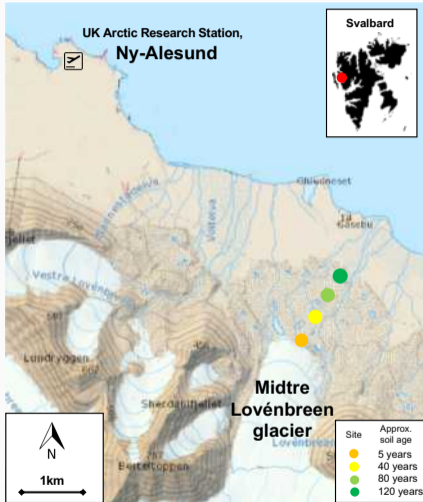


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- What is the net carbon balance during this transition?
- Can geophysical methods monitor winter soil evolution processes in the Arctic?



Field site



Ny-Ålesund, Svalbard ($78^{\circ} 56'N$, $11^{\circ}56'E$)

- Chronosequence, trade space for time

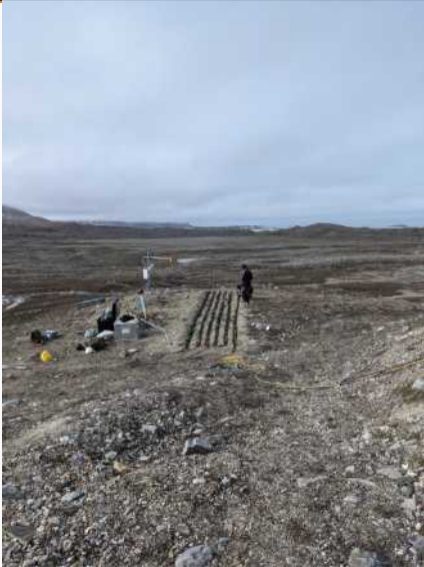
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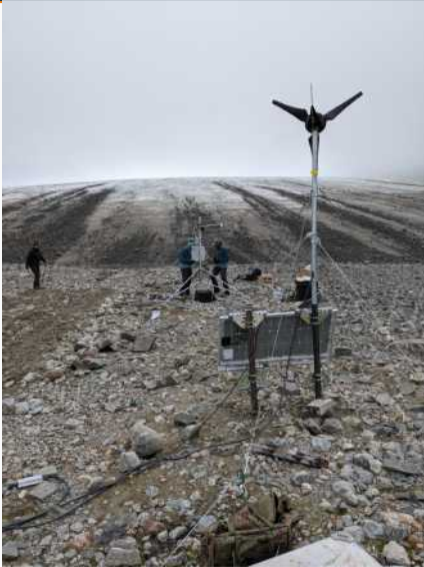
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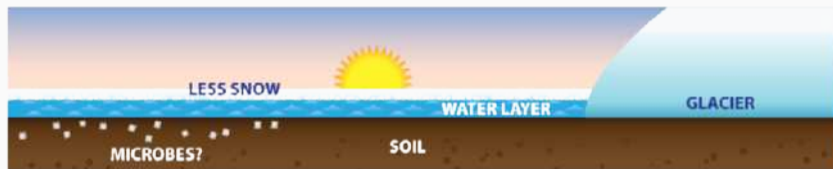
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- NMR water content (MRS MIDI2, calibration)
- Radio silent area, no data streaming

Chronosequence

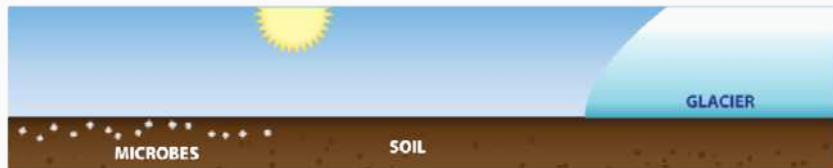
Winter



Spring



Summer



Current status

PRIME Systems

- 2 PRIME ERT systems installed in July
- 6 lines of 37 electrodes at 30 cm spacing $\approx 10 \times 1.5$ m area
- Preliminary data pulled in July
- Crew is currently in the field checking on system

Biological sampling

- Biological DNA/mRNA sampling along sequence in July ≈ 40 samples
- Soil samples also collected

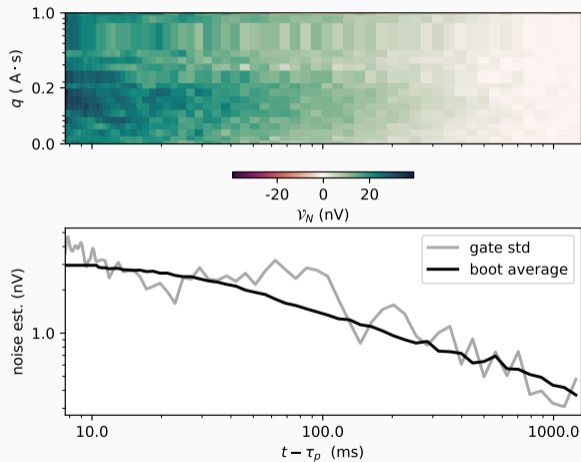
NMR data

- MRS-MIDI 2 (10 m square loops) surface NMR soundings collected in July
- Vista Clara Dart collection planned for next year, but drilling difficult

Site 1, Glacier snout

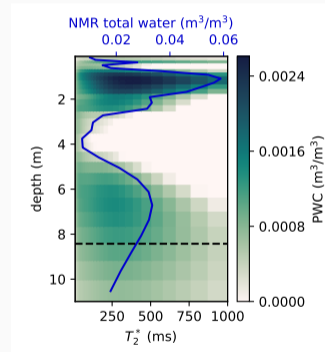


Site 1 NMR



- 64 stacks
- FID pulse sequence
- low noise level ≈ 3 nT
- 10 m square loop
- coincident 1-turn Tx and 12-turn Rx

Site 1 Inversion



Res3DInv

Akvo

Site 1

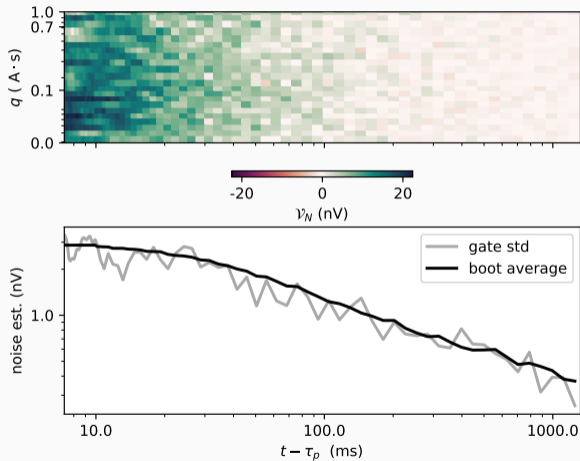


- Water level at 0.6 m consistent with augur
- fine silt sediment encountered down to 0.6 m
- some ice in augur hole
- ERT shows somewhat more resistive layer at 2 m consistent with less water

Site 2



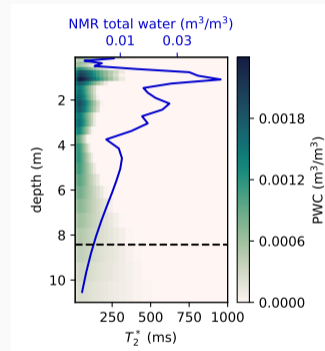
Site 2 NMR



- 64 stacks
- FID pulse sequence
- low noise level ≈ 3 nT
- less NMR signal, faster decays
- 10 m square loop
- coincident 1-turn Tx and 12-turn Rx

Site 2 inversion

Res3DInv



Akvo

Site 2



- Many large cobbles encountered at 0.5 m
- much drier holes
- ERT shows somewhat more resistive layer at 2 m consistent with less water

Conclusions and future work

1. Preliminary findings are encouraging
2. NMR provides useful interpretation aid for ERT monitoring
3. Resolution difference between methods a challenge, may try even smaller (prepolarized?)
NMR loops

Questions, comments, suggestions?



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