Multi-polarization Ground-penetrating Radar: SnowEx 2020 Grand Mesa IOP
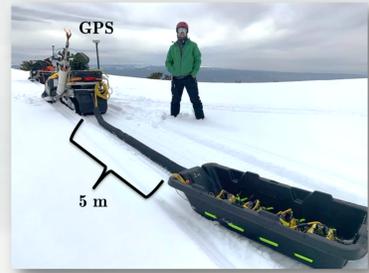
Tate G. Meehan

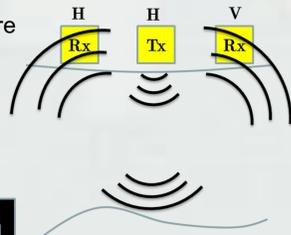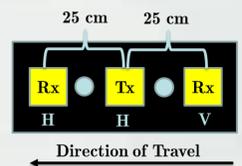## Multi-Polarization Ground-Penetrating Radar (GPR)

GPS

5 m

Multi-Polarization GPR Array

▶ Sensors & Software
  • 1 GHz (L-band)
▶ 2 polarizations
  • HH (co-polar)
  • HV (cross-polar)

H   H   V
Rx   Tx   Rx

25 cm   25 cm

Rx   Tx   Rx
H   H   V

Direction of Travel

Summary

- Multi-polarization Coherence Provides Automatic TWT Picks
- Significantly Reduces the Bottle Neck of GPR Processing
- Provides Quick SWE product with Density Information
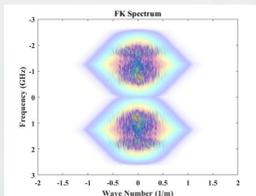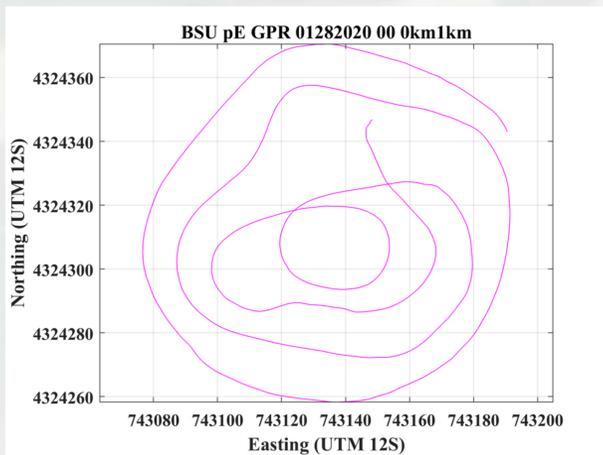- Data can be found at NSIDC (soon!)

Data Processing

- Georeferencing
- F-K Filter
  ▶ Frequency – Wavenumber
- Time-Zero Correction
- Coherent Noise Removal
- Kuwahara Filter
  ▶ Edge Preserving Smoothing
- Coherence
- TWT Picks

$$C = \frac{1}{2} \sum_t \left\{ \left[\sum_{t=1}^{M} f_{t,t(i)} \right]^2 - \sum_{t=1}^{M} f_{t,t(t)}^2 \right\}$$
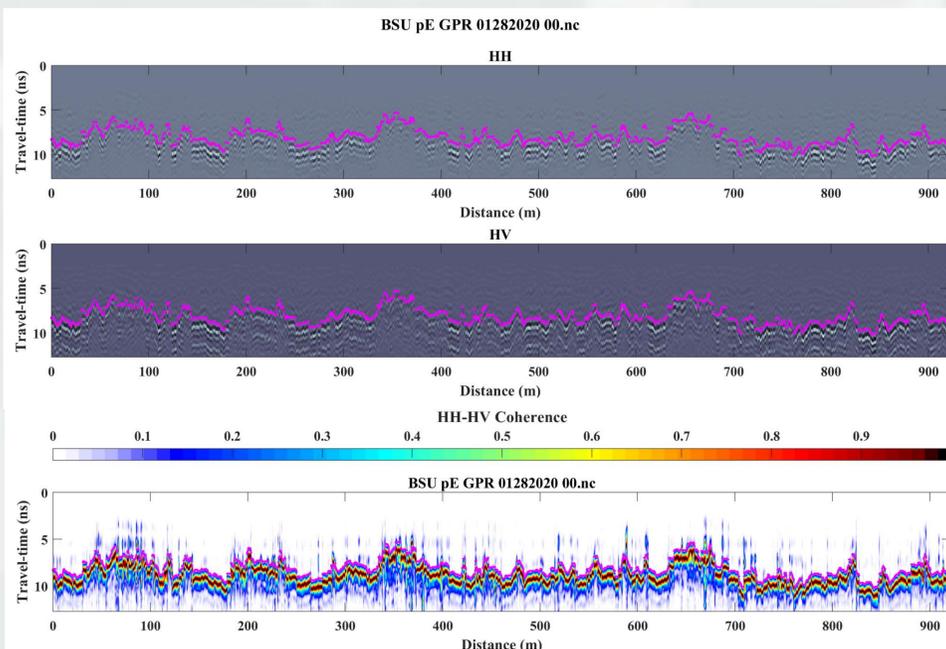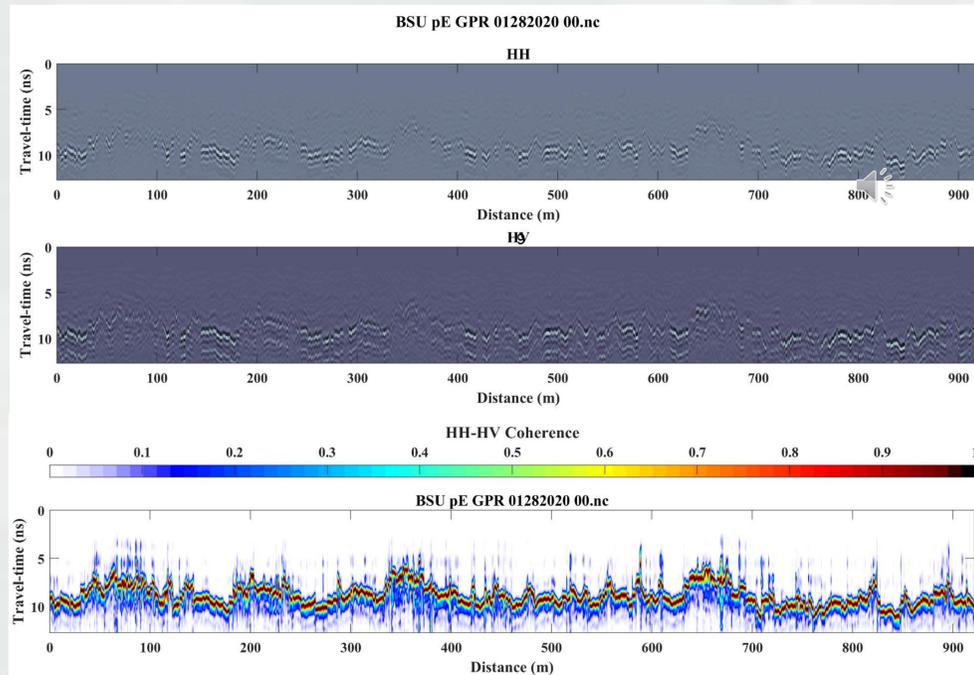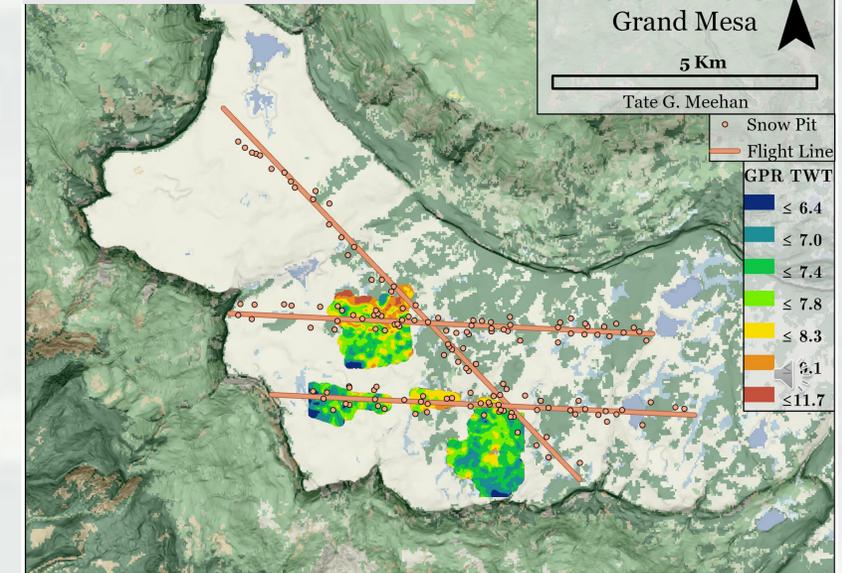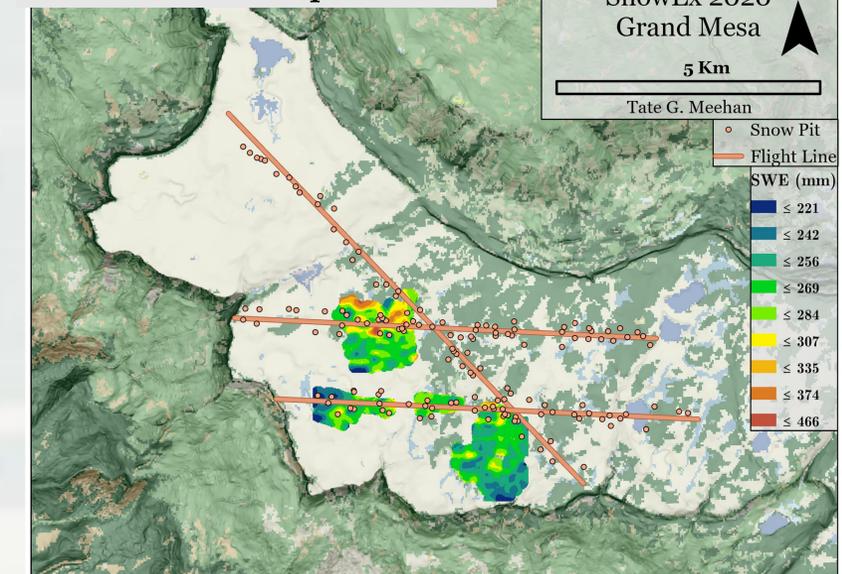

FK Spectrum

Original   Kuwahara 7x7

https://imagej.nih.gov/ij/plugins/kuwahara.html

Pit 6N18 Hiemstra Spiral

BSU pE GPR 01282020 00 0km1km

Two-Way Travel Time

SnowEx 2020 Grand Mesa
N
5 Km
Tate G. Meehan

○ Snow Pit
— Flight Line
GPR TWT
≤ 6.4
≤ 7.0
≤ 7.4
≤ 7.8
≤ 8.3
≤ 9.1
≤11.7

Snow Water Equivalent

SnowEx 2020 Grand Mesa
N
5 Km
Tate G. Meehan

○ Snow Pit
— Flight Line
SWE (mm)
≤ 221
≤ 242
≤ 256
≤ 269
≤ 284
≤ 307
≤ 335
≤ 374
≤ 466

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