

# Radio Frequency Polar Ice Properties and Attenuation

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# Friis Transmission Equation

$$\frac{P_r}{P_t} = G_r G_t \left( \frac{\lambda}{4\pi R} \right)^2 (1 - |\Gamma_r|^2)(1 - |\Gamma_t|^2) |a_r \cdot a_t^*|^2 e^{-\alpha R}$$

P:Power

G:Gain

$\lambda$ : Wavelength

R:Distance

$\Gamma$ :Reflection Coefficient

a:Polarization Vector

$\alpha$ :Absorption Coefficient

# Cresis Data

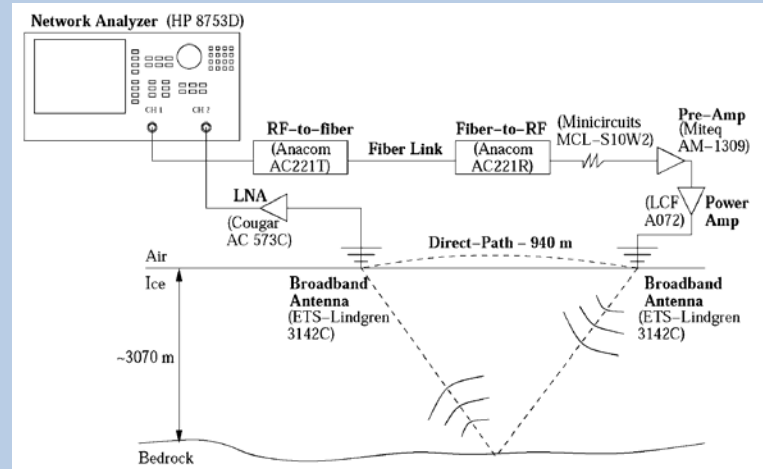
- Purpose: Use radio sounding techniques to determine ice sheet condition and their relation to rising sea levels.

## Locations:

- Greenland 1993-present
- Antarctica 2002/4/6
- Arctic 2005/6

# Collection Methods

- Ground Based
  - Two tethered sleds
- Airborne
  - 110<sup>m</sup>/<sub>s</sub> aircraft
  - 500m elevation

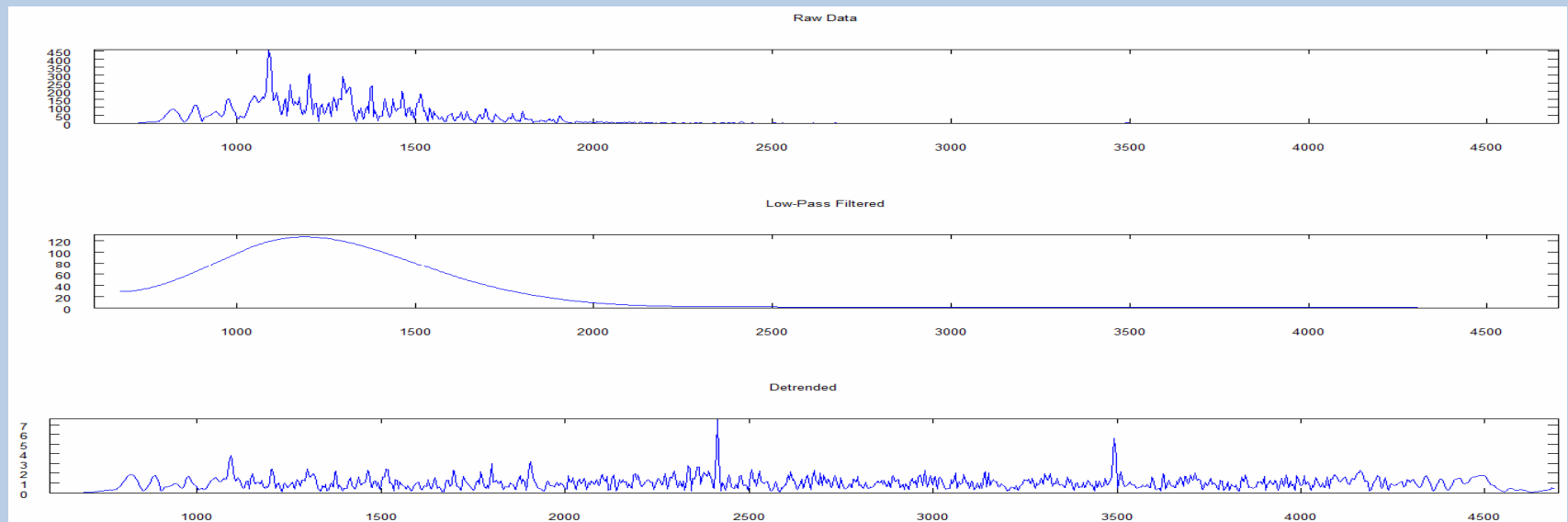


# Data Provided

- Lat/Lon points
- Depth ( $\approx 5\text{m}$  resolution)
- Return voltage
- Bedrock Depth (Extracted/Estimated)
- GPS elevation (airborne)
- Date/time

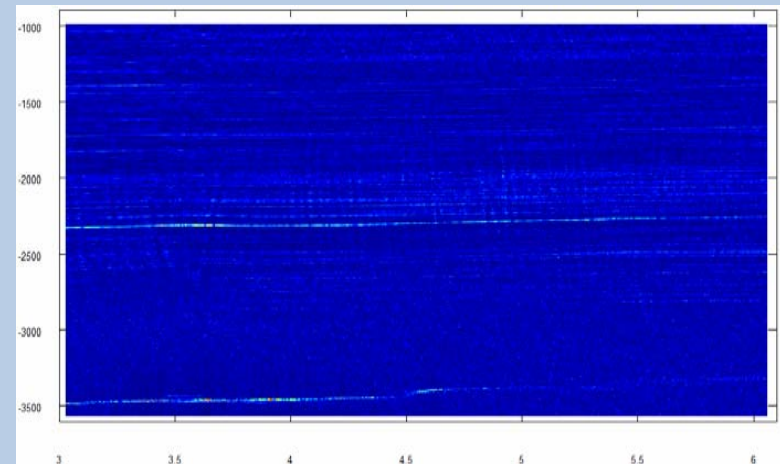
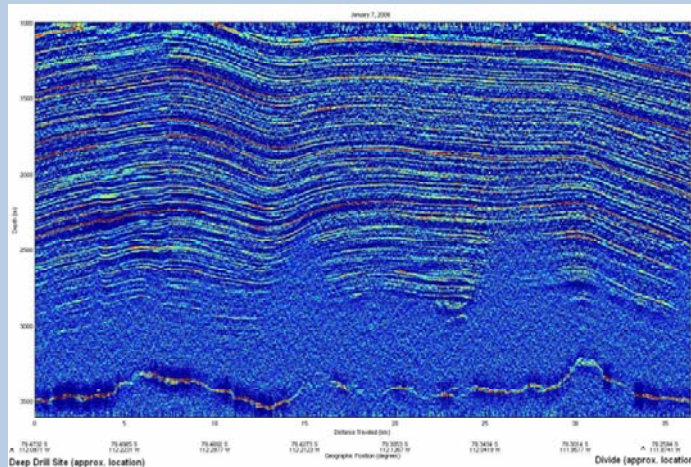
# Current Progress

- Collection/manipulation of data
  - Octave programming (Matlab)
  - Filtering



# Current Progress

- Recreation of previous results
- Error checking



# Current Issues

- Negative attenuation lengths
- Missing bedrock data over small intervals
  - Bedrock depth is linearly interpolated where possible yet sometimes missing entirely
- Varying signal strength due to bedrock conditions

# Future Work

- Deeper understanding of data collection methods/equipment
- More complex/accurate RF deterioration models

# Questions