

# Welcome to *PolarConnect*



## Ice Shelf Flow & Fracture Dynamics

With PolarTREC Teacher David Thesenga & Antarctic Researchers

Dr. Gordon Hamilton and Lynn Kaluziński

**19 October 2016**

# Getting to Know Adobe Connect

Slides will be shown here

Exit presentation

Mute your speakers

Raise your hand

List of all participants

Follow the chat

Find out more about the presentation

Chat here



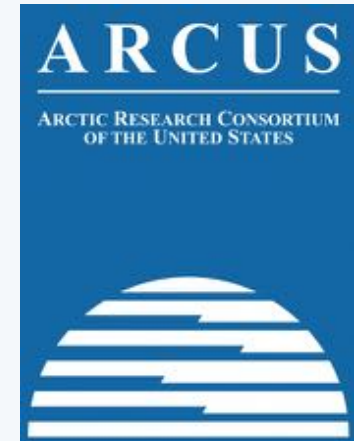
# Participant Introductions

**In the Chat box, please introduce yourself  
by typing in your:**

- ✓ Name
- ✓ School or Institution
- ✓ The number of students and adults participating with you in the same location

# What is PolarTREC?

- Since 2004, the Arctic Research Consortium of the United States (ARCUS), a non-profit organization, has been administering the PolarTREC Program.
- PolarTREC is professional development for K-12 teachers. They are paired with researchers for 2-6 week research experiences in the polar regions.
- Over 150 teachers from around the United States have joined scientists in the Arctic and Antarctica to learn about science, the polar regions, and to share what they have learned with their students and communities.



*25 Years of Connecting Arctic Research*  
[www.arcus.org](http://www.arcus.org)

# Questions

## During the Presentation:

- Type your question in the text chat box

## At the End of the Presentation:

- Raise your hand with the “hand button”.
- PolarTREC staff will call on you and activate your microphone.
- Speak loud and clear, directly into the computer microphone or the phone to ask your question.



# Robots in the

# **DANGER ZONE**

Ice Dynamics in the McMurdo  
Shear Zone

**Project I-178**  
**Gordon Hamilton (PI)**  
**Lynn Kaluziński**  
**David Thesenga**



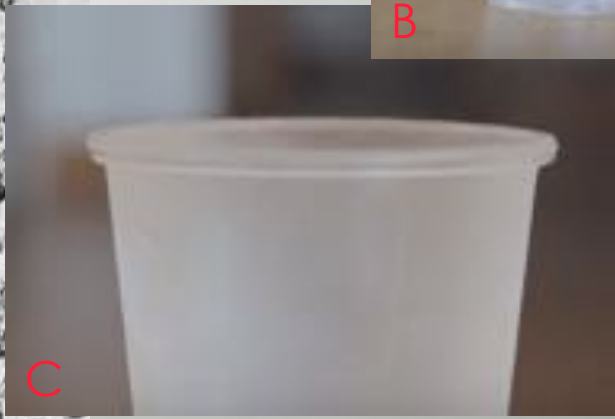
Ross Ice Shelf



A



B



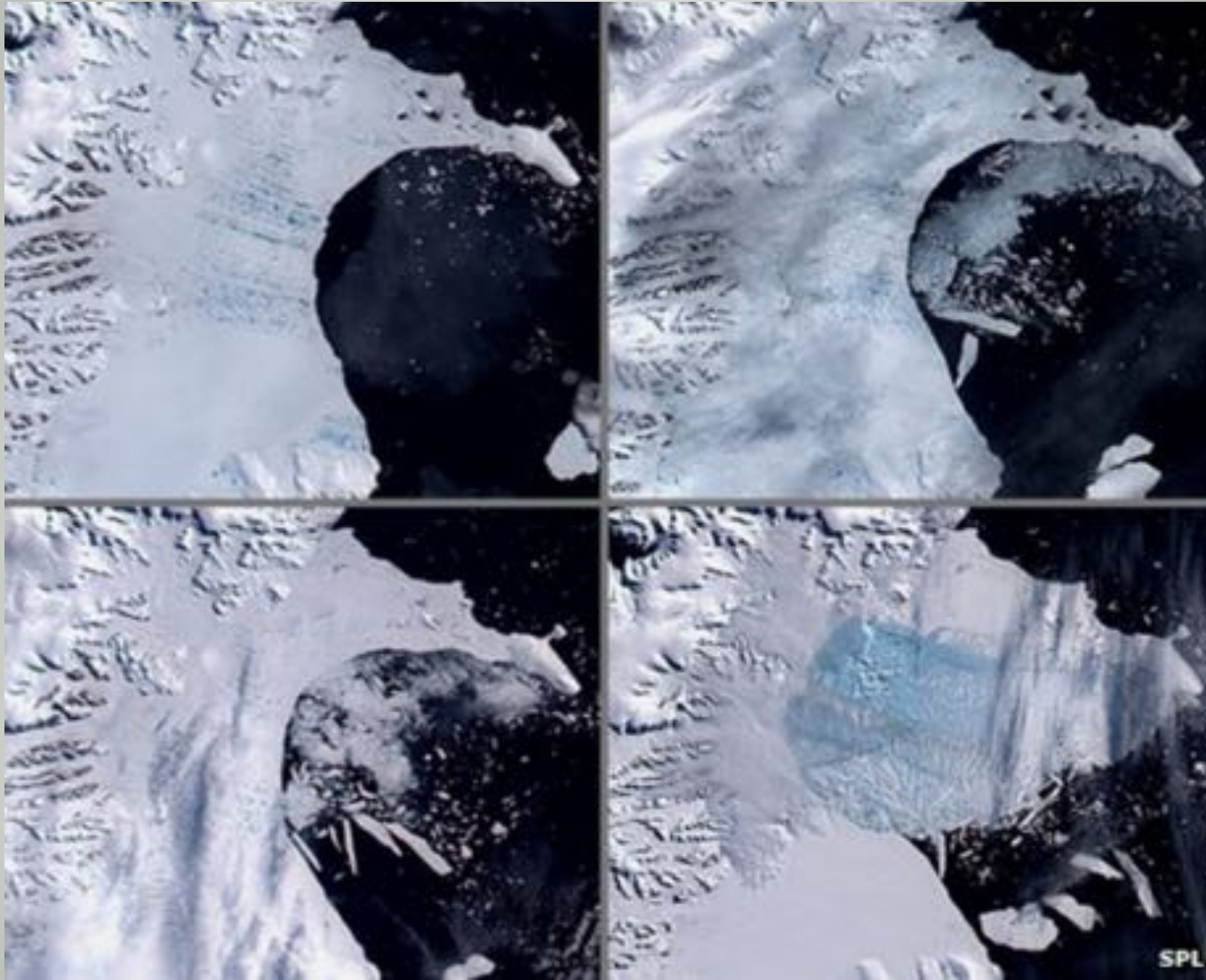
C



Ice shelves act like dams...



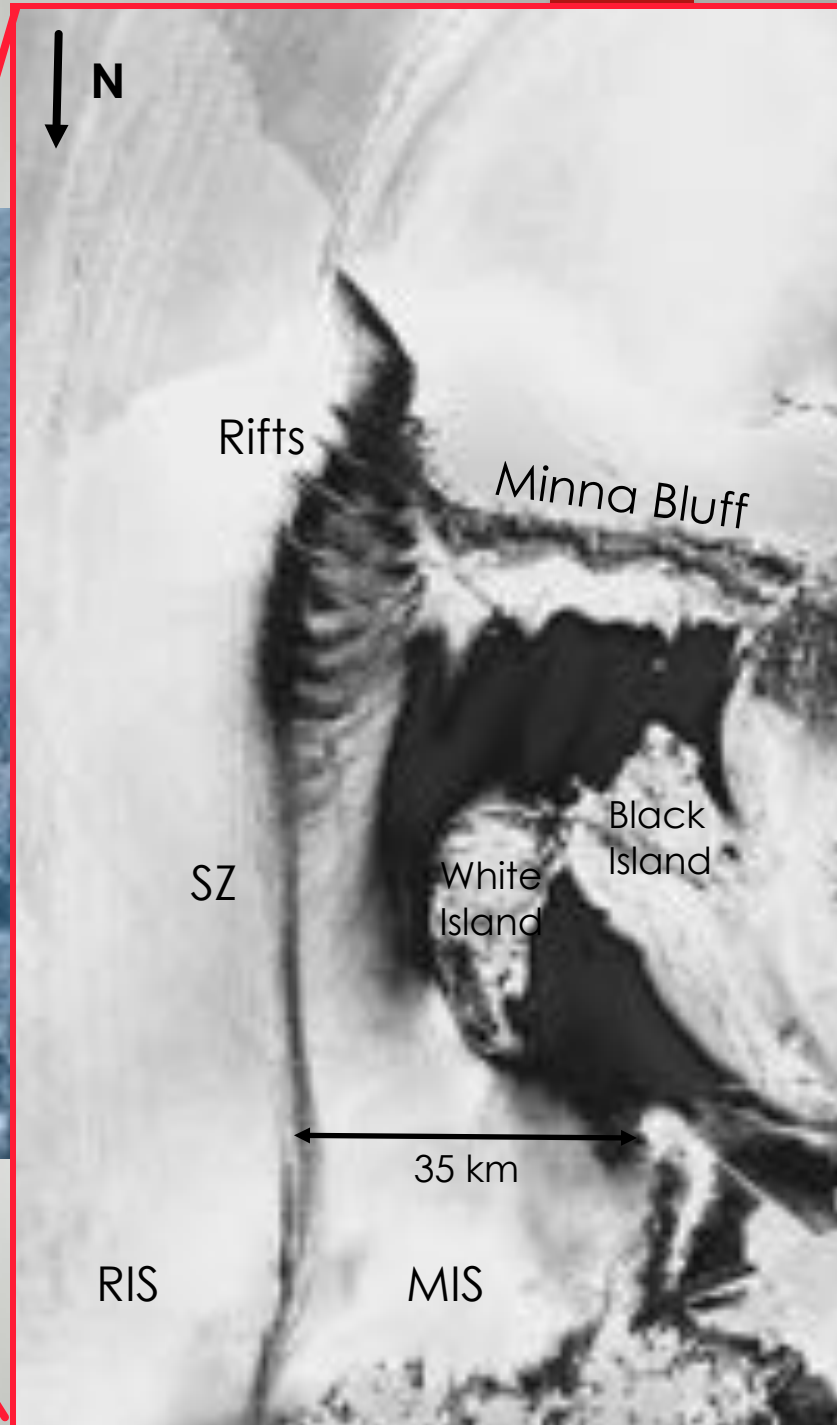
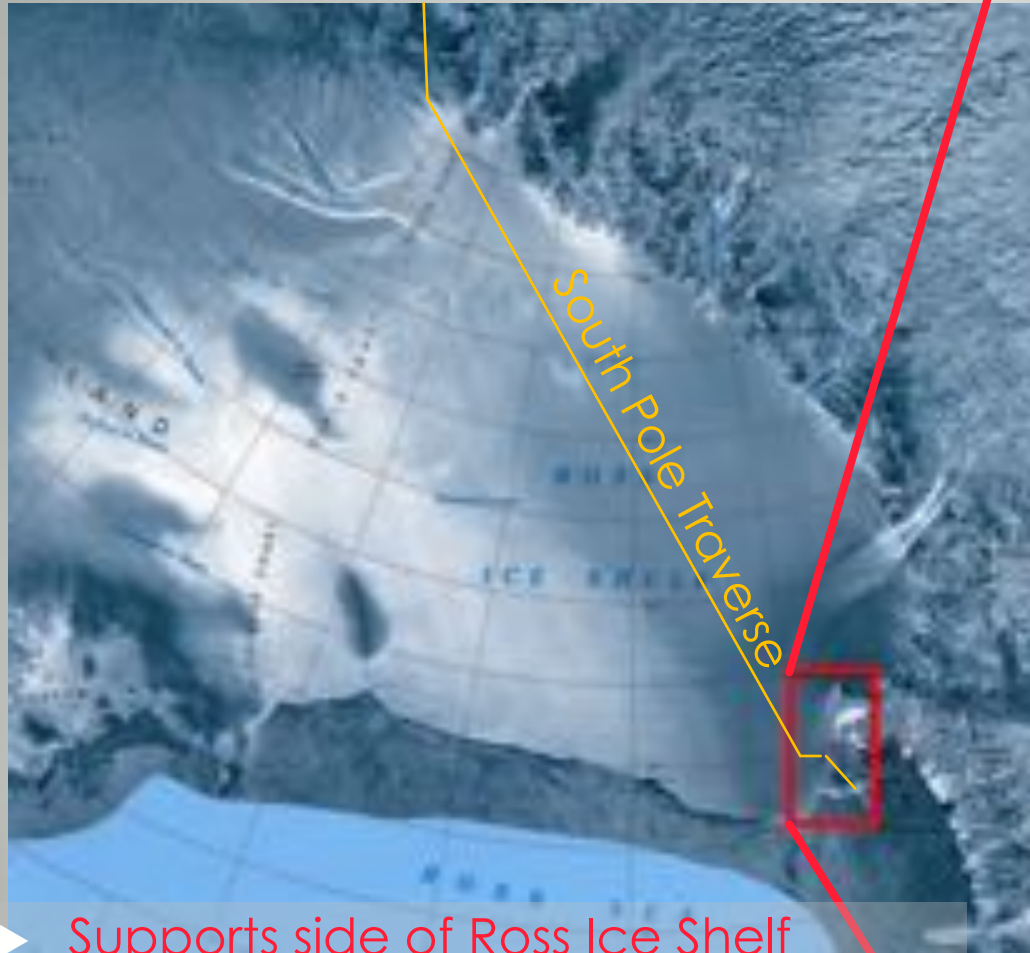
# Larsen B Ice Shelf



# Where Are We?



# The McMurdo SZ



- ▶ Supports side of Ross Ice Shelf
- ▶ Is the SZ unstable?
- ▶ SPT crosses the SZ every year
- ▶ Will route be feasible in the future?

# GPS/ Remote Sensing

- Determine surface velocities and strain rates

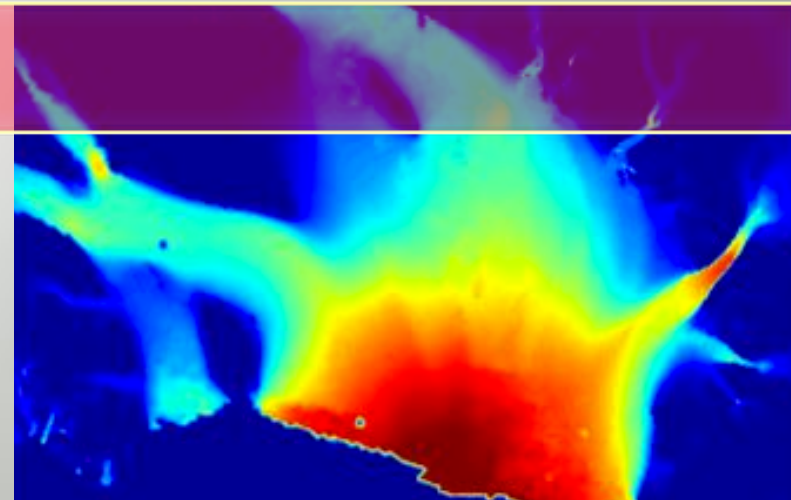


# GPR and Seismic Observations

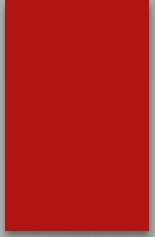
- Map crevasse spacing and orientation within ice shelf

# Numerical Modeling

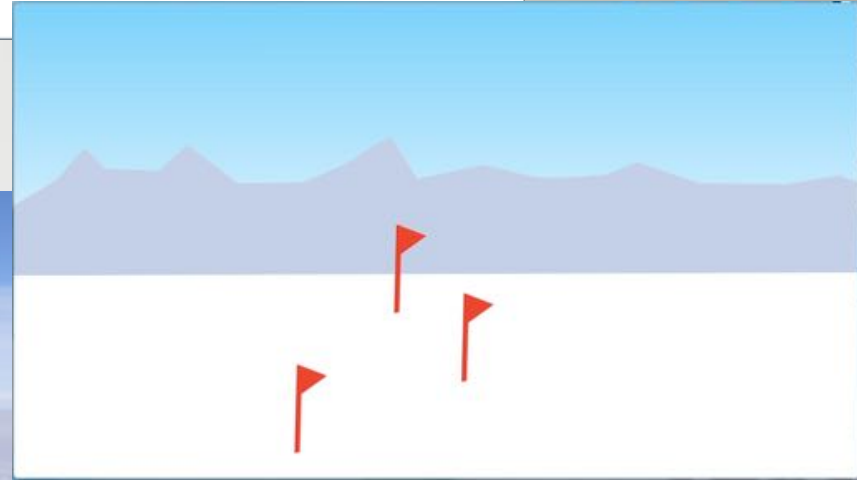
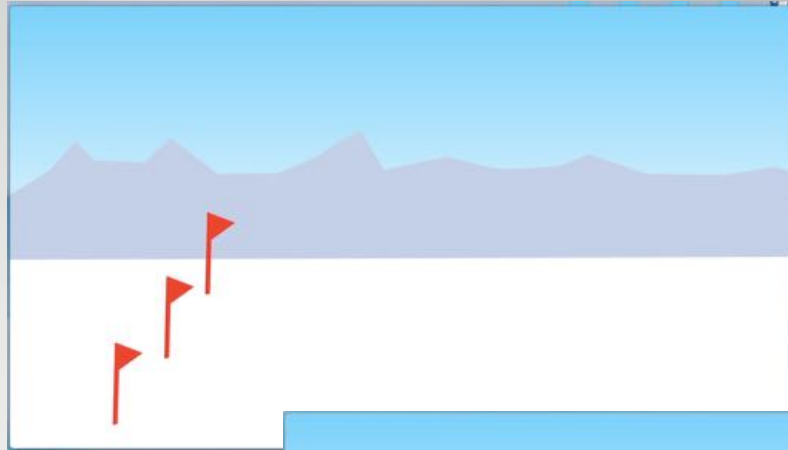
- Model Ross Ice Shelf (RIS) sensitivity to changing lateral stresses

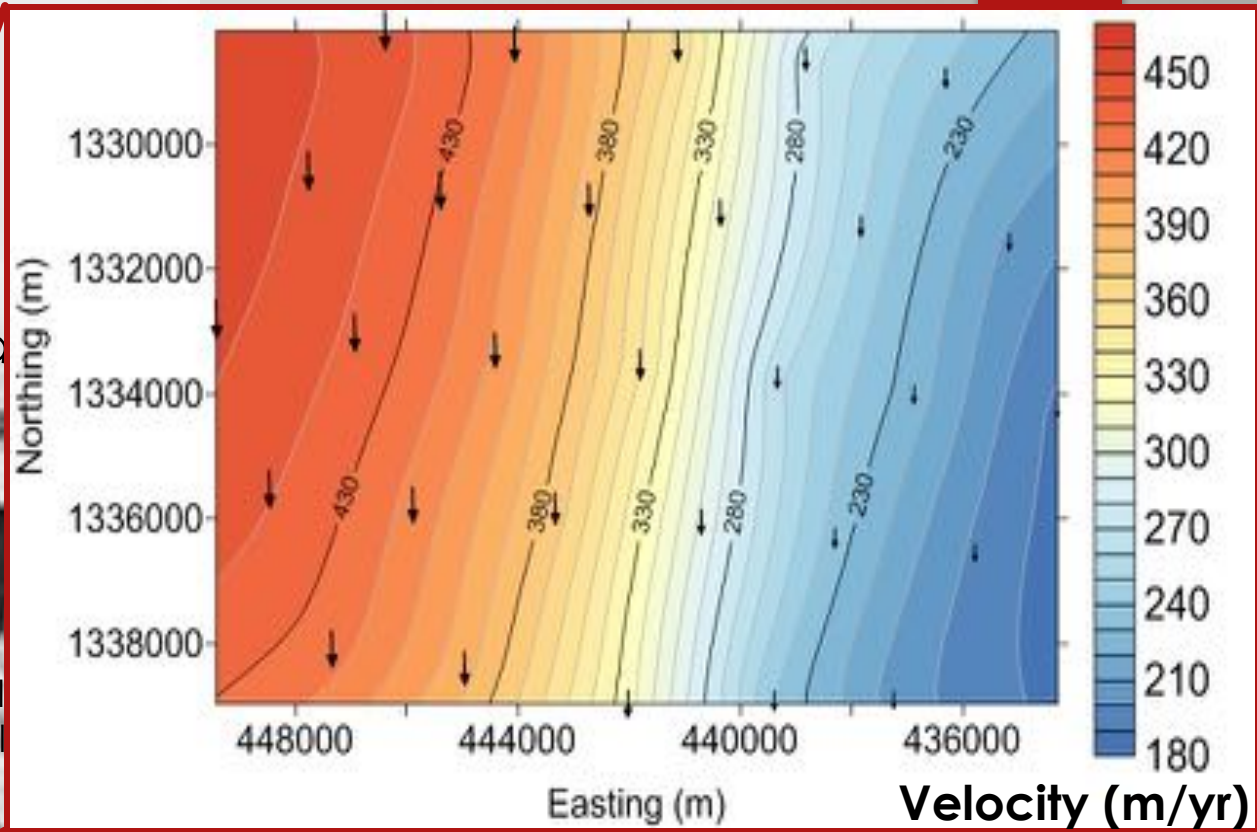


# GPS Observations



- ▶ Survey 29 poles
- ▶ 12 x 12 km grid
- ▶ Travel by skidoo and helicopter in the **DANGER ZONE**





GPS Results: Ice Shelf Velocities

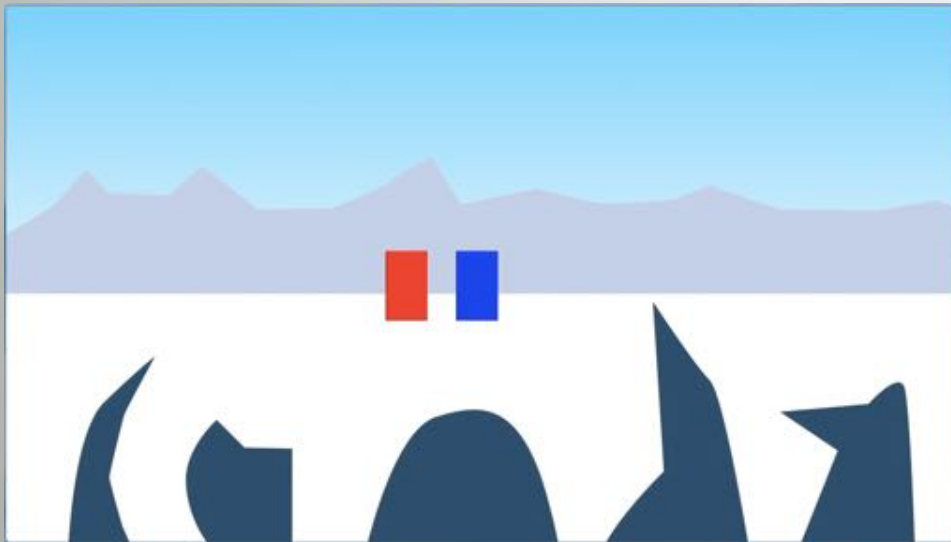
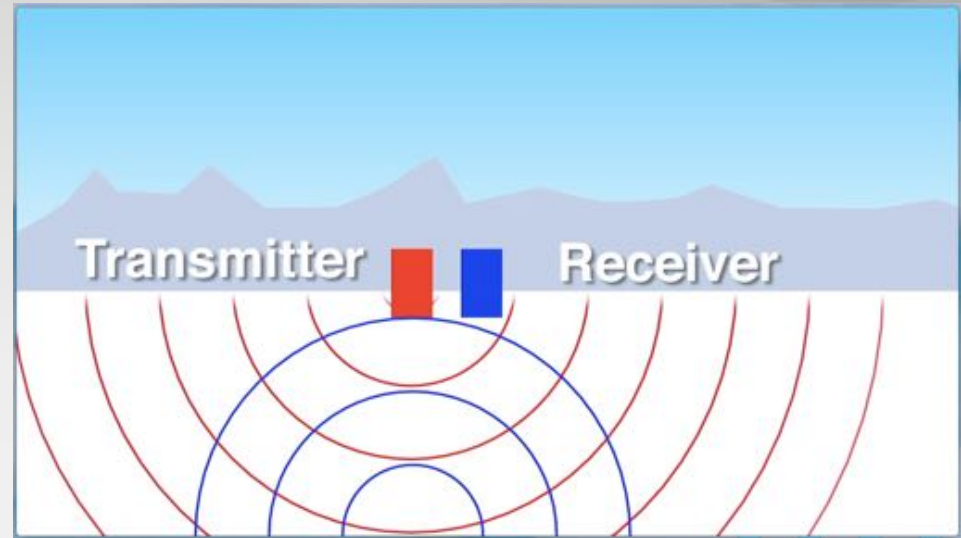
# GPR Observations





# GPR Observations

- ▶ 400 MHz - surface crevassing
- ▶ 200 MHz – basal marine ice layer



- ▶ Return signal from ~180m depth
- ▶ Total ice thickness ~270m

# Dangers in the Shear Zone



# Dangers in the Shear Zone



# Robots - Yeti 2.0 and Scotty

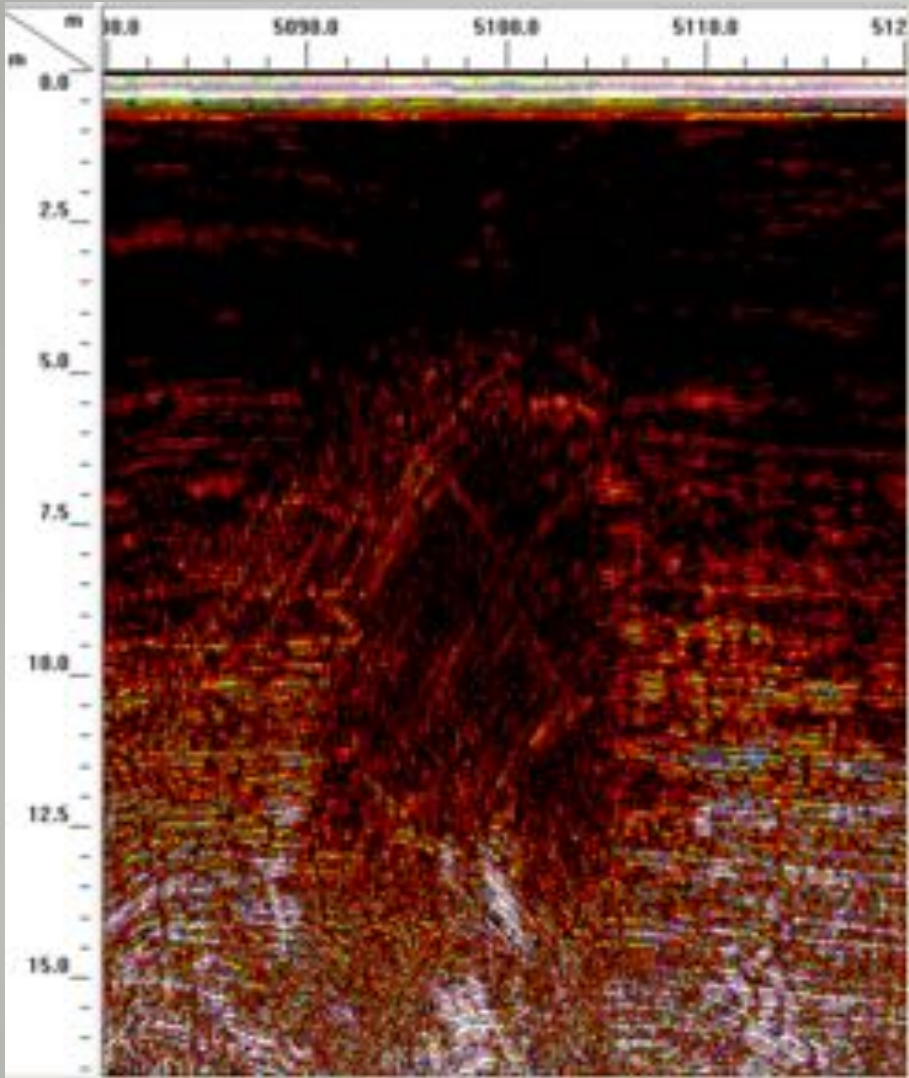
- ▶ Specifically designed to travel over ice and snow
- ▶ Can tow up to 200 lbs
- ▶ Developed at Thayer School of Engineering at Dartmouth with collaboration from CRREL
- ▶ Center pivot keeps wheels in contact with ground (sastrugi)
- ▶ GPS guided



THAYER SCHOOL OF  
ENGINEERING  
AT DARTMOUTH

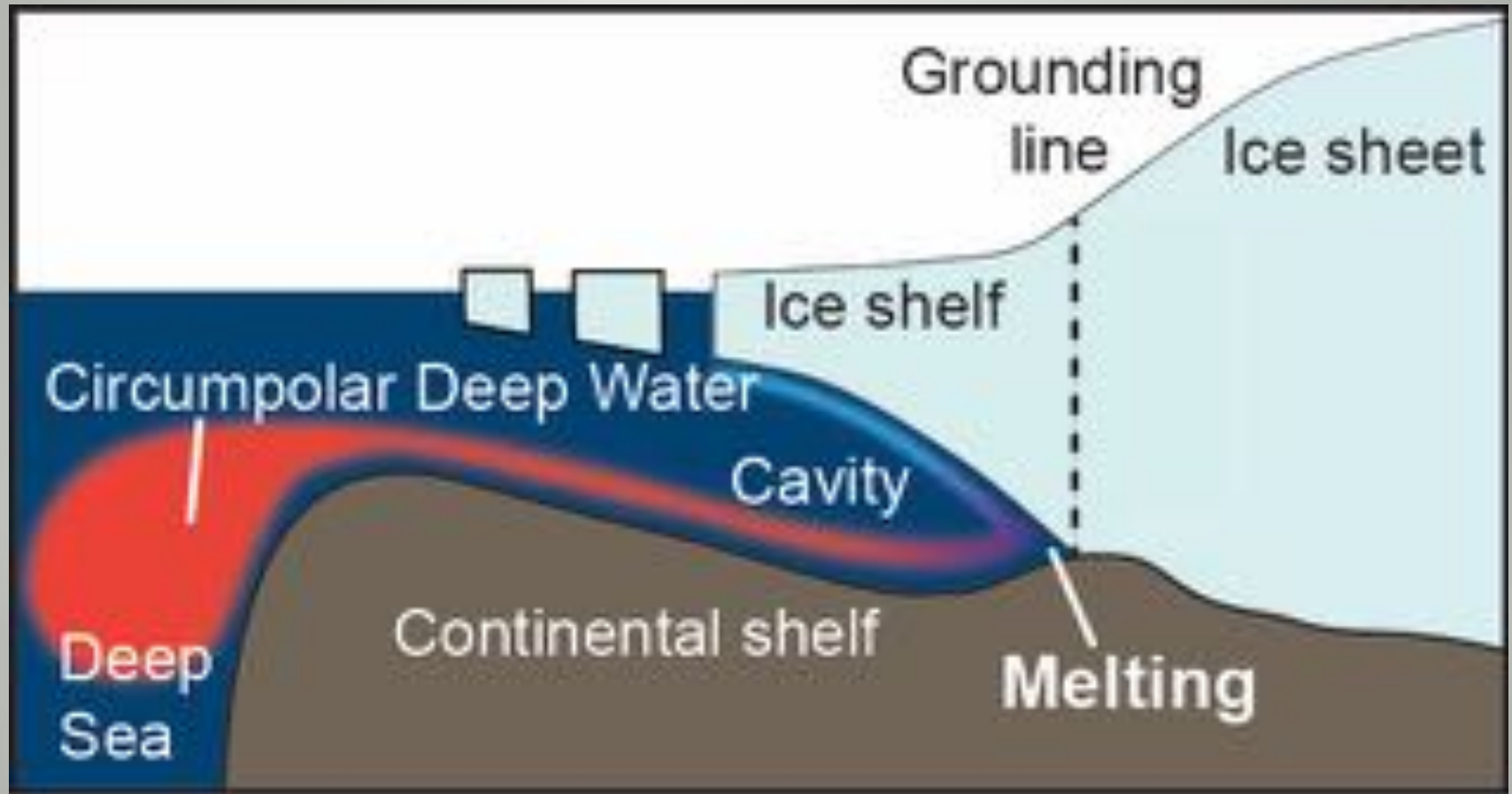


Reality

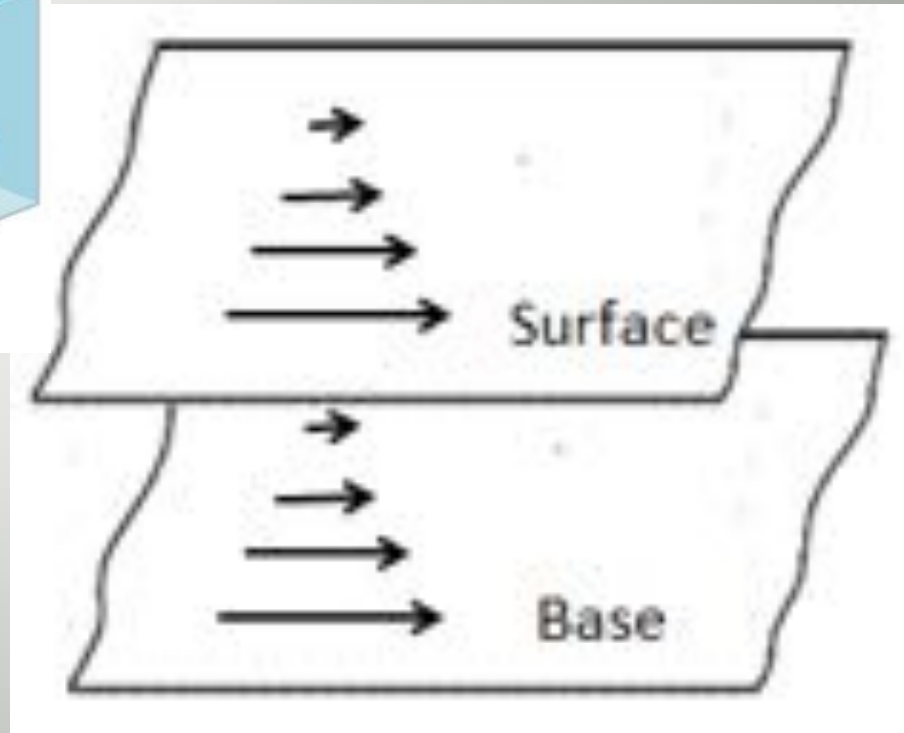
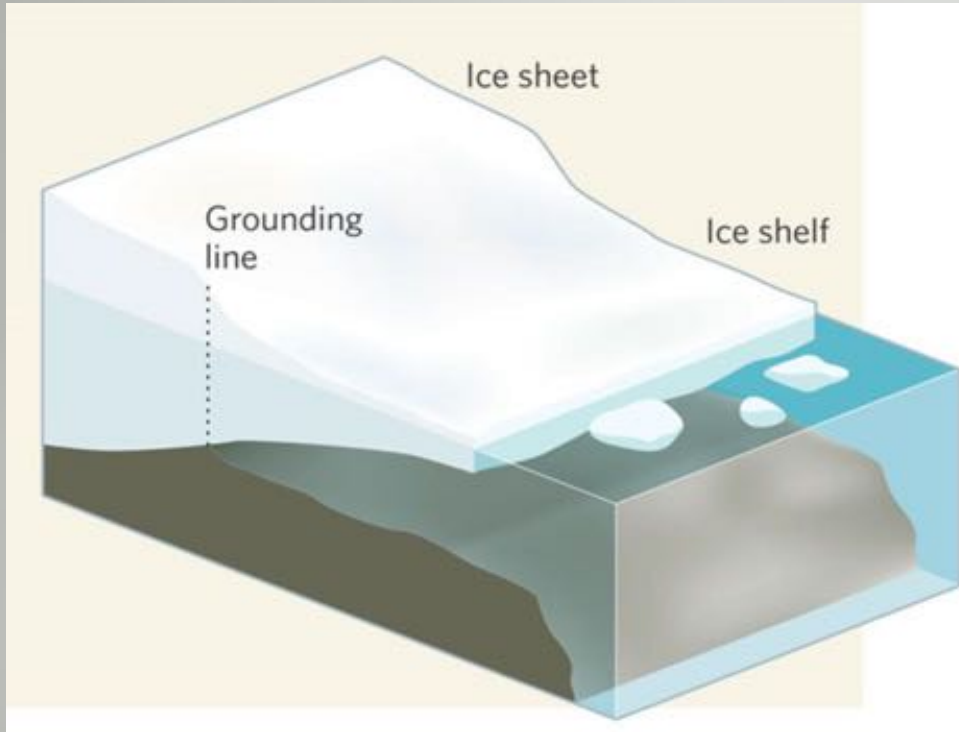


GPR View

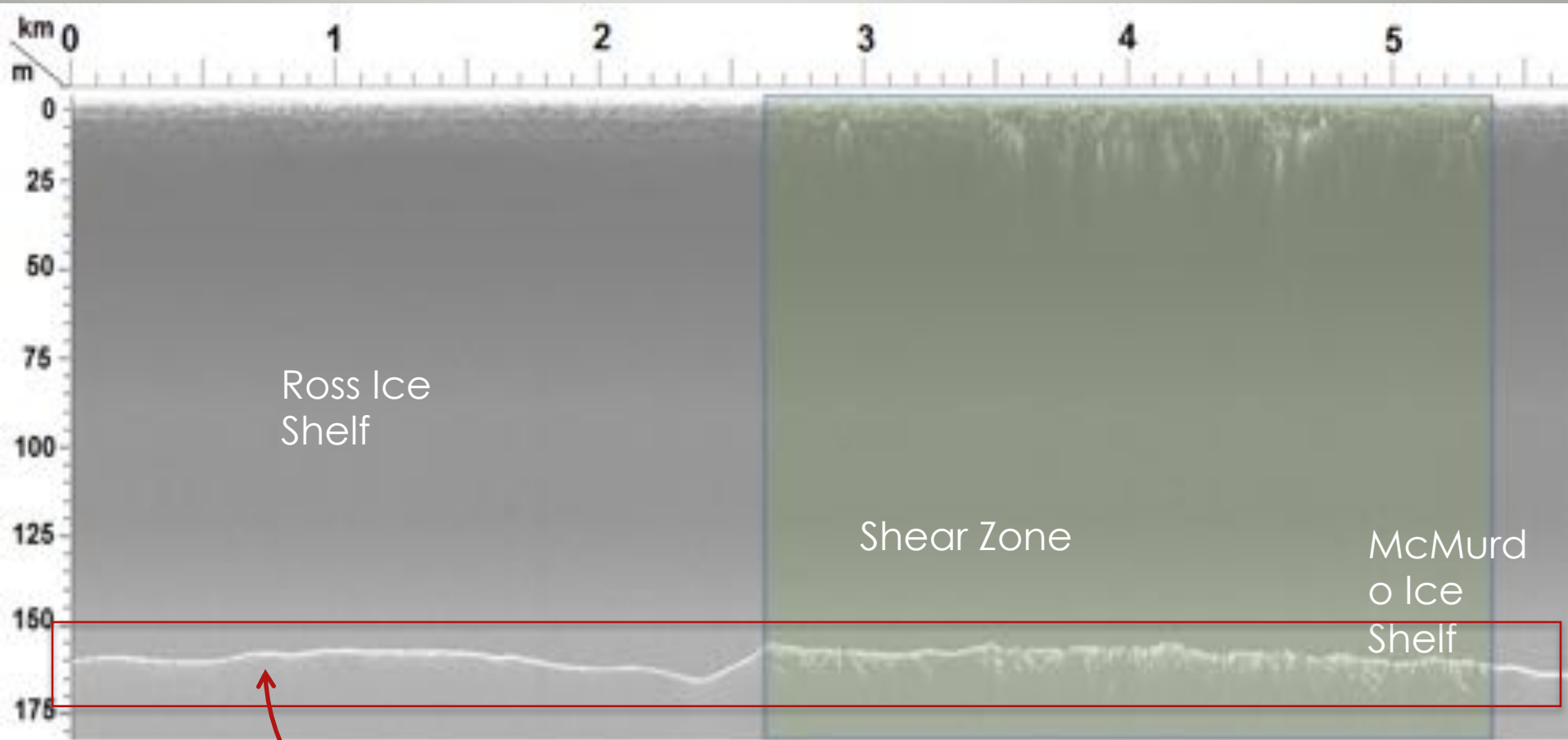
# Basal Marine Ice Formation



# Basal Crevasses



# Crevasses – New Questions



Basal Marine Ice Transition?



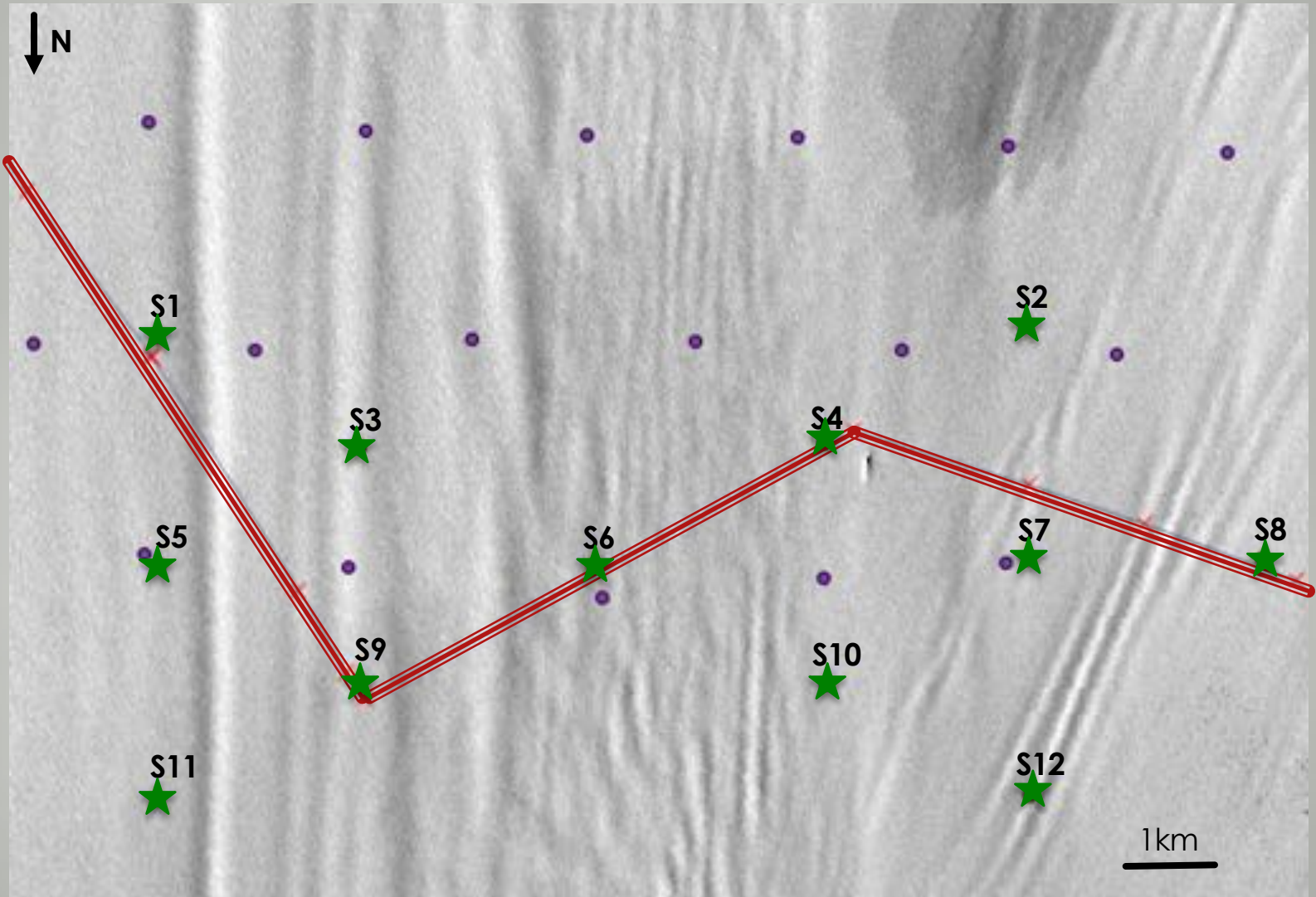
# Need to Move ...



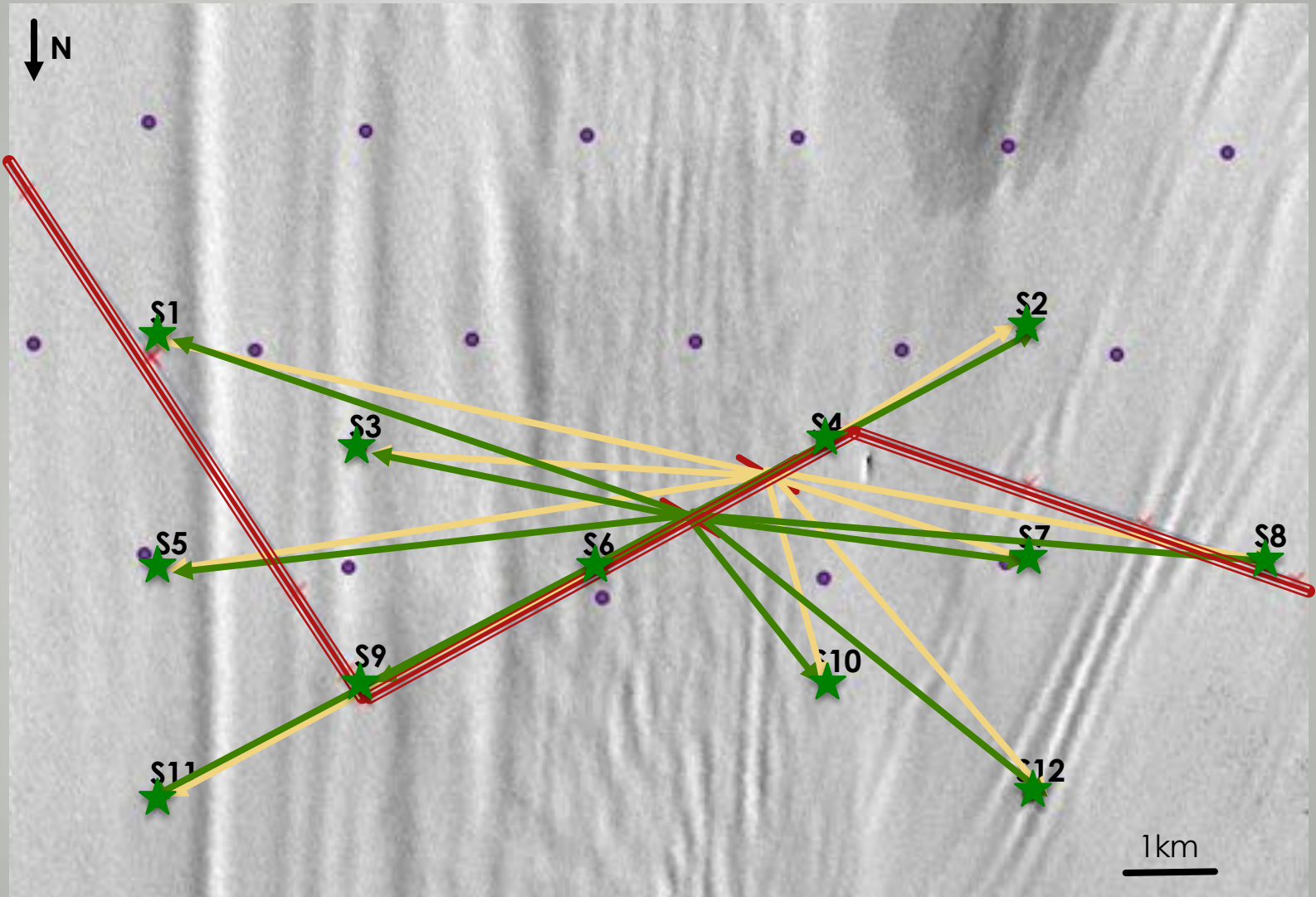
# Seismics



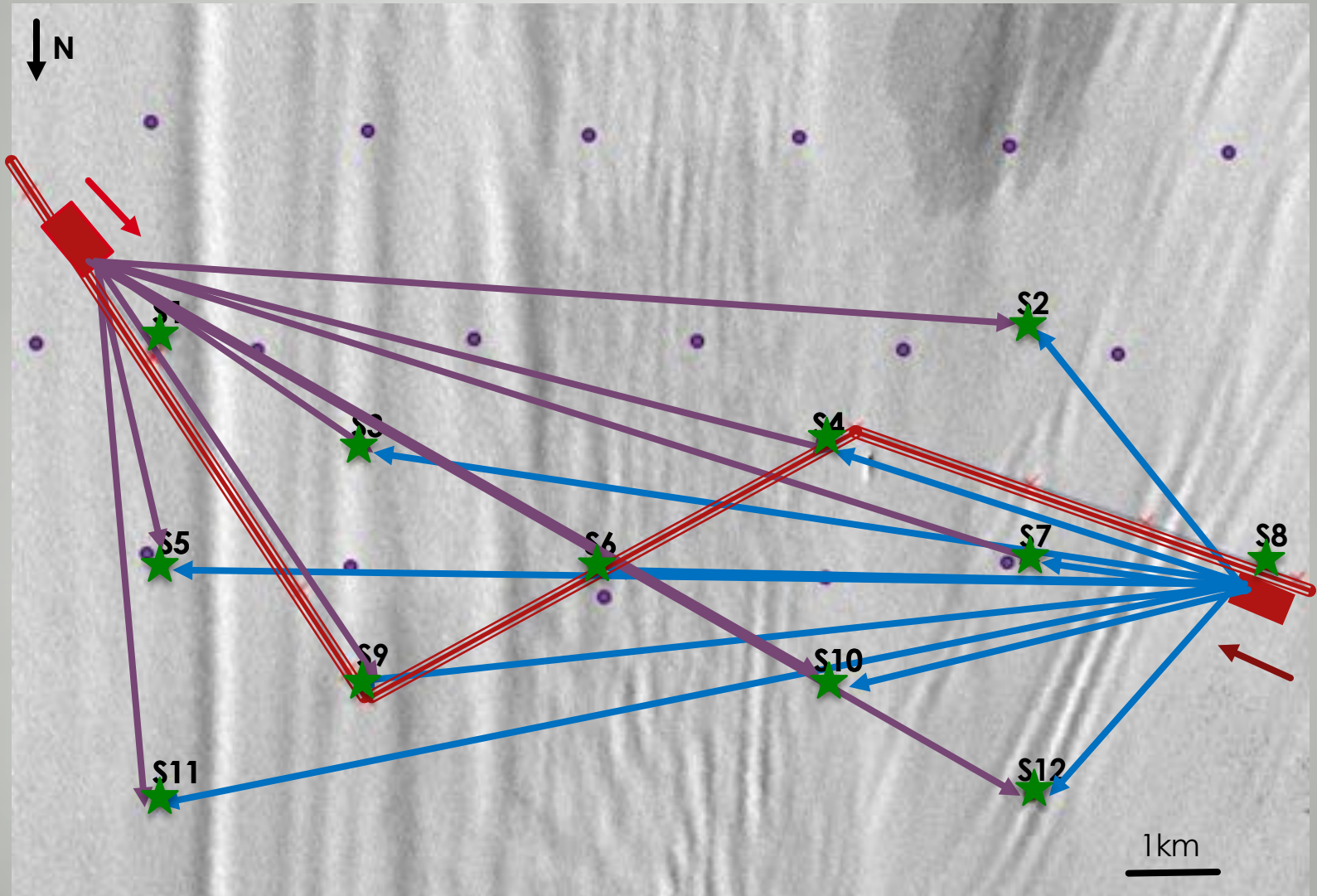
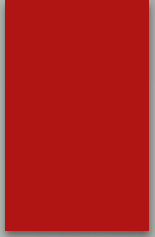
# Seismic Array



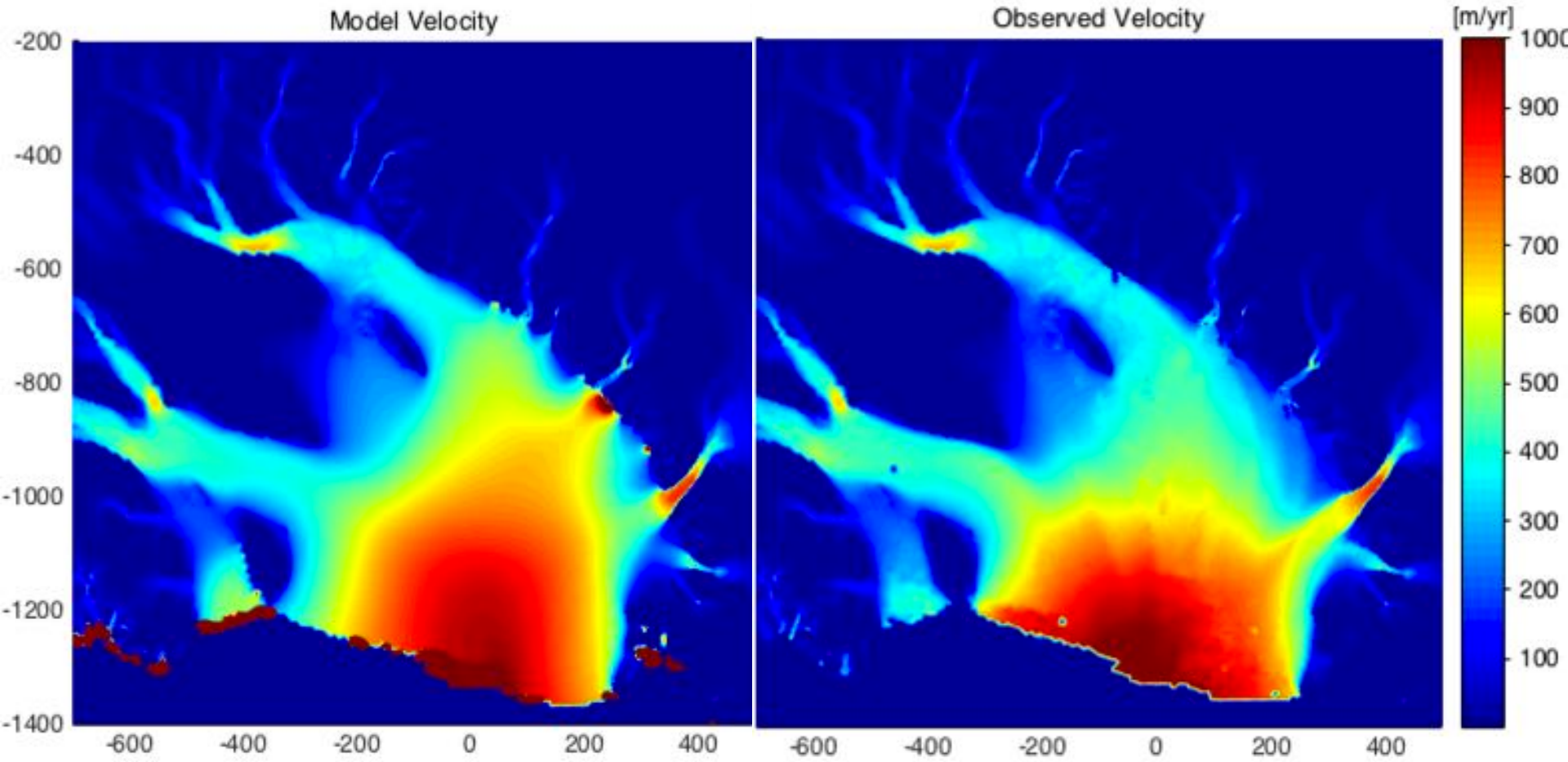
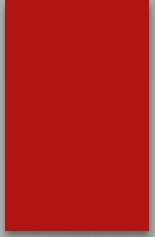
# SPOT Blasts



# SPOT Travel To/From



# Numerical Modeling



# Summary

- ▶ Last of three field seasons
- ▶ Robust GPR data set
  - ▶ Correlation of surface and basal crevasses
  - ▶ Located in area of highest strain rate
- ▶ How much are properties of shear zone inherited from Minna Bluff?
  - ▶ Surveying further south this season
- ▶ Seismic survey - discover bulk properties of ice at depth
- ▶ Modeling - Sensitivity analysis of weakening Shear Zone

# Follow a Researcher™



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**MAINE**  
Cooperative Extension



## Follow a Researcher™



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Questions?



THAYER SCHOOL OF  
ENGINEERING  
AT DARTMOUTH

# Join PolarTREC!

[www.polartrac.com/about/join](http://www.polartrac.com/about/join)

Everyone can participate in different ways:

- **Follow Expeditions**
- **Participate in PolarConnect Events**
- **Join the Polar Education Email List**
- **Check out the great resources**
- **Become a PolarTREC Teacher or Researcher**
- **Become a member of ARCUS**

# Thank You!

*An archive of the event will be available shortly.*

<http://www.polartrec.com/polar-connect/archive>



*25 Years of Connecting Arctic Research*  
[www.arcus.org](http://www.arcus.org)