Welcome!

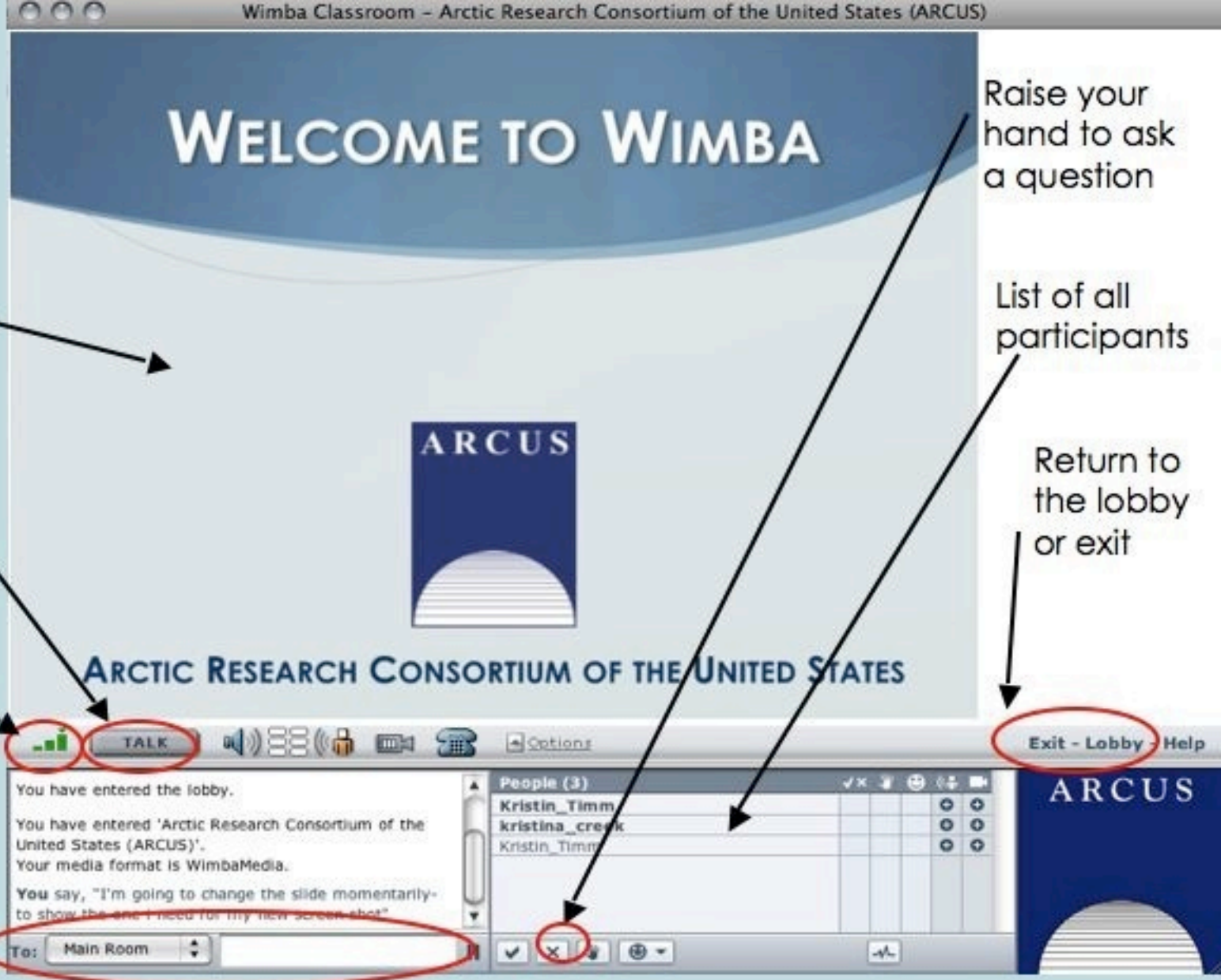
ED 593 - Applied Earth Science Concepts for Educators

Webinar 1 ◆ 8 August 2011

Live Connection with Julie Brigham-Grette, Ross Powell, and Mark Goldner in Svalbard, Norway!

POLAR TREC

Wimba
people teach people



Slides will be shown here

If using VOIP, press and hold here to talk

Your connection strength

'Chat' with one person or the entire group

Raise your hand to ask a question

List of all participants

Return to the lobby or exit

Please note:

- Participant using the telephone can mute/unmute by pressing *6 on the phone.
- Today's event will be recorded and archived.

Roll Call

When called, please state your:

- ✓Name
- ✓School / Institution

Questions

To Ask a Question:

- ✓Raise your hand with the "hand button"
- ✓Type your question in the text chat box
- ✓Speak loud and clear and directly into the phone to ask your question.

POLAR TREC

High Arctic Change 2011
PolarTREC and REU

Dr. Ross Powell
N. Illinois University

Dr. Julie Brigham-Grette
UMASS Amherst

Daren McGregor
Colby College

Mark Goldner, Heath School

George Roth
Univ. of Washington

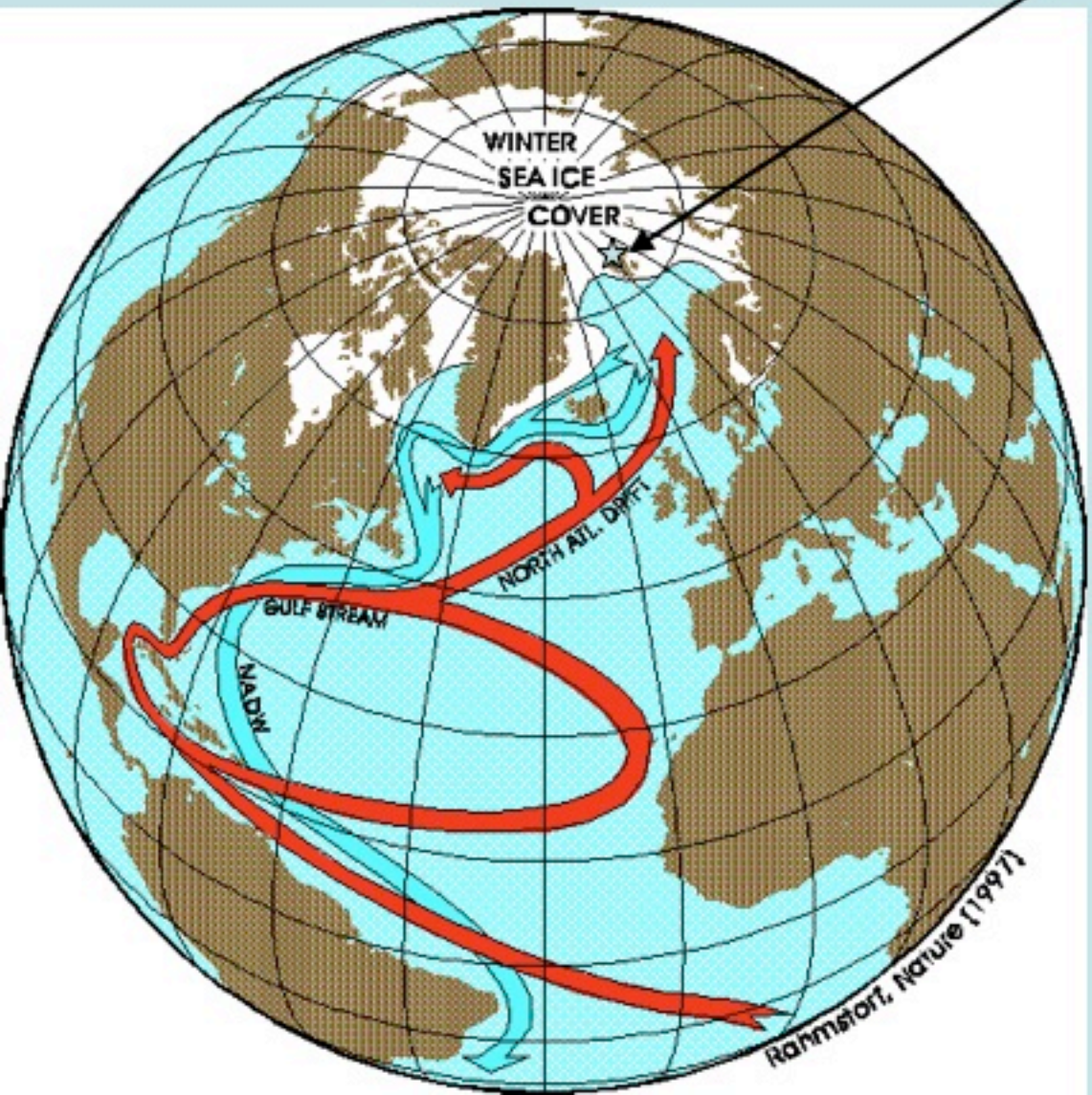
Daksha Rajagopalan
Yale University

Rebecca Siegel
Hampshire College

Rachel Valletta
Syracuse University

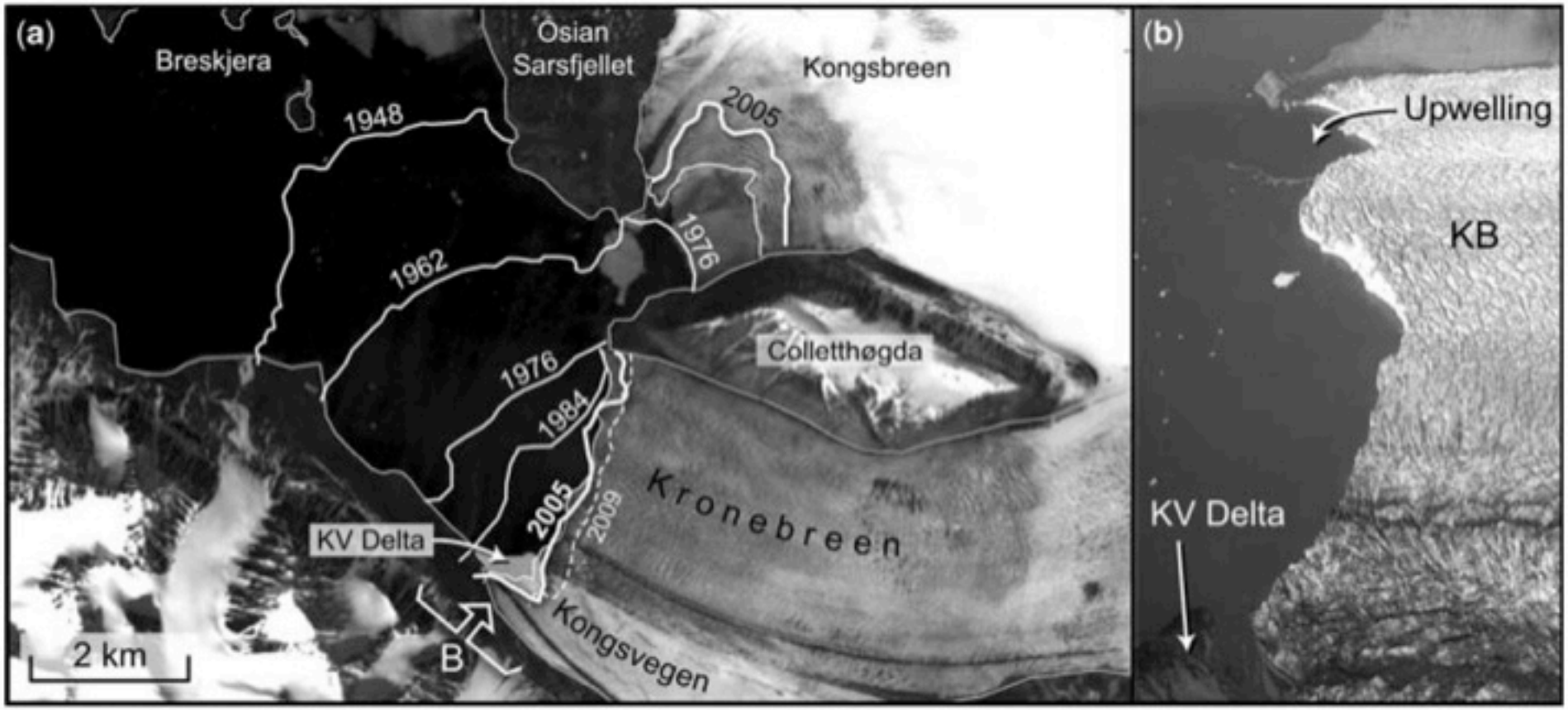
Liz Ceperley
Beloit College

Why Svalbard?



- Northern Extent of Gulf Stream
- Very Strong Effects of Climate Change: <u>Rising Temperatures</u> and <u>Melting Glacier Ice</u>

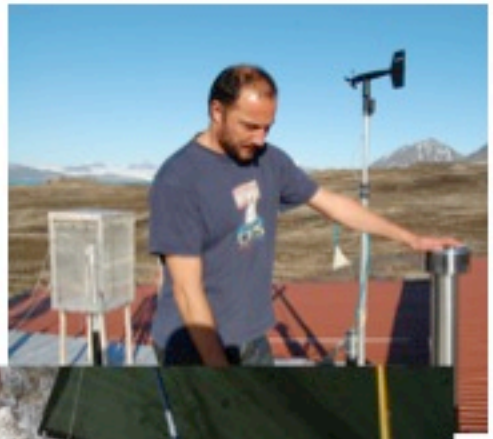

Kvitøya
Nordaustlandet
Vestfonna
Austfonna
Ny Friesland
Ny Ålesund
Olav V land
Oscar II land
Prins Karls forland
SPITSBERGEN
Barentsøya
Edgeøya
Storfjorden
Barentshavet
Hopen



Trusel et al, 2010

Ny Ålesund, Svalbard

International Research Base at 79° North

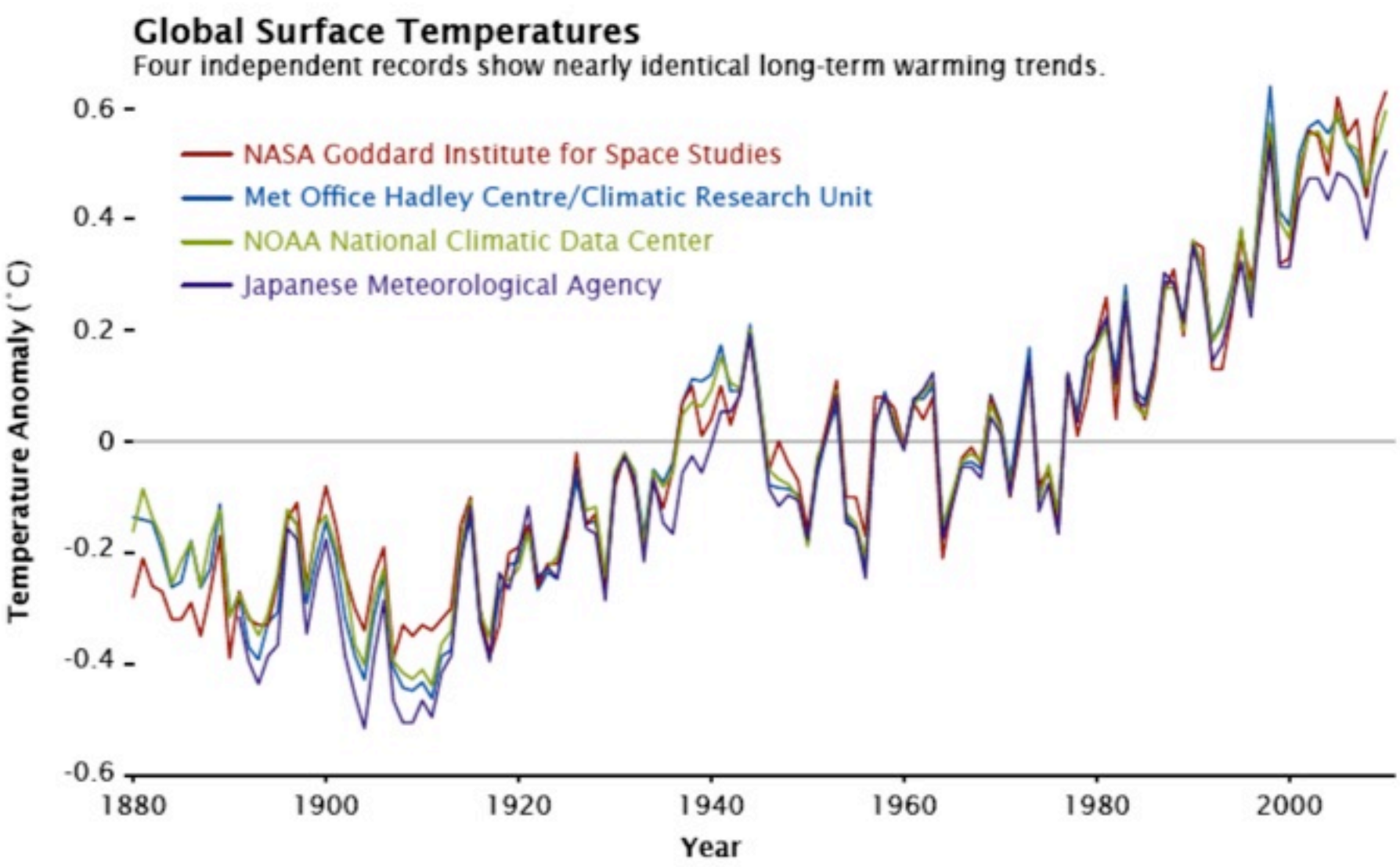


Ny Ålesund, Svalbard


THE DAY AFTER TOMORROW
IN THEATRES WORLDWIDE 28 MAY 2004
The World is Warming
WHERE WILL YOU BE?

There is undeniable evidence for global warming…

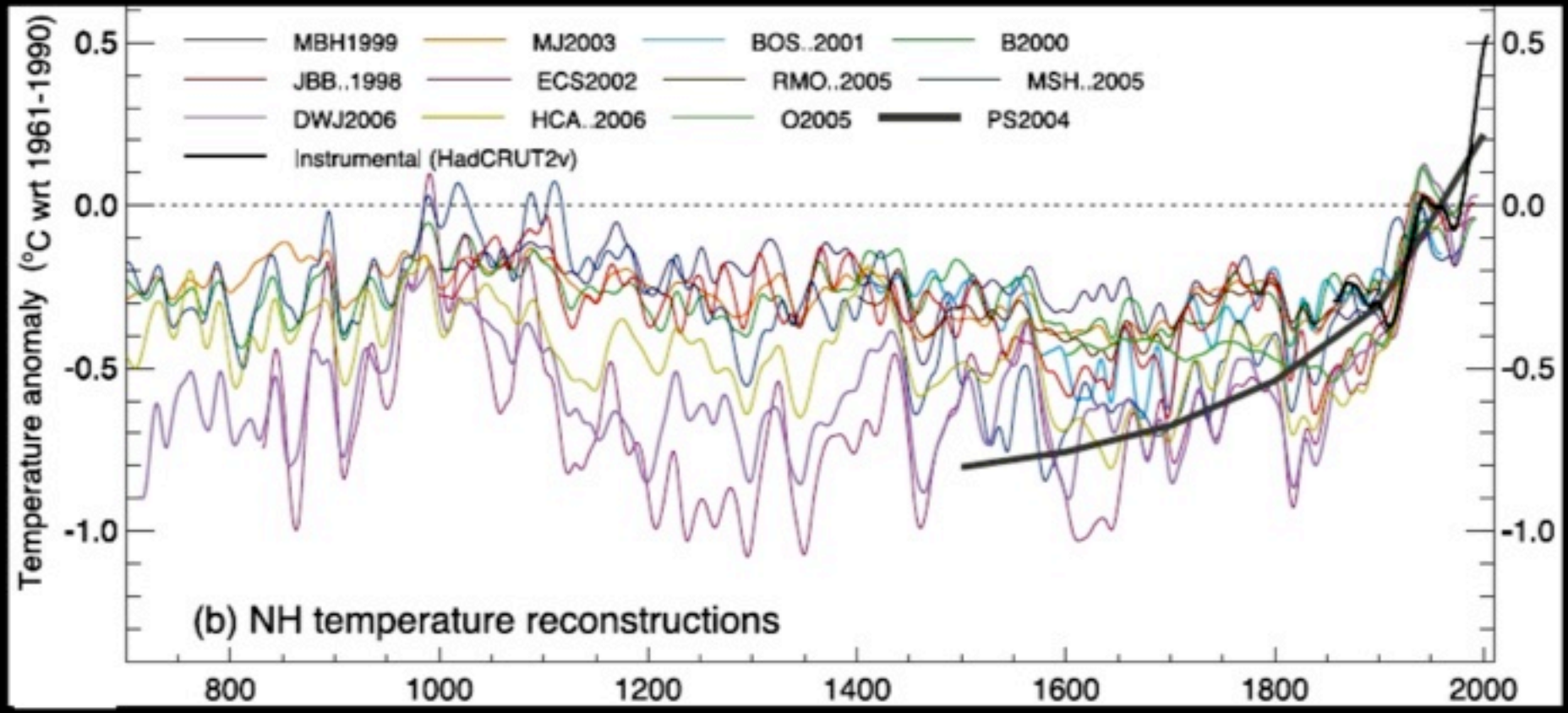
The REAL truth



Credit: NASA Earth Observatory/Robert Simmon

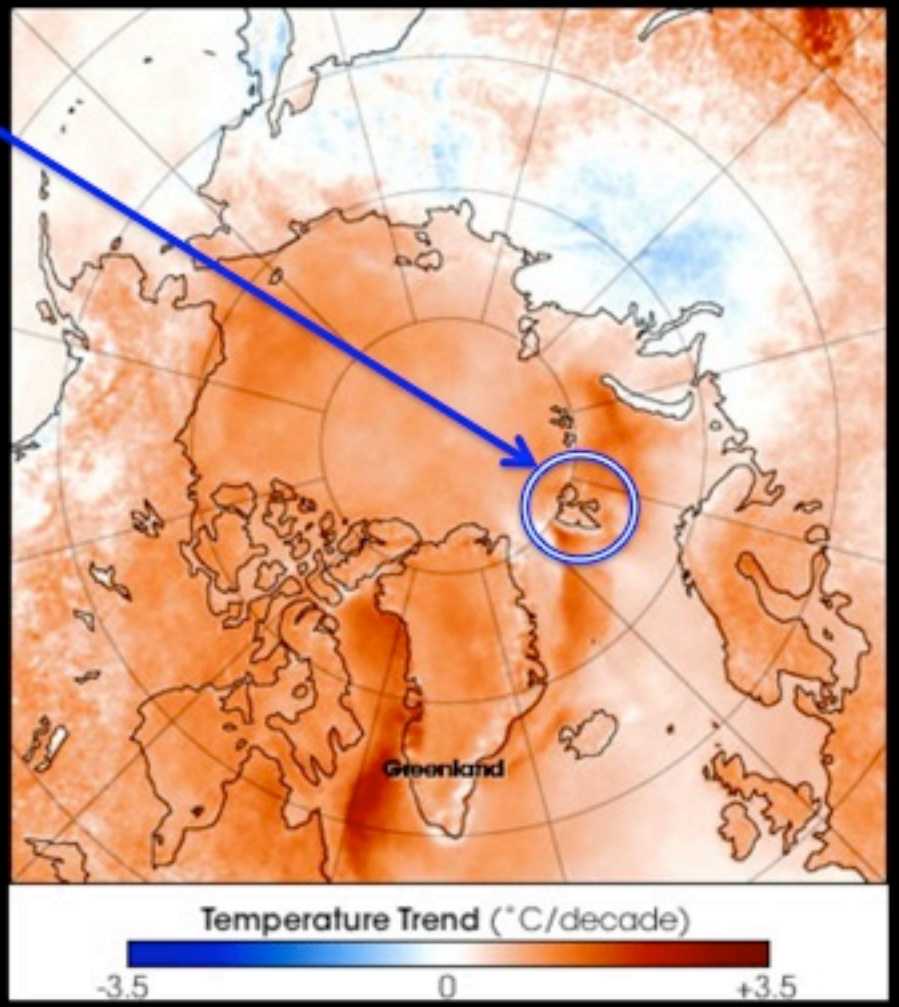
Data Sources: NASA Goddard Institute for Space Studies, NOAA National Climatic Data Center, Met Office Hadley Centre/Climatic Research Unit, and the Japanese Meteorological Agency.

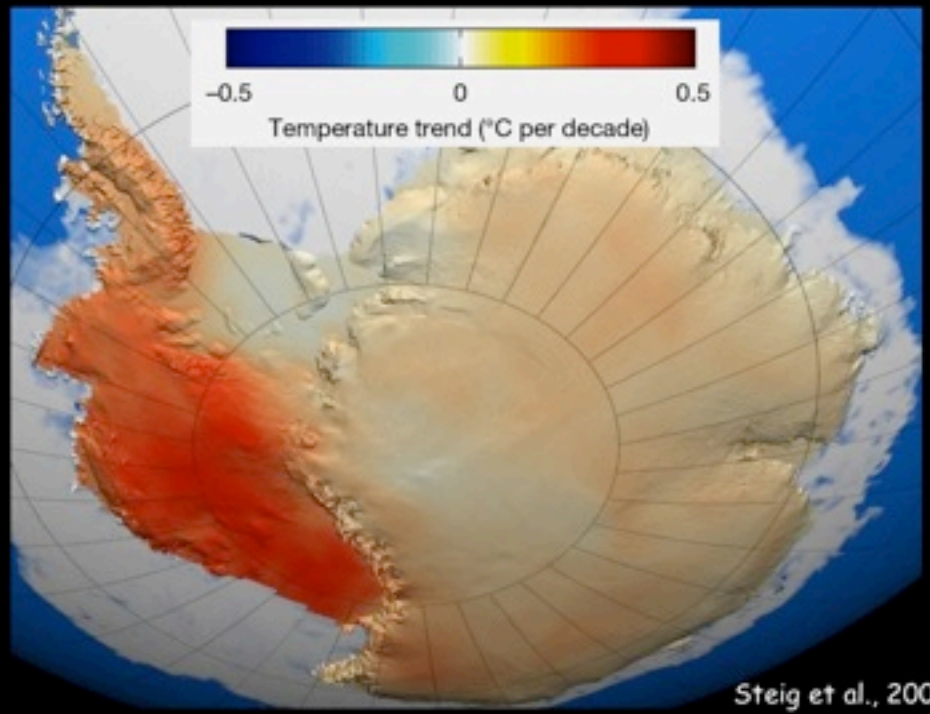
Similar to the (updated) "hockey stick" curve for average global temperatures



Svalbard

Today polar regions are warming rapidly

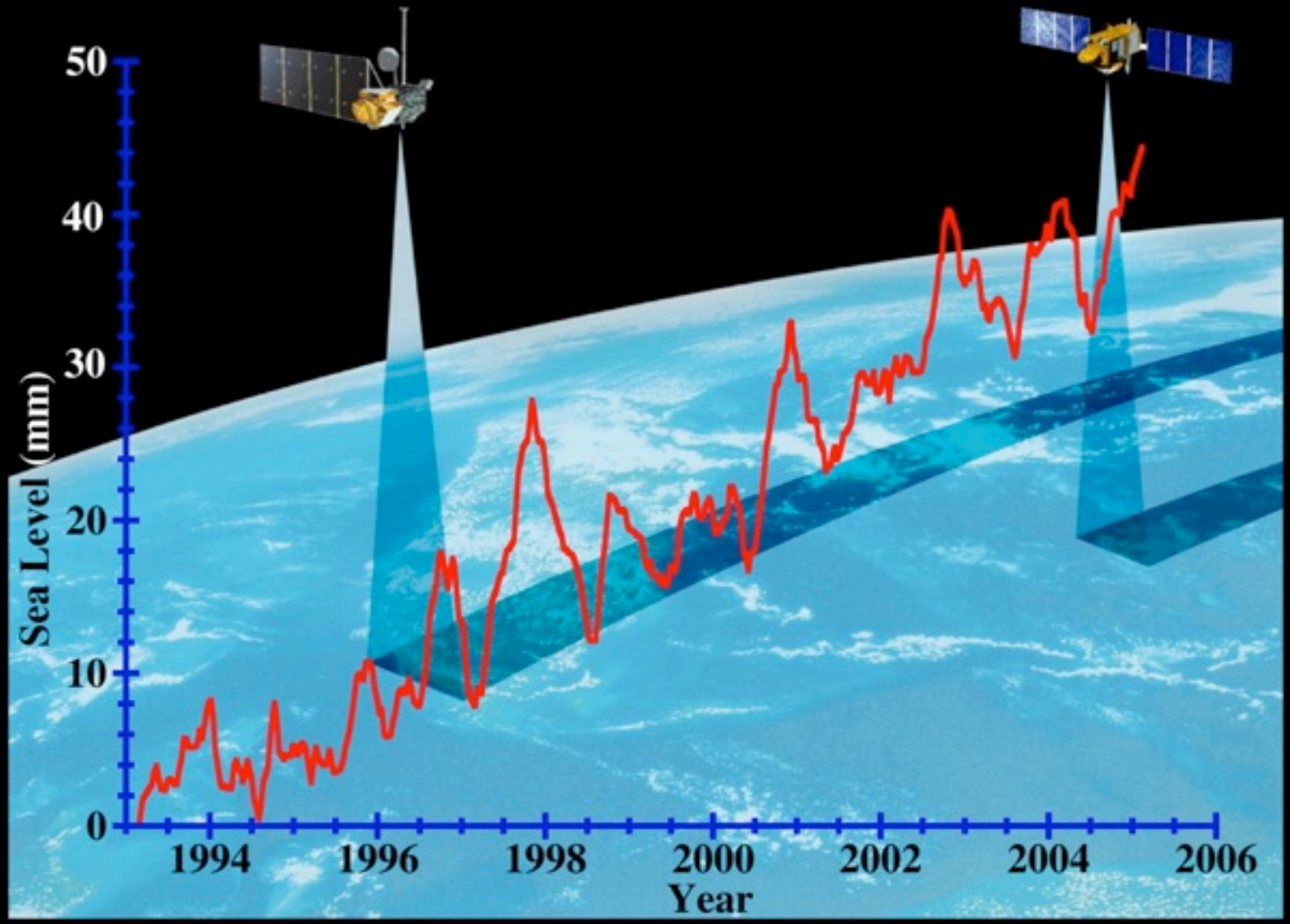




Steig et al., 2009

especially Arctic and Antarctic Peninsula

Sea level is rising from warming oceans and melting glaciers

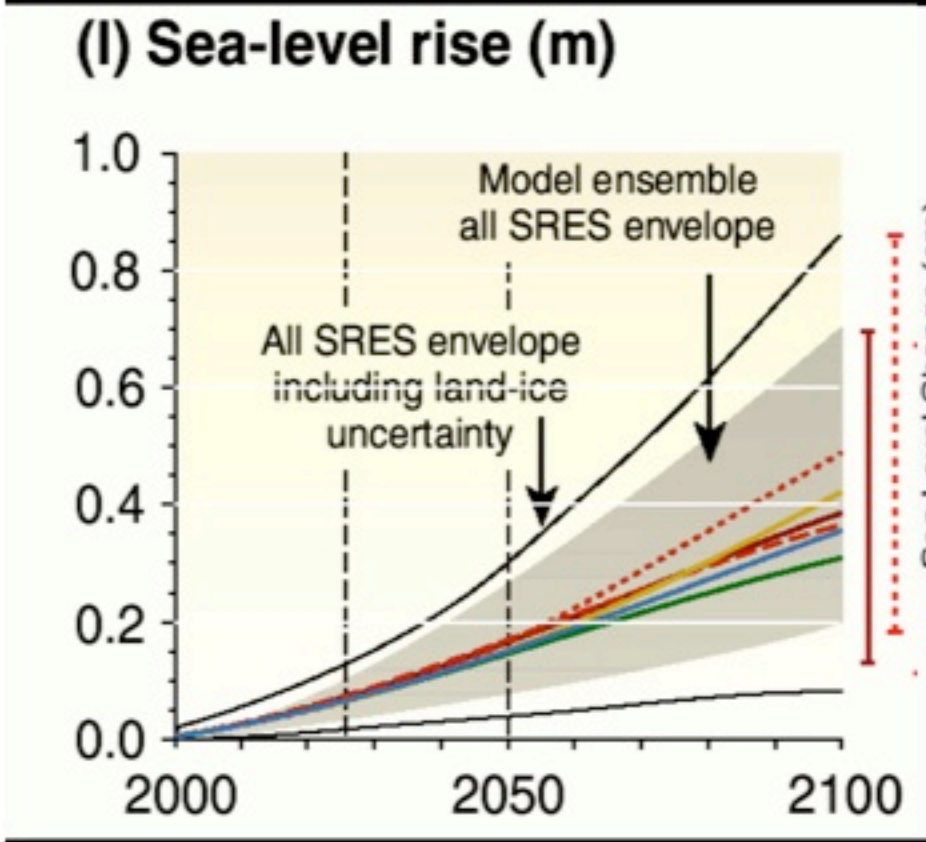


Sea-Level Forecast: IPCC 2001 & 2007

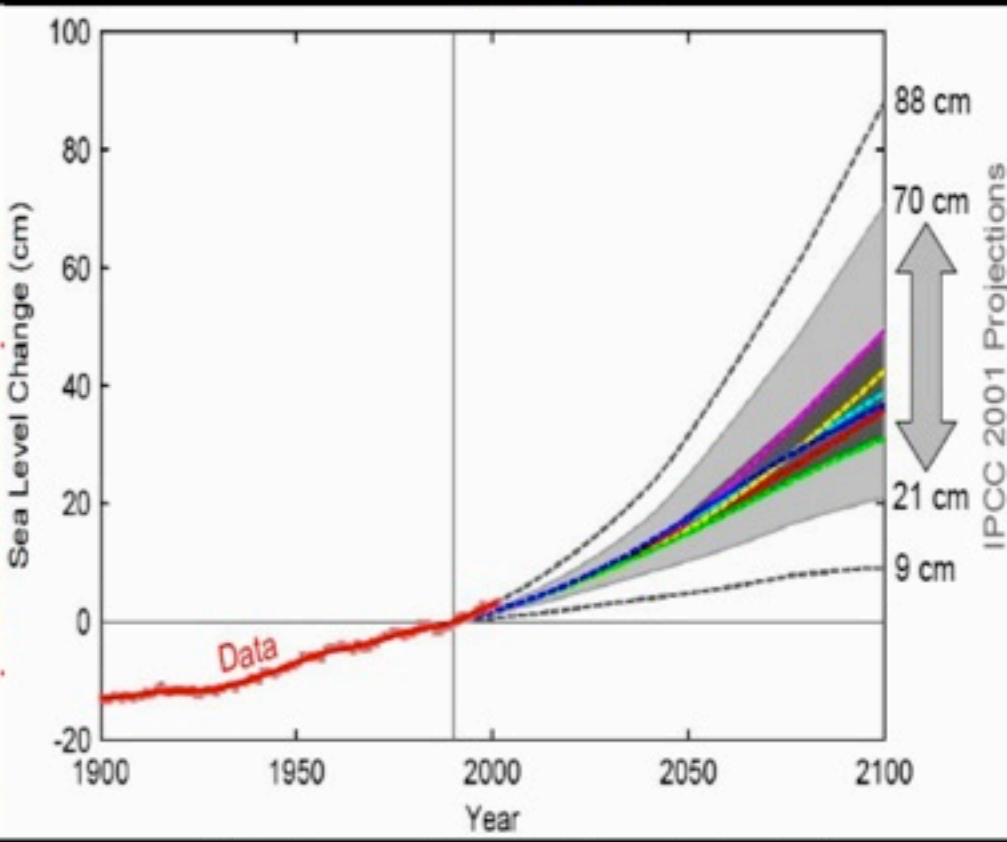
40cm (1.25ft) rise by 2100,
1m (3.3ft) by 2200
IPCC 2001 error estimate:
20-80cm

IPCC 2007 error: 20-60cm
(does not include ice sheet melting)

2001



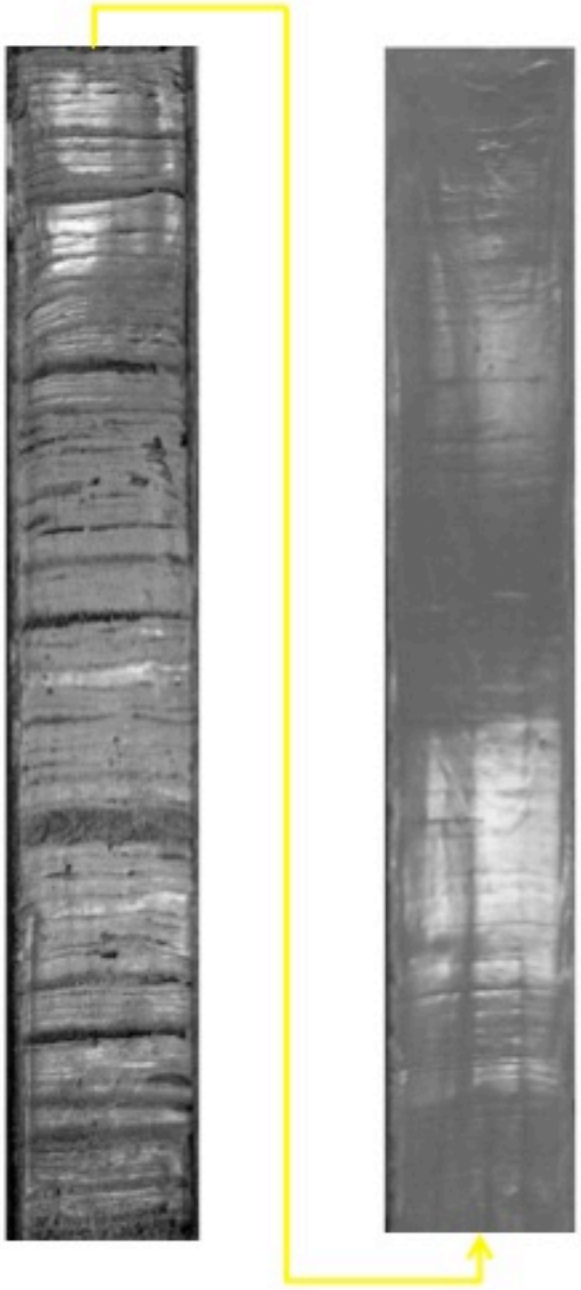
2007



http://www.realclimate.org/images/sealevel_1.jpg

Svalbard glaciers are *dynamic*

… and can lose ice FAST – we need to understand these processes (student talks)



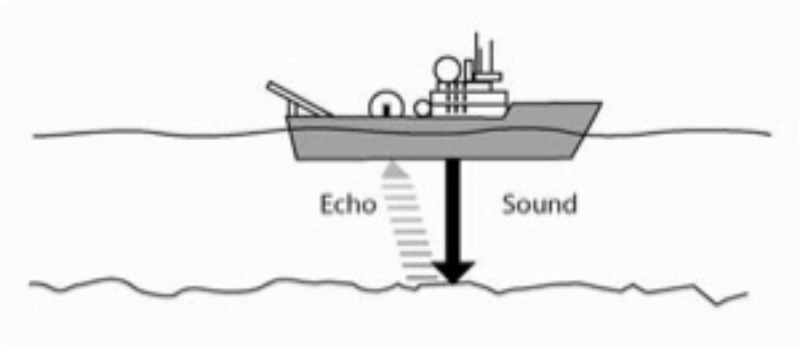
Understand older records –

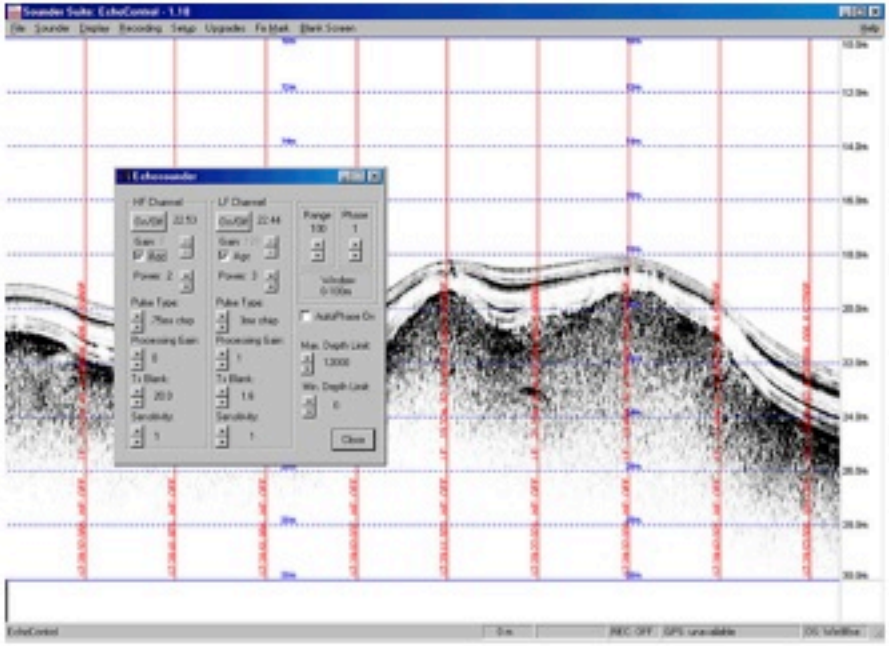
(more student talks…)

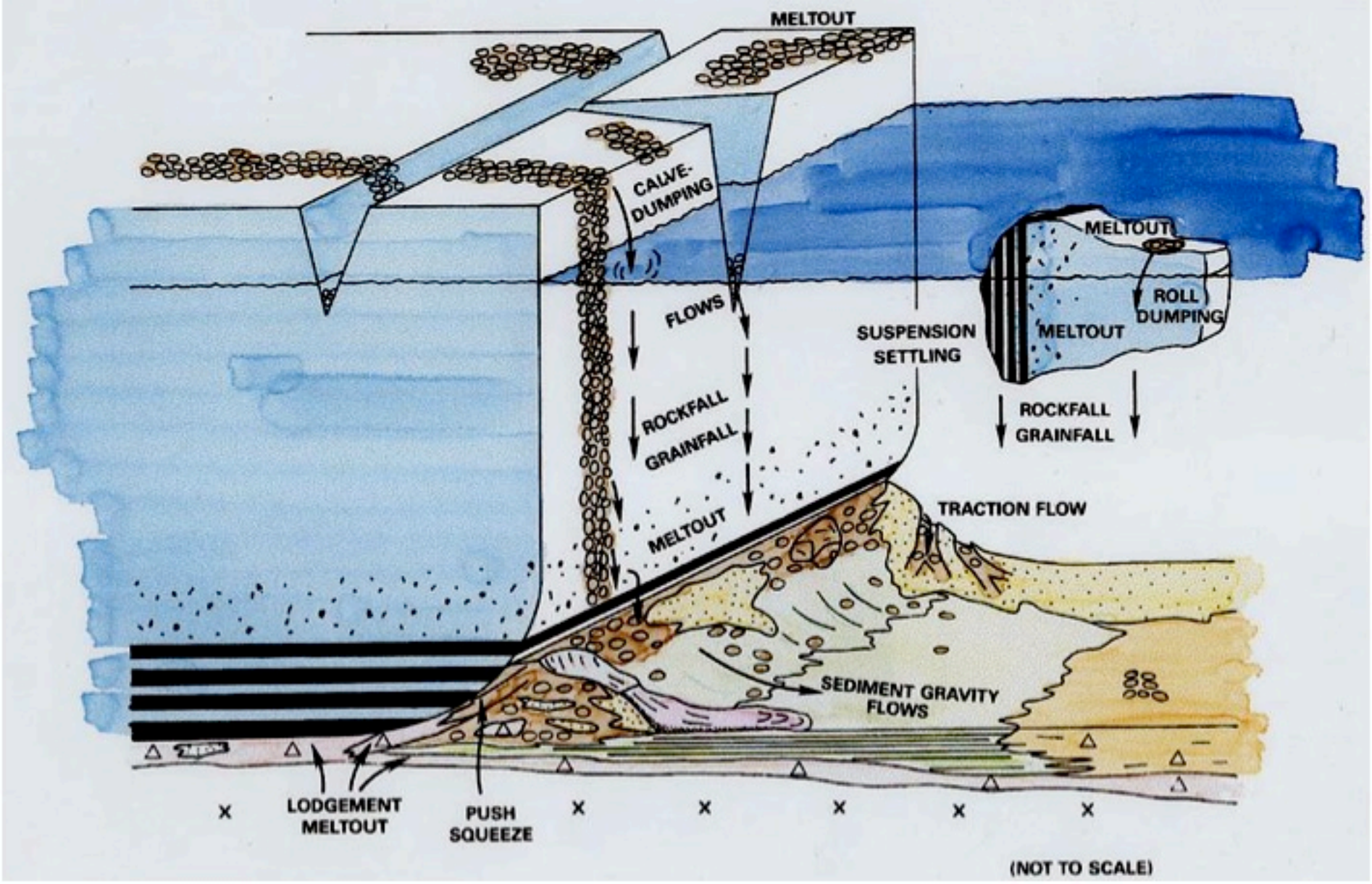
Shows rate of glacial retreat

Bathymetric Change at Kronebreen and Kongsvegen

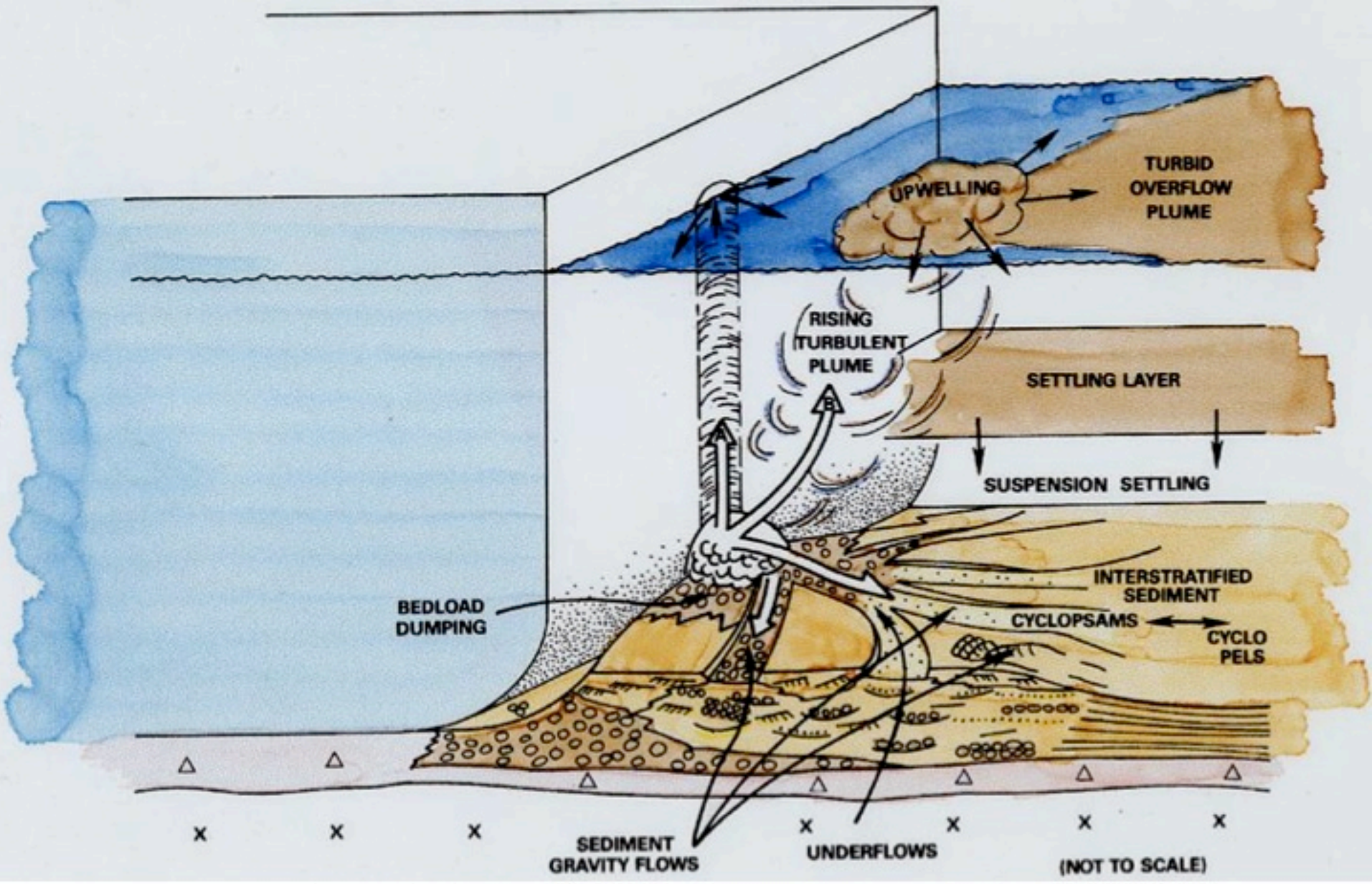
George Roth, University of Washington





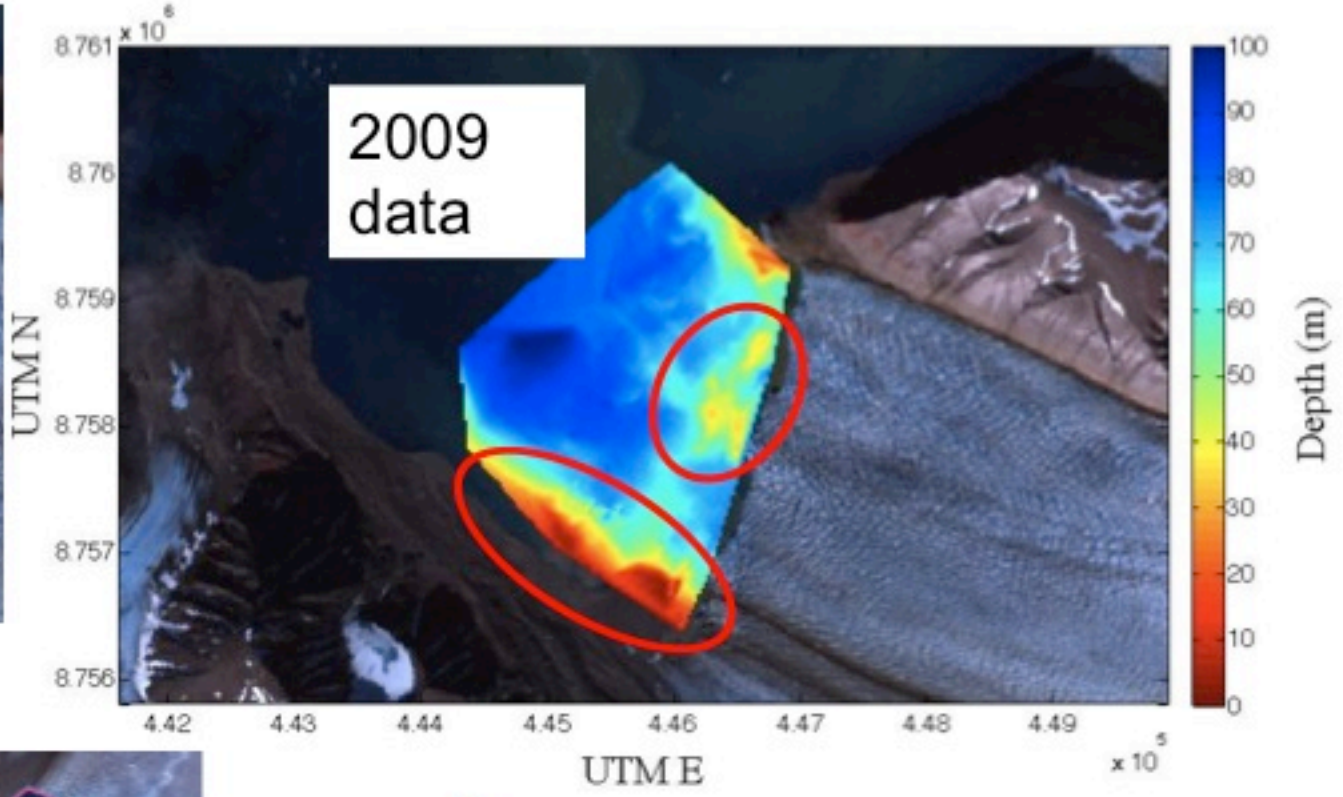


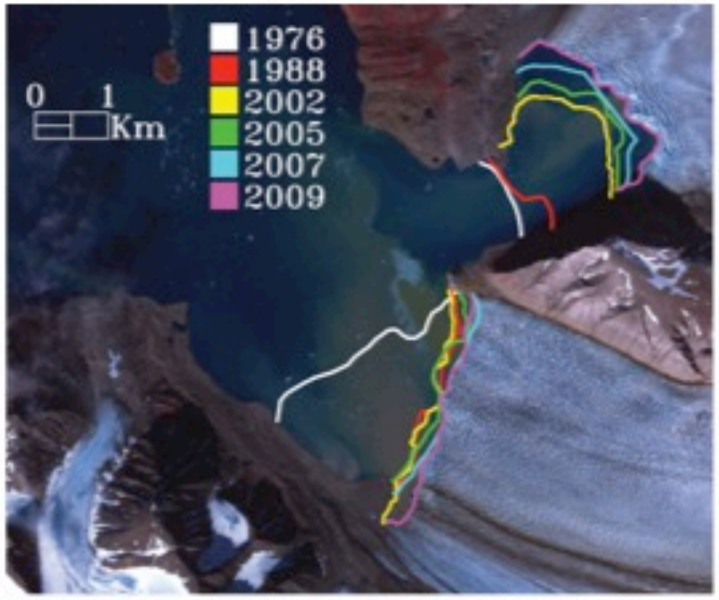
Morainal Bank deposits (Powell, 1981)



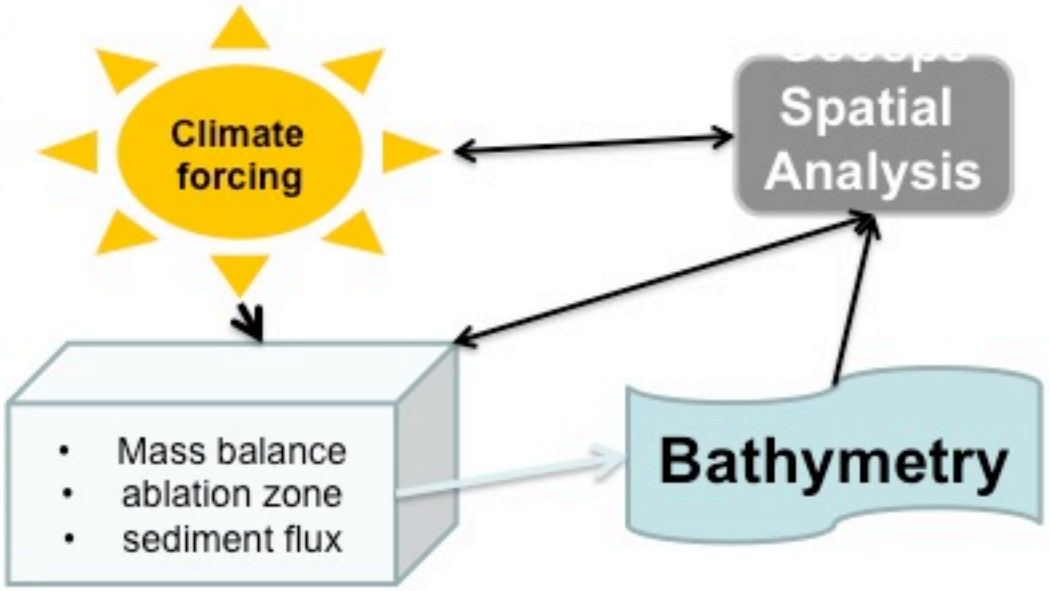
Grounding line fan (Powell, 1981)

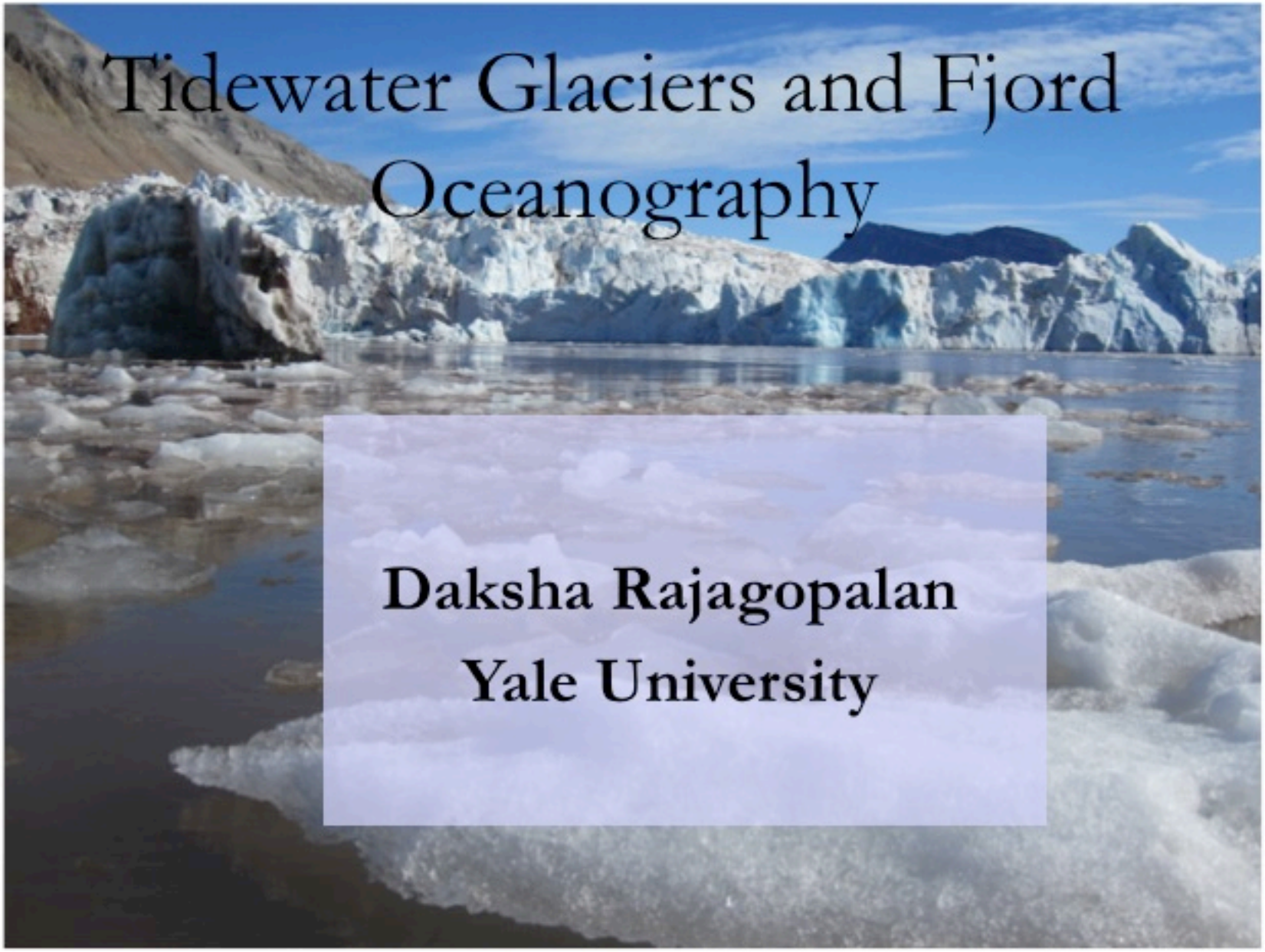
Images: Laura Kehrl, 2009 REU student





Glacier terminii over the last ~35 y





Tidewater Glaciers and Fjord Oceanography

Daksha Rajagopalan

Yale University

How Does Oceanography influence Tidewater Glaciers?

- Fjord circulation
- Water column structure
- Observations and

Modeling of ocean-ice interactions

The Equipment

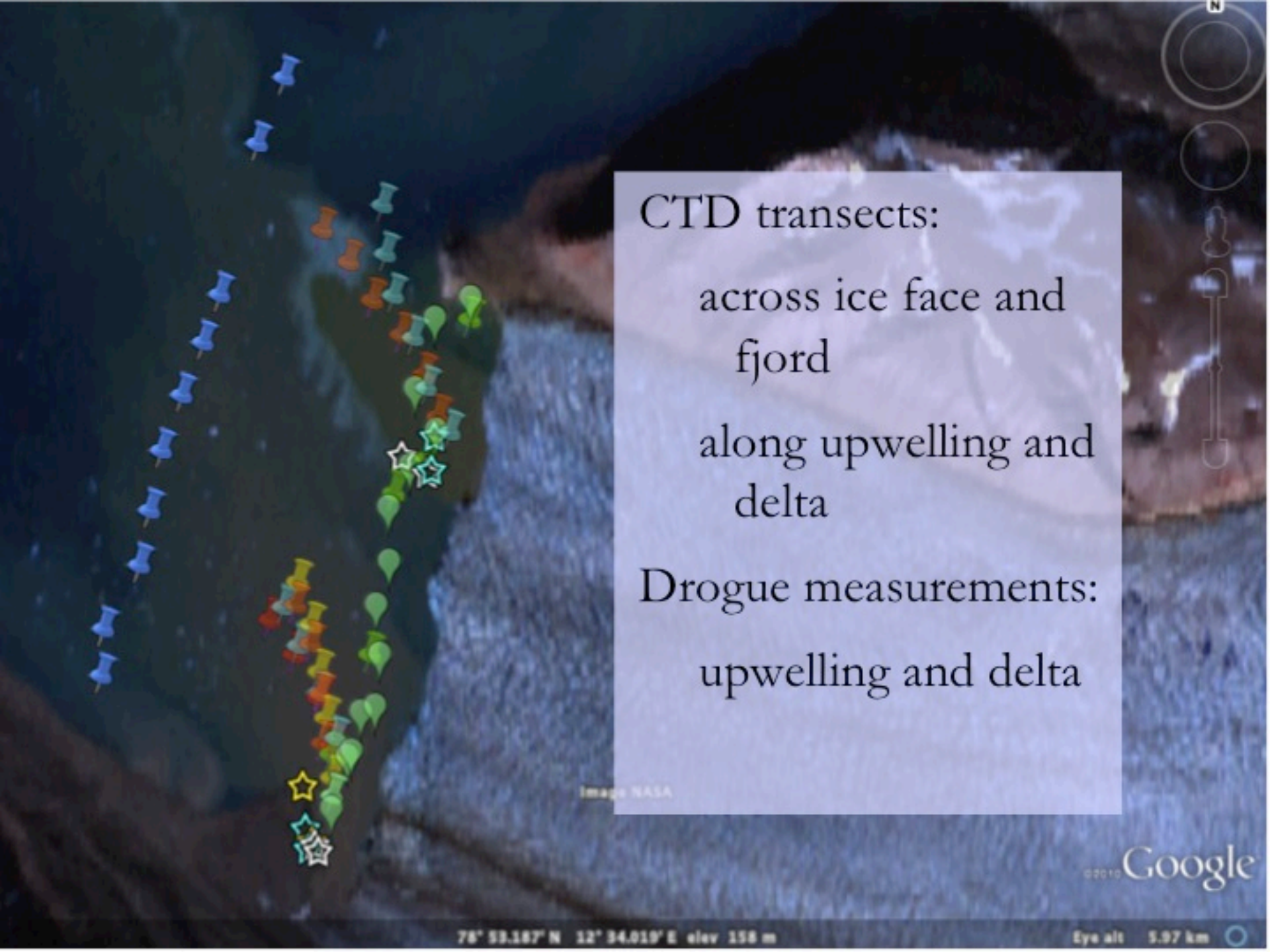
CTD conductivity temperature, depth using

Seabird 19

Seabird 19+ V2

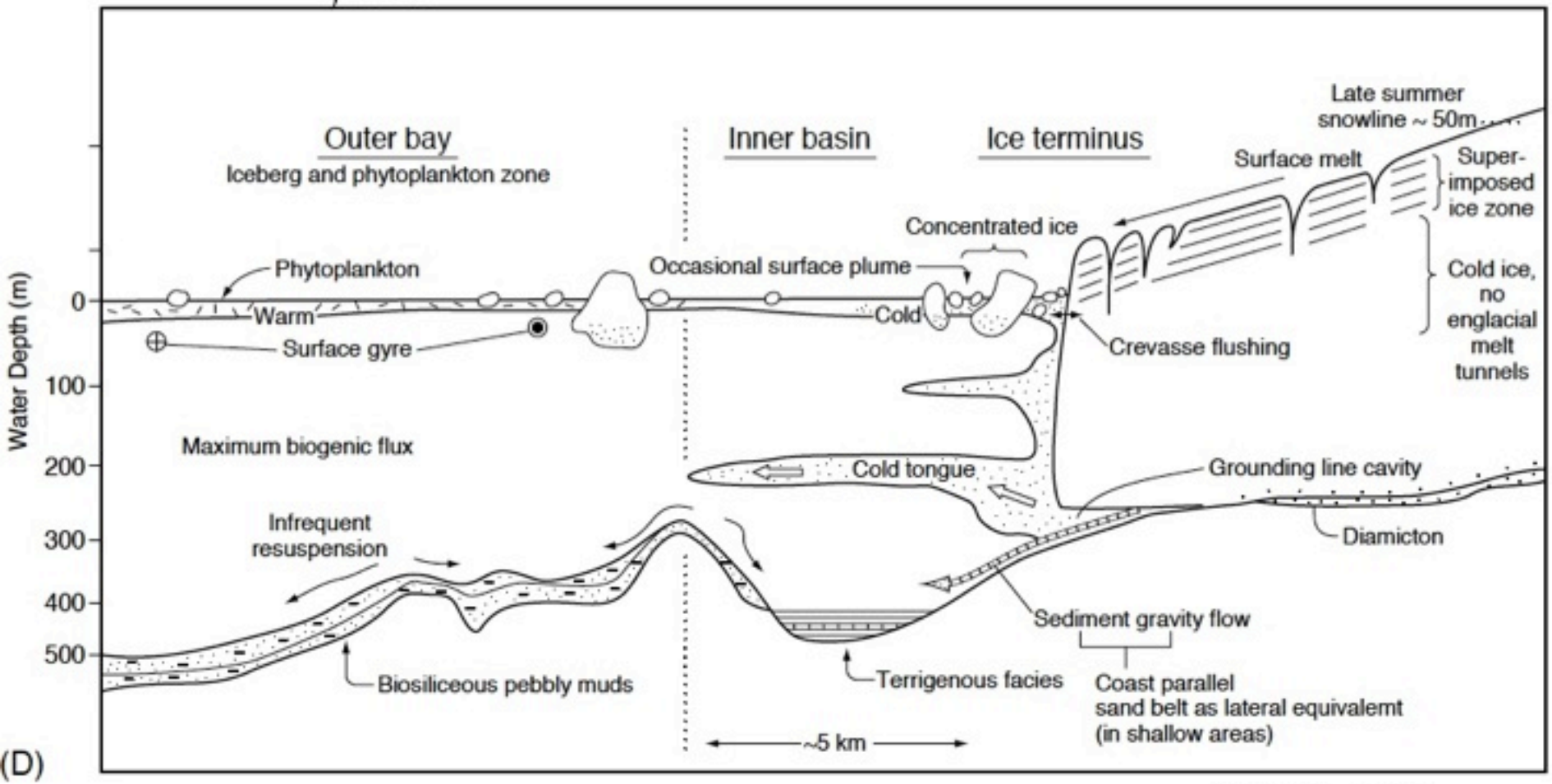
More Equipment – drogues to understand currents and water masses

Old bed sheets and recycled PVC


CTD transects:
across ice face and fjord
along upwelling and delta
Drogue measurements:
upwelling and delta
Image NASA
©2010 Google
78° 53.187' N 12° 34.019' E elev 158 m
Eye alt 5.97 km

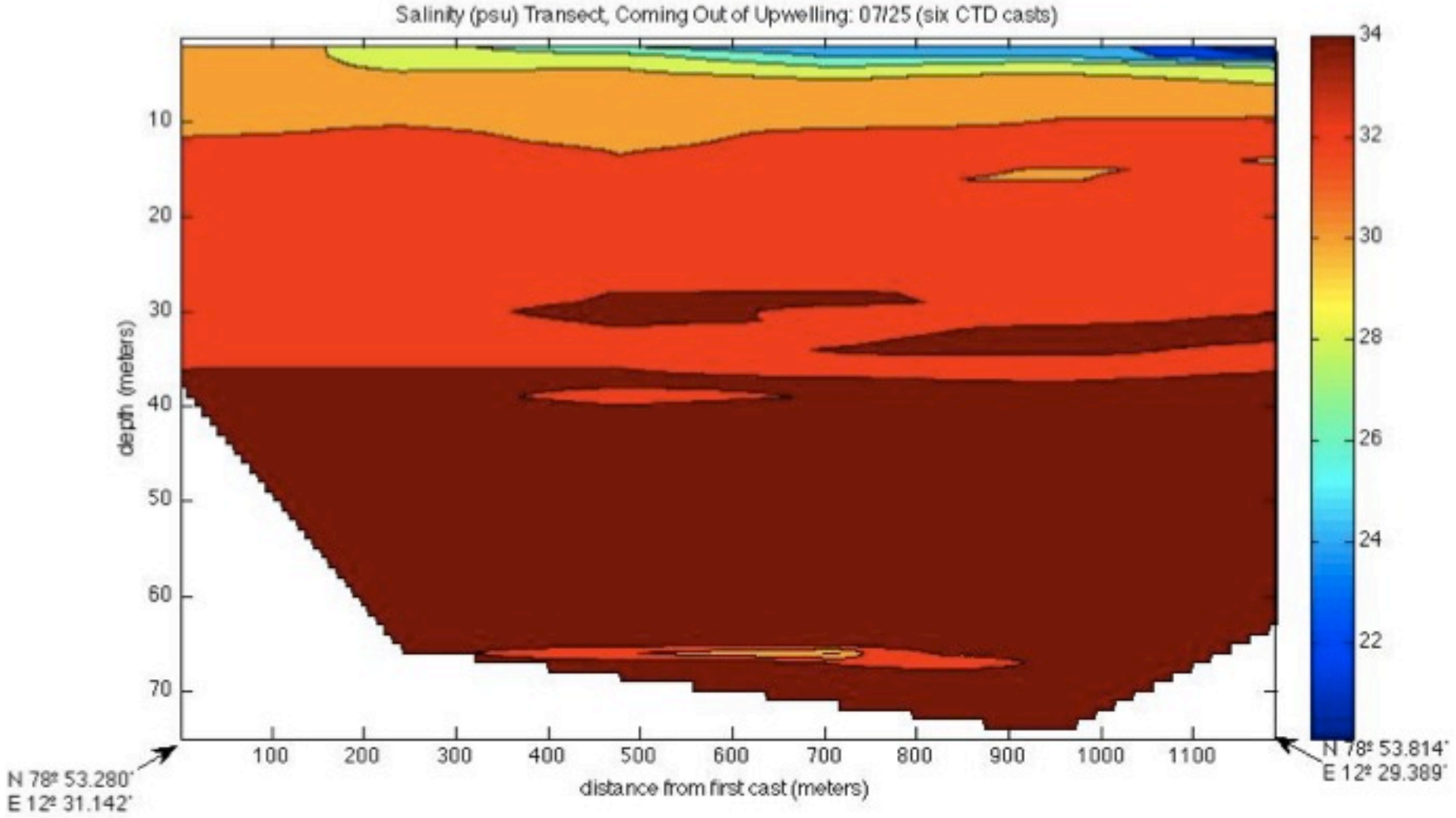
Interaction of the tidewater glacier face with the oceanography of the fjord

- where are the water masses near the ice face coming from? Does the North Atlantic Water penetrate this far into the fjord?

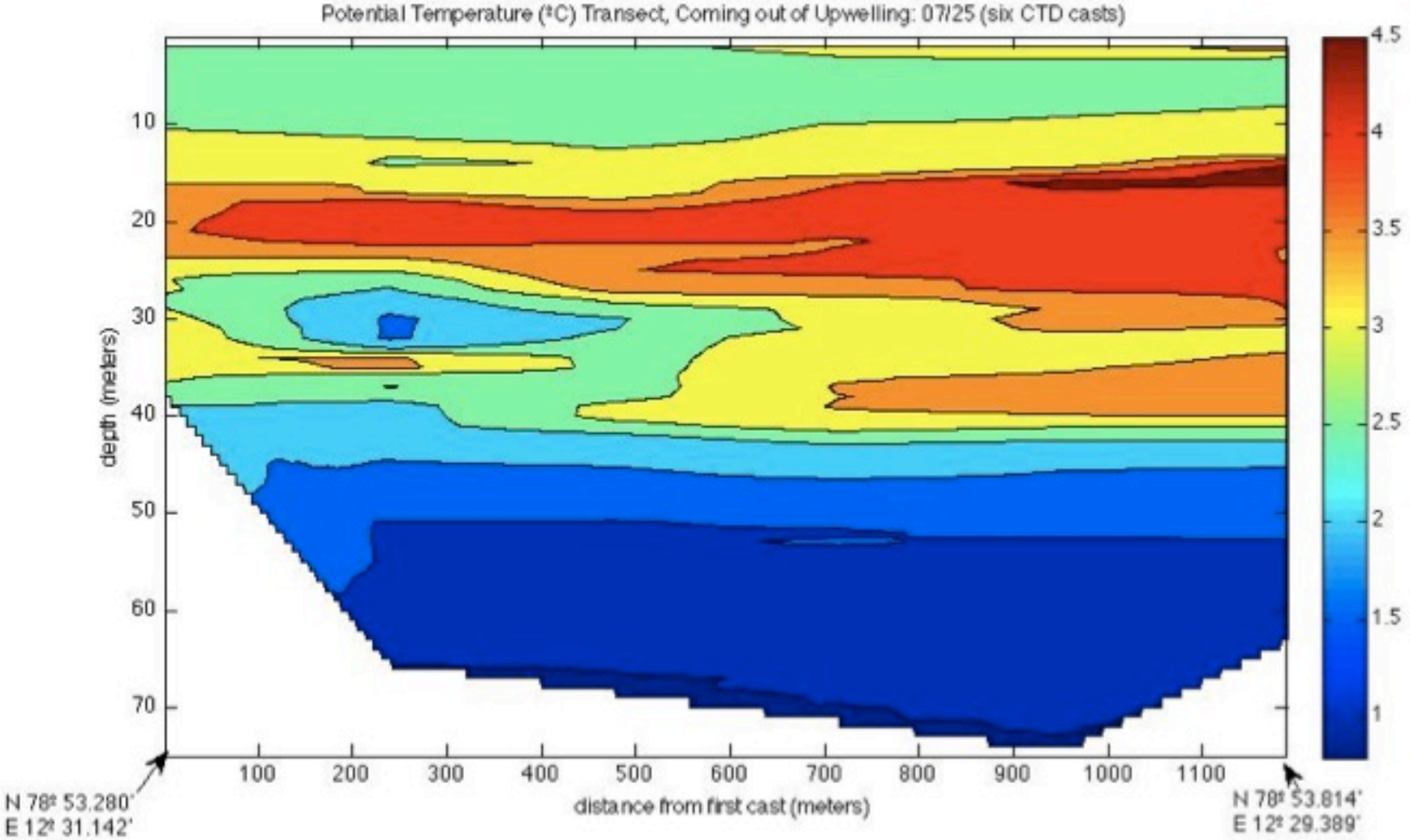


Powell, 2003

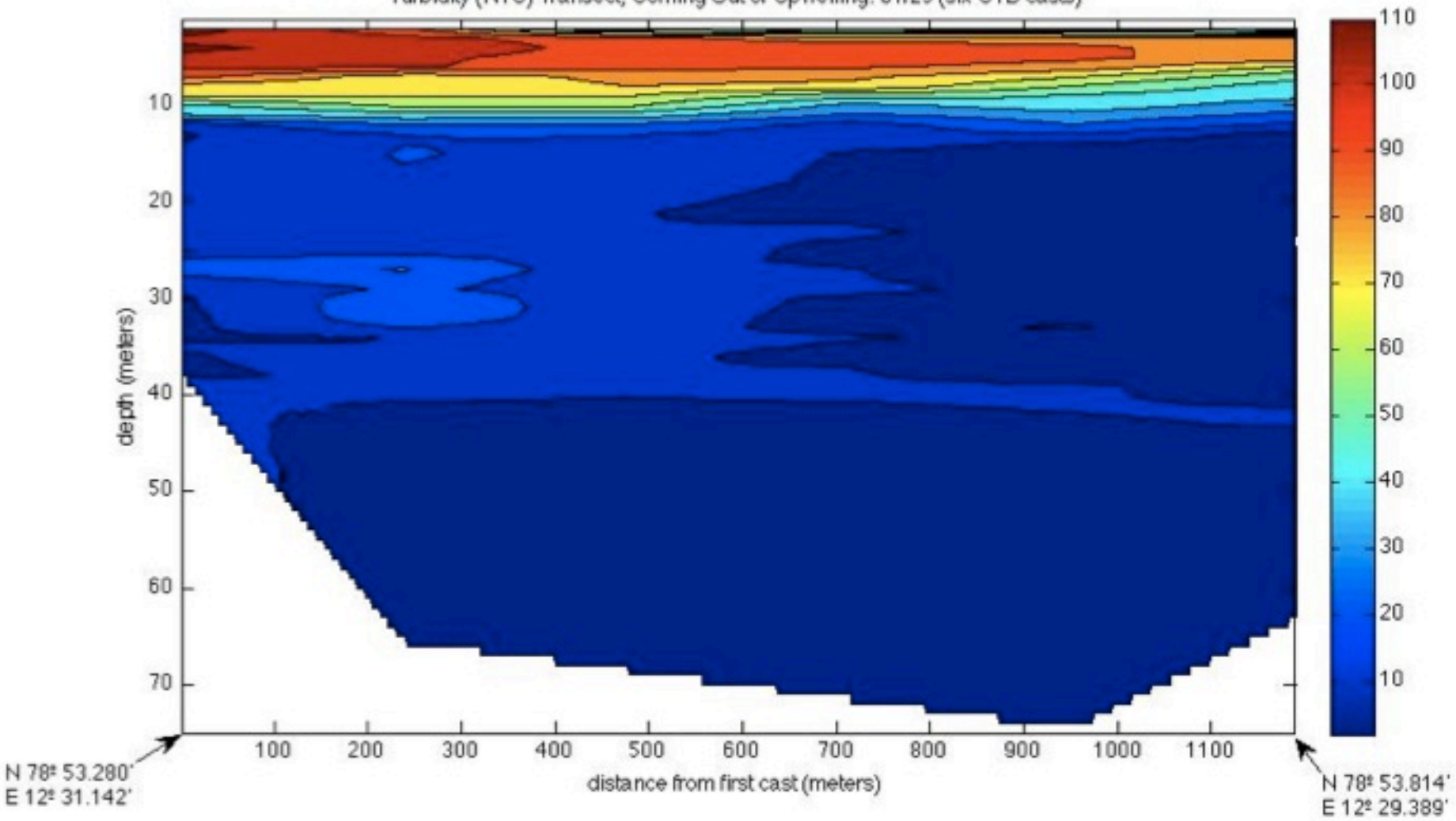
Salinity


Salinity (psu) Transect, Coming Out of Upwelling: 07/25 (six CTD casts)
depth (meters)
10
20
30
40
50
60
70
100
200
300
400
500
600
700
800
900
1000
1100
distance from first cast (meters)
34
32
30
28
26
24
22
N 78º 53.280'
E 12º 31.142'
N 78º 53.814'
E 12º 29.389'

Temperature



Turbidity


Turbidity (NTU) Transect, Coming Out of Upwelling: 07/25 (six CTD casts)
depth (meters)
10
20
30
40
50
60
70
100
200
300
400
500
600
700
800
900
1000
1100
distance from first cast (meters)
110
100
90
80
70
60
50
40
30
20
10
N 78º 53.280'
E 12º 31.142'
N 78º 53.814'
E 12º 29.389'

Calving Rates vs. Tides and Melt Rates at the ice face

Rebecca Siegel, Hampshire College

Programming the Hobo

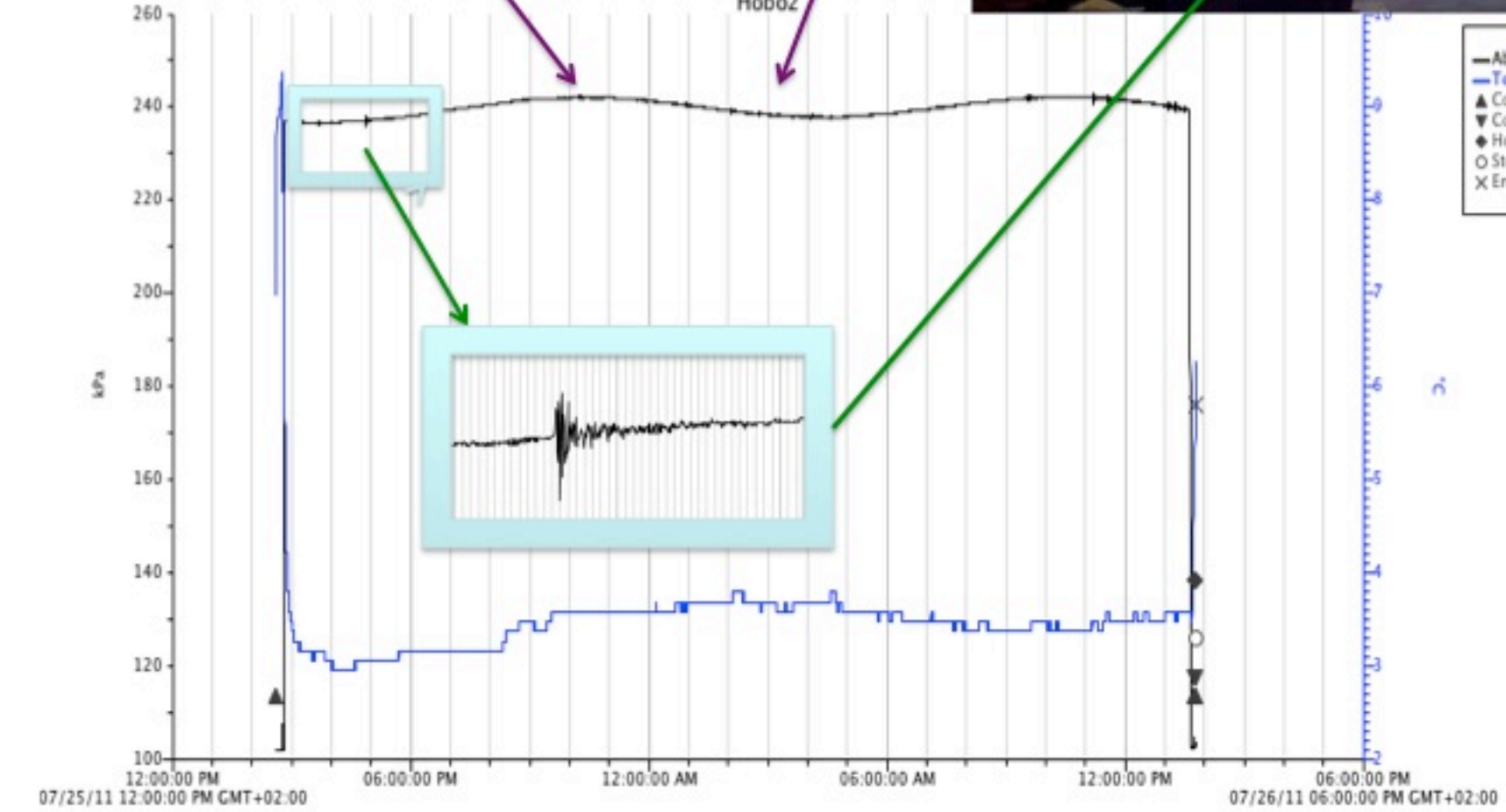
Delta Hobo Site

Rock Hobo Site

A Hobo

www.onsetcomp.com/

Delta Hobo Graph from July 26



Spatial distribution of sediment from Kronebreen and Kongsvegen glaciers

Liz Ceperley
Beloit College

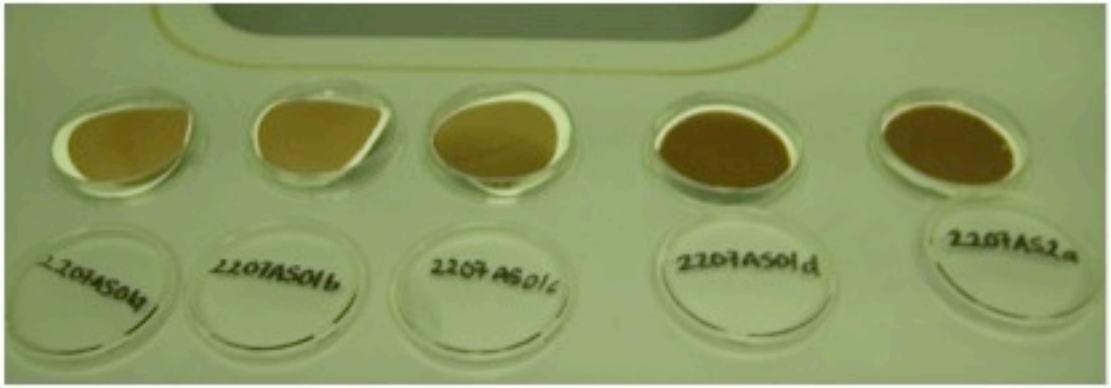
Where does it go?

Not mixing

Mixing

Collect water and box core samples to see if the sediment form the different sources is mixing or not mixing.

Use XRD



Till on icebergs

Bedrock composition can be found on icebergs and sediment in streams

Suspended sediment

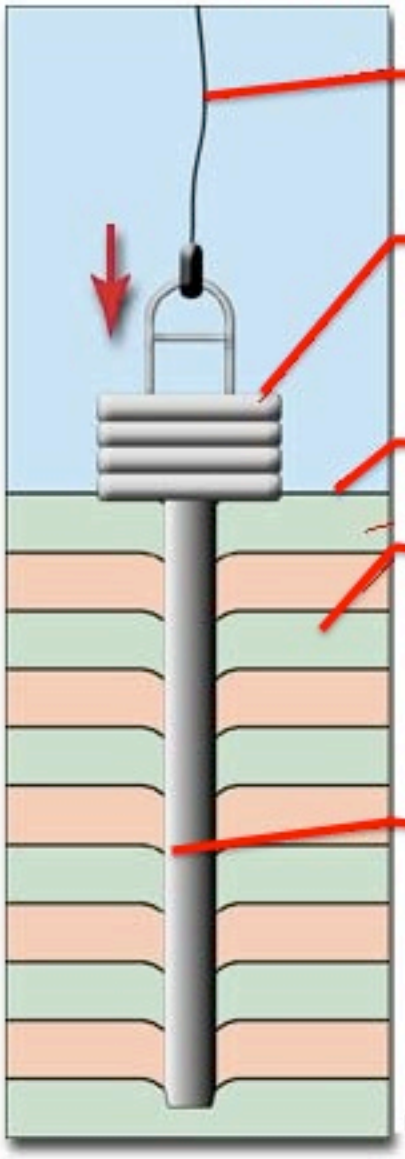
Use a box core to collect sediment from fjord floor

Rachel Valletta, Syracuse University
Daren McGregor, Colby College

Project Goals:

- How does core chemistry change as I go along the ice face of the glacier?
- Are there chemical patterns and relationships that change with respect to distance from the glacier/ down the fjord?
- Are effects of a warming climate (& thus rapid tidewater glacial recession) exhibited in fjord floor sedimentology over a decadal time scale?

Sediment cores



The corer is attached to a heavy steel cable that drops off our boat's winch

Heavy weights help the corer penetrate the seafloor

The seafloor may preserve micro layers, or "laminations"

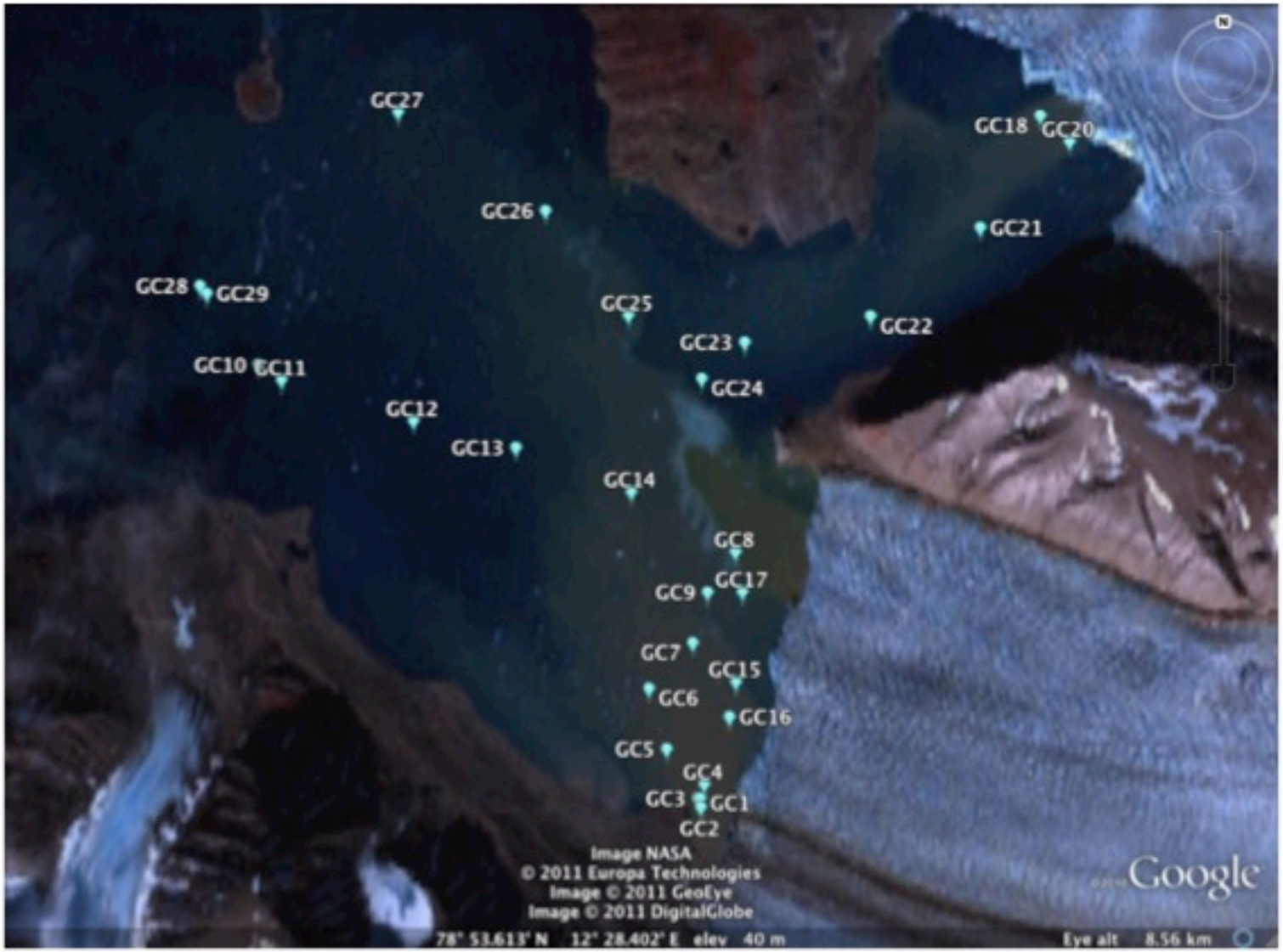
We lower the 'gravity corer' to ~10m above seafloor, then let it freefall (hopefully!) up to 1m deep

This is the core barrel; inside is a plastic core liner that keeps the sediment layers preserved and safe for travel

http://www.classroomatsea.net/

http://www.iaea.org/nael/page.php?page=2142

Localities


GC27
GC18
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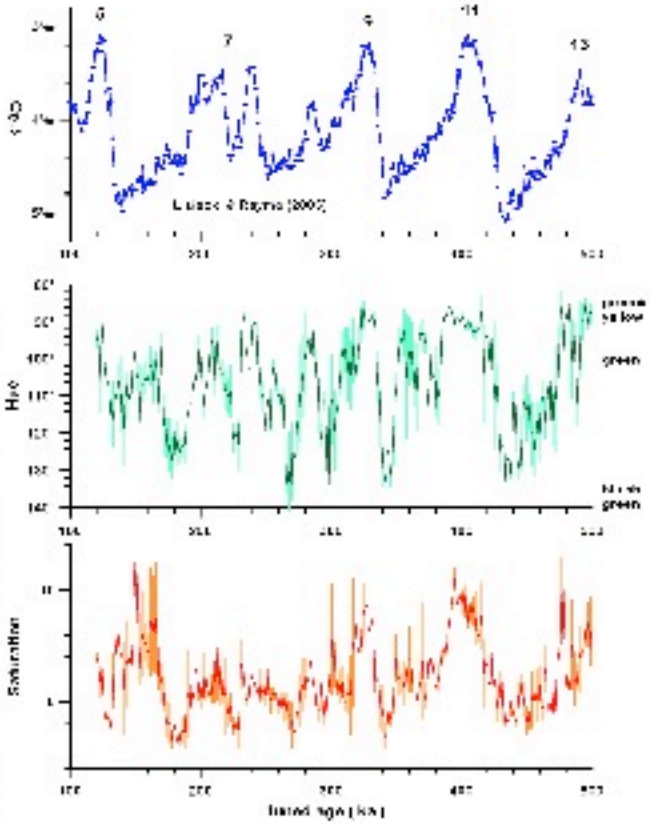
GC1
GC2
Image NASA
© 2011 Europa Technologies
Image © 2011 GeoEye
Image © 2011 DigitalGlobe
Google
78° 53.613' N 12° 28.402' E elev 40 m
Eye alt 8.56 km

Analytical Techniques

Step 1

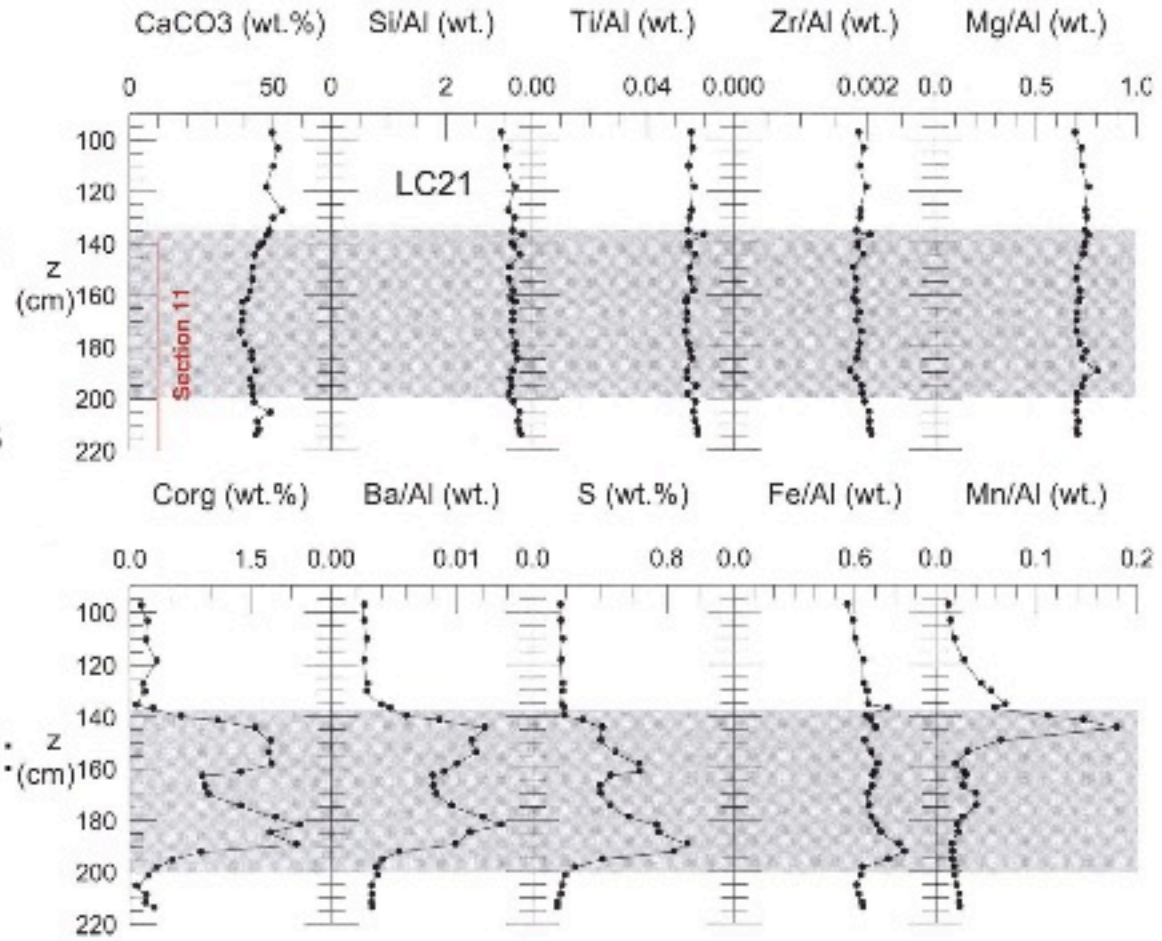
1) Initial core descriptions
2) Geotek Linescan imaging
3) P-wave velocity (Density)
4) Color Spectrophotometry
5) Magnetic susceptibility



Step 2. ITRAX XRF Analysis

What can data tell us?

- Chemical relationships or spikes in the XRF can be correlated to actual events in the history of the core.
  - A common example is $\delta^{18}O$ as a thermometer.
- Ca/Fe ratio can indicate how sediment is deposited: settling versus drifting.
- Sr/Ca ratio can indicate whether or not there is oceanic water entering the fjord.



Step 3. Dating by ^{210}Pb & ^{137}Cs

Learning Science Together is Fun!

- ✓ Hands on inquiry based learning and science planning
- ✓ Individual ownership of a research project

- ✓Team effort with use of jointly collected data sets
- ✓ Self reliance and problem solving.






As a Teacher, What am I bringing home?

- Experience of Polar Field Research
- Deeper understanding of glacial processes and climate change
- How and why scientific data is collected and what we do with it

Funding provided by

US National Science Foundation
Office of Polar Programs

Who support

REU – Research Experience for Undergraduates

Polar TREC – Teachers & Researchers Experiencing and Collaborating

NIU Northern Illinois University

UMASS AMHERST

POLAR TREC