

2009 Greenland/Antarctica OIB

Snow Radar

Data Results and Status

C. Leuschen, P. Gogineni, C. Allen





CReSIS Snow Radar



The University of Kansas
Center for Remote Sensing of Ice Sheets

PI: Carl Leuschen
Co-PI: Prasad Gogineni
GRAs: Ben Panzer
Aqsa Patel

NASA Collaborators:
Thorsten Markus
Don Cavalieri

Deployments:

- Spring 2009, NASA P-3: Greenland and Arctic Sea Ice.
- Fall 2009, NASA DC-8: Antarctica and Antarctic Sea Ice

Sample Results:

- Sample results obtained with a quick-look processing algorithm.
- Full SAR processing with motion correction will improve results with accurate geo-location and topography.
- Sea ice results show detection of air-snow and snow-ice interfaces.
- Land ice results show layering up to 20 meters below the surface.

Science Issues:

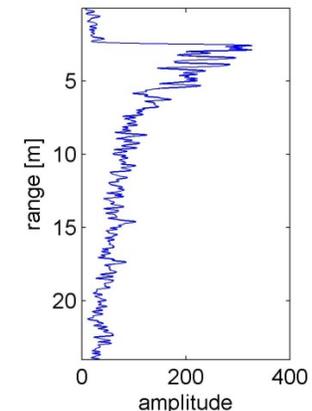
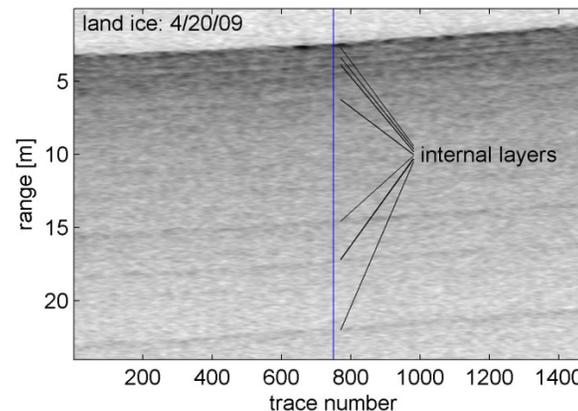
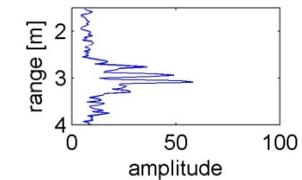
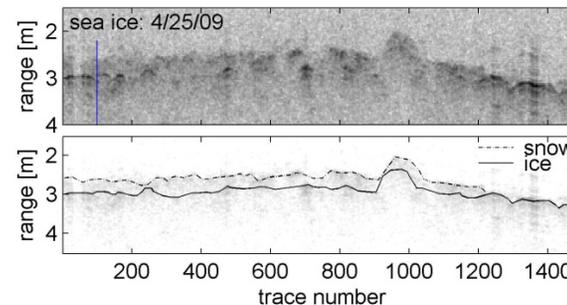
- Snow cover modulates ocean-ice-atmosphere interactions.
 - Reduces heat flux between sea ice and atmosphere.
 - Mechanical load changes sea ice freeboard.
- Snow cover introduces uncertainties in satellite altimetry height retrievals over sea ice.
 - ICESat-2, CryoSat-2.

Approach:

- Develop an ultra-wideband (2.5-7 GHz) radar to directly sound snow thickness.
- Deploy with laser and radar altimeters on airborne platforms to survey land and sea ice.

Data Products:

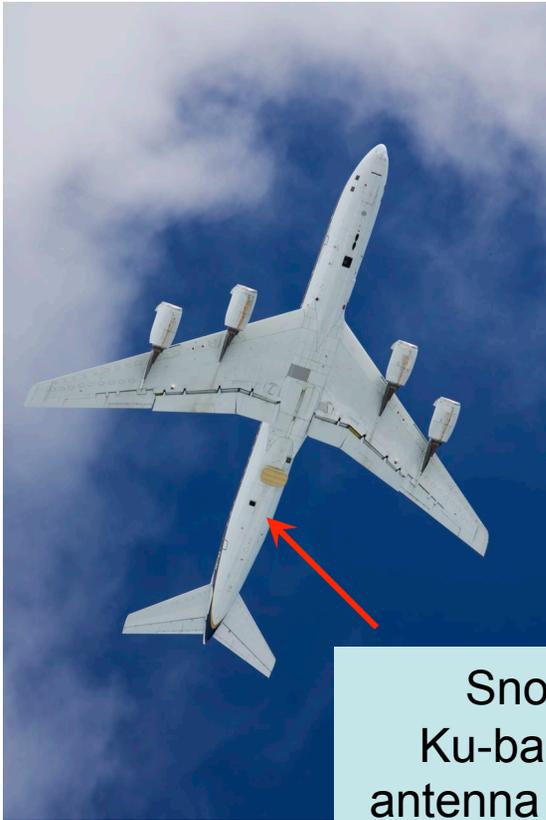
- Snow thickness on sea ice.
- High resolution surface topography.
- High resolution internal layering in the top ten meters of firn.



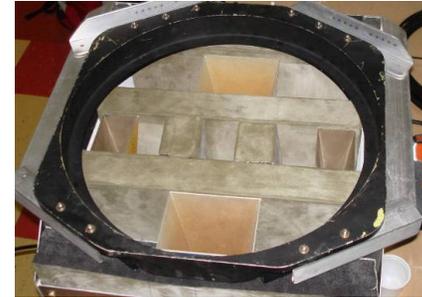
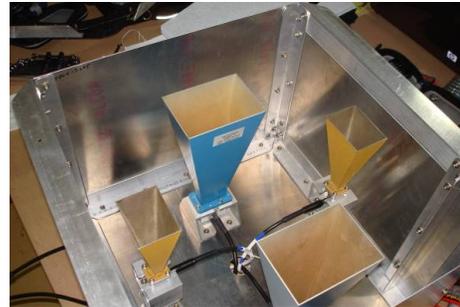
Installation Electronics



Installation Antennas



Snow and
Ku-band radar
antenna placement
(Nadir Port #9)



Snow and Ku-band antennas in metal enclosure (left) before and (right) after adding absorber material .



Internal cabling for
the Snow and Ku-
band antennas
mounted in the
belly of the DC-8.

Data Summary

DATE	FLIGHT DESCRIPTION	DATA [GB]
3/31/2009	Arctic Sea Ice	234.00
4/1/2009	E. Greenland	227.00
4/2/2009	Cross Arctic Sea Ice	289.00
4/5/2009	Cross Arctic Sea Ice	293.00
4/6/2009	NW Greenland Glaciers	242.00
4/17/2009	NW Greenland Glaciers	373.00
4/20/2009	NE Greenland	457.00
4/21/2009	Sea ice-envisat overflight NOAA	271.00
4/22/2009	NW Greenland Glaciers	395.00
4/23/2009	East Central Greenland	381.00
4/24/2009	Eastern Greenland	380.00
4/25/2009	Sea ice- Greenarc overflight- NOAA	247.00
4/27/2009	W. Greenland/Jacobshaven	359.00
4/28/2009	Jacobshaven	370.00
5/1/2009	E. Greenland	356.00
5/2/2009	S. Greenland	316.00
5/5/2009	W. Central Greenland	160.00
		5350.00

Data Summary

DATE	FLIGHT DESCRIPTION	DATA [GB]
10/16/2009	Getz Ice Shelf	172.00
10/18/2009	Pine Island Area	189.00
10/20/2009	Pine Island Glacier	226.00
10/21/2009	Sea Ice, Bellingshausen and Amundsen Seas	253.00
10/24/2009	Sea Ice, Weddell Sea	350.00
10/27/2009	Pine Island Glacier	196.00
10/28/2009	Thwaites, Smith, Koehler Glaciers	200.00
10/29/2009	Pine Island Glacier	275.00
10/30/2009	Sea Ice Weddell Sea	350.00
10/31/2009	Antarctic Peninsula	275.00
11/2/2009	Thwaites, Smith, Koehler Glaciers	275.00
11/3/2009	Antarctic Peninsula	275.00
11/7/2009	Pine Island Glacier- Abbot Ice Shelf	366.00
11/9/2009	Pine Island Glacier	327.00
11/12/2009	Abbot Ice Shelf	296.00
11/15/2009	Antarctic Peninsula-Drewry and Evans Ice Streams	346.00
	Antarctic Peninsula- Larsen C- Starbuck, Sumner,	
11/16/2009	Melville glaciers, LARISSA and SOLIS camp sites	310.00
11/18/2009	Thwaites, Smith, Koehler Glaciers	277.00
		4958.00

Data Quality

Greenland sea ice flights

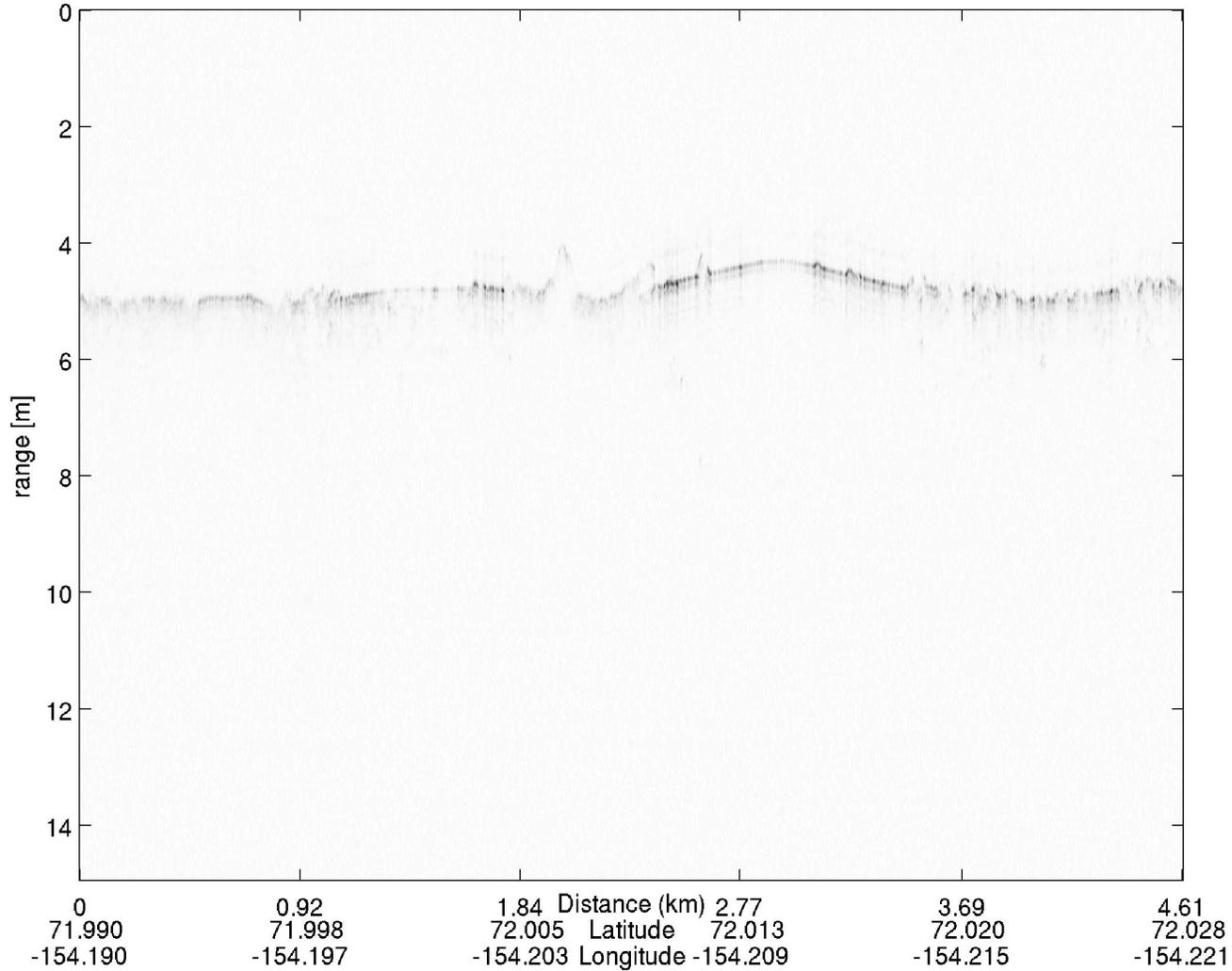
- 03/31/09: 10% - incorrect attenuator settings (first instrument flight)
- 04/02/09: 50% discernable snow thickness, 80% surface
- 04/05/09: 50%, 80%
- 04/21/09: 50%, 80%
- 04/25/09: 50%, 80%

Antarctic sea ice flights

- 10/21/09: 30%, 80%
- 10/24/09: 30%, 80%
- 10/30/09: 30%, 80%

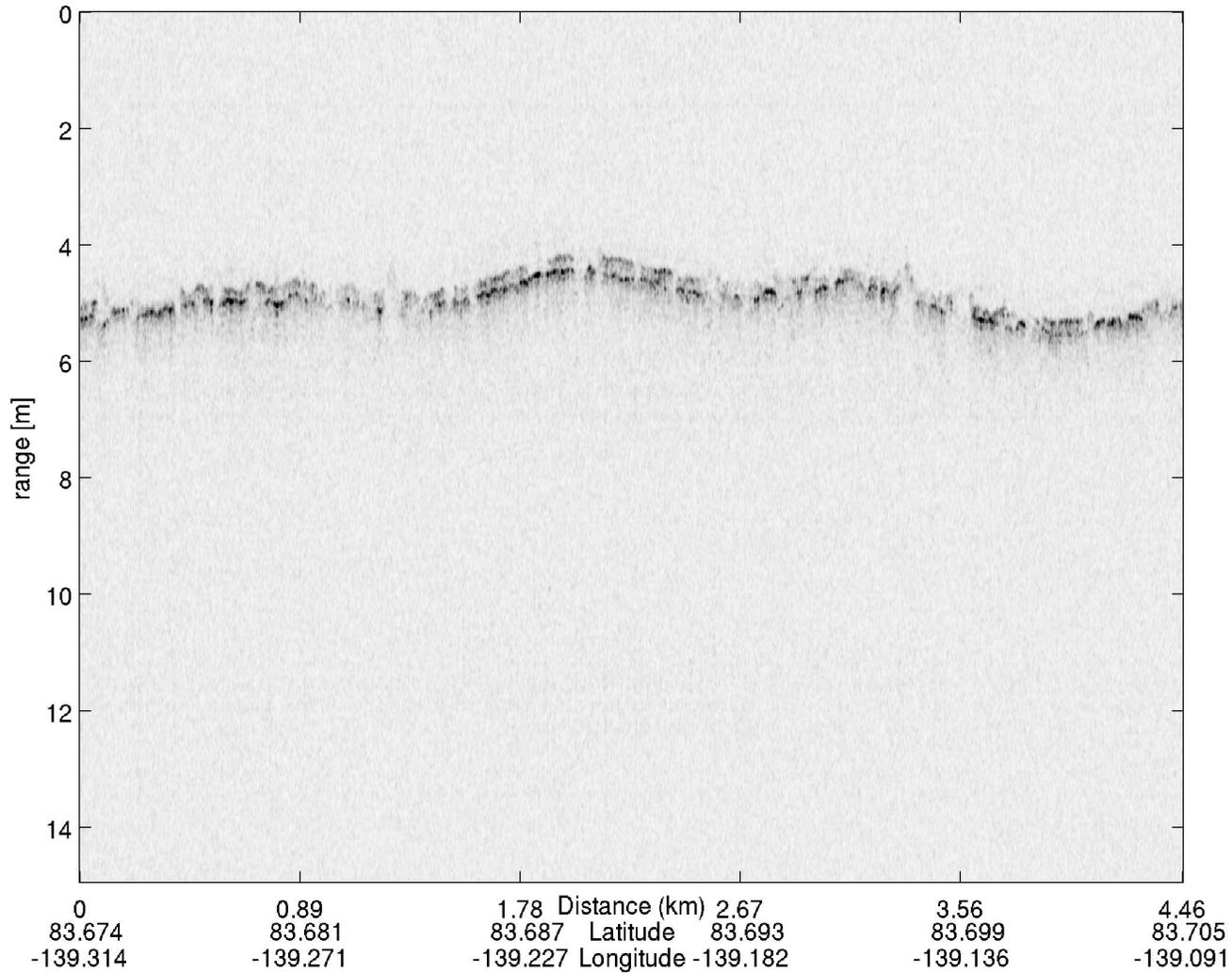
Example Data

Echogram 0024, Thule to Fairbanks, 04/02/2009



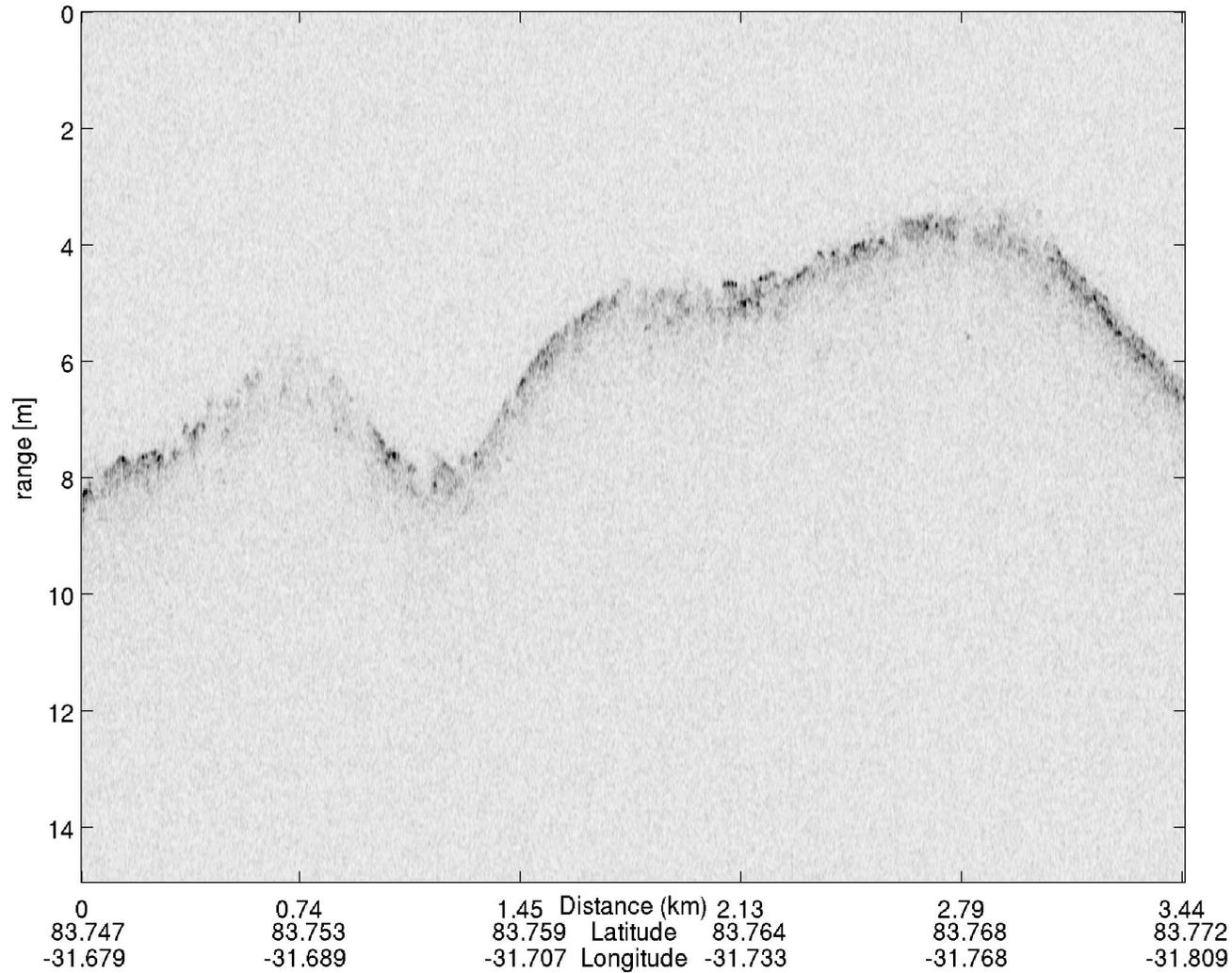
Example Data

Echogram 0343, Fairbanks to Thule, 04/05/2009



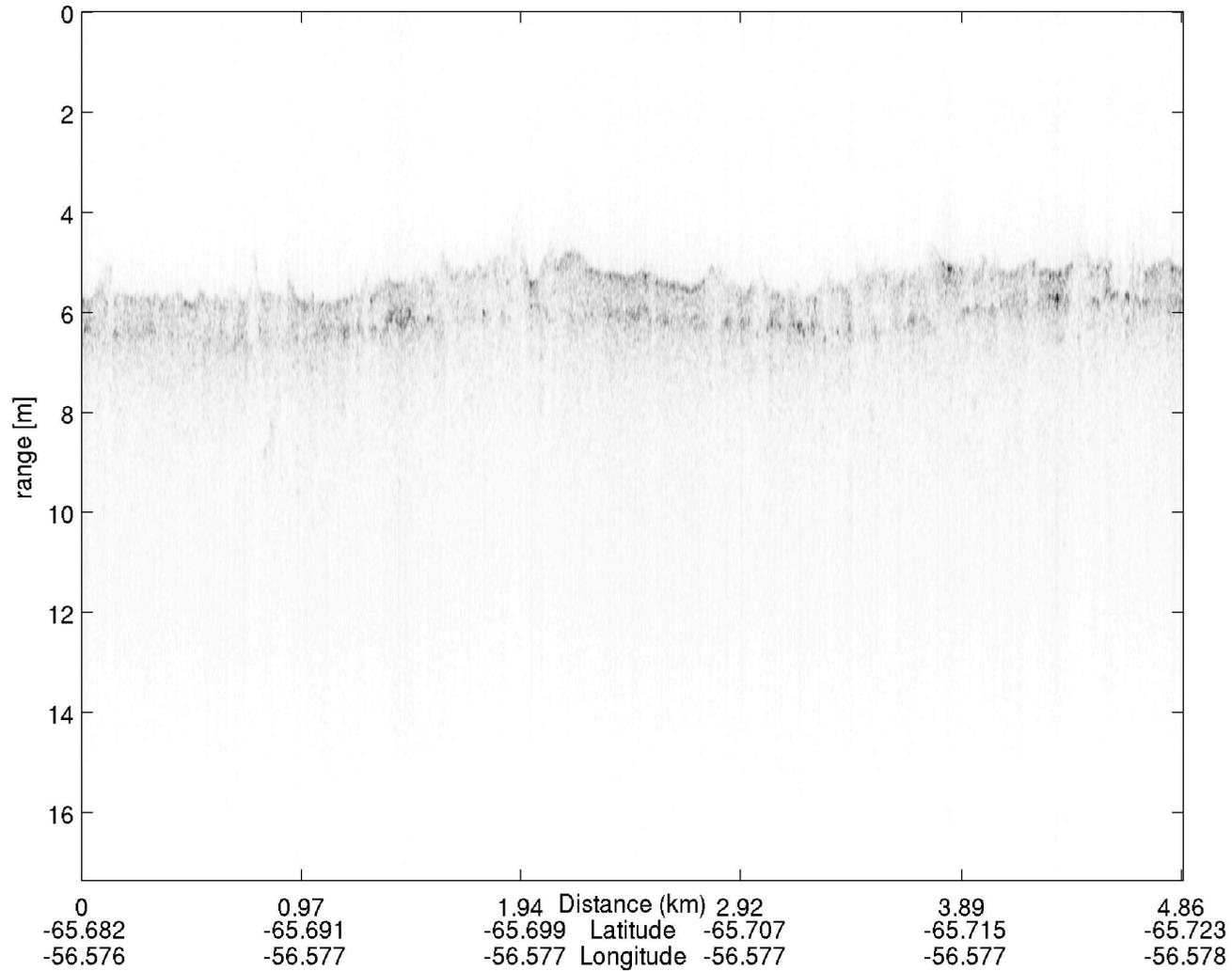
Example Data

Echogram 0010, Ice camp mission, 04/25/2009



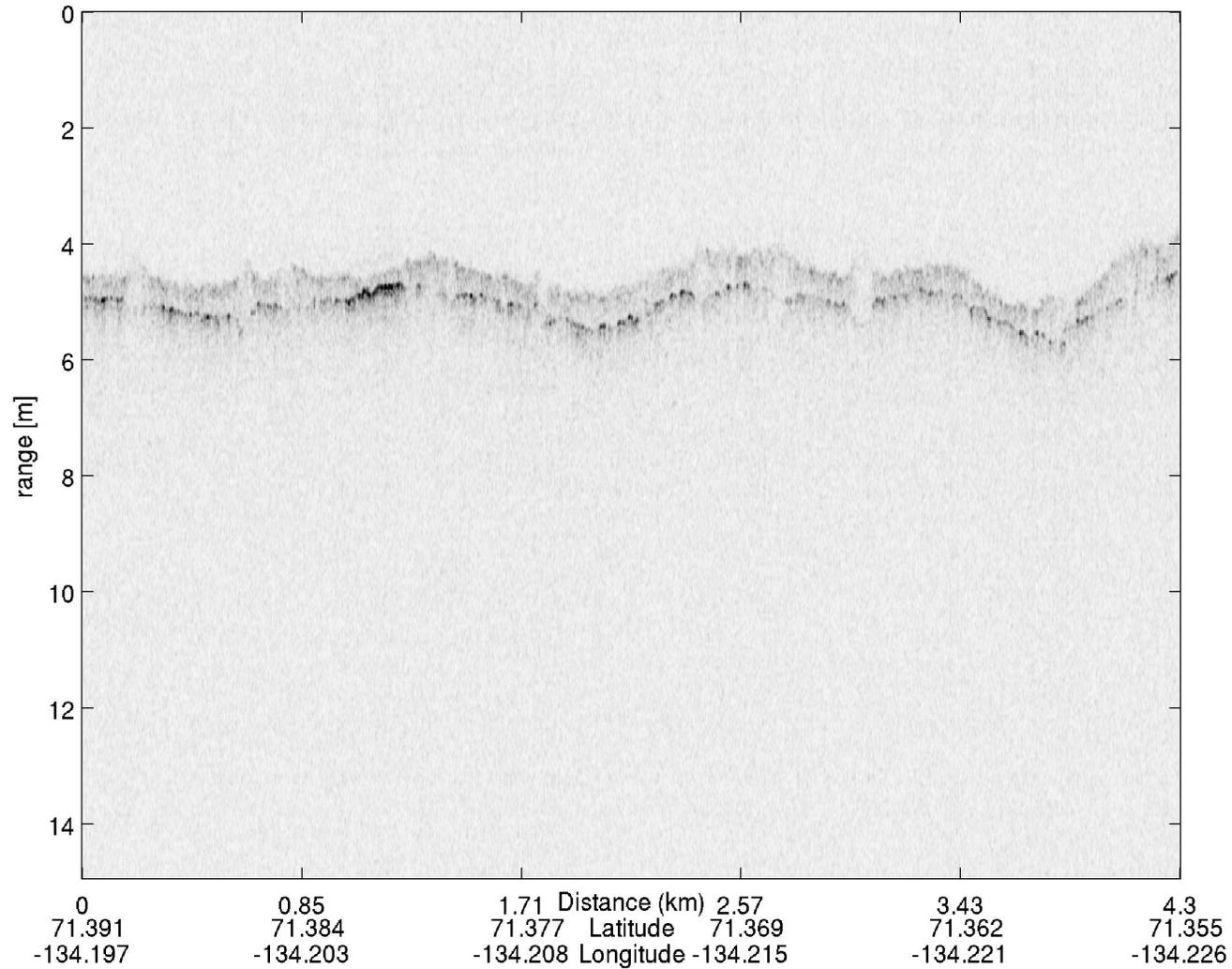
Example Data

Echogram 0030, Weddell Sea, 10/30/2009



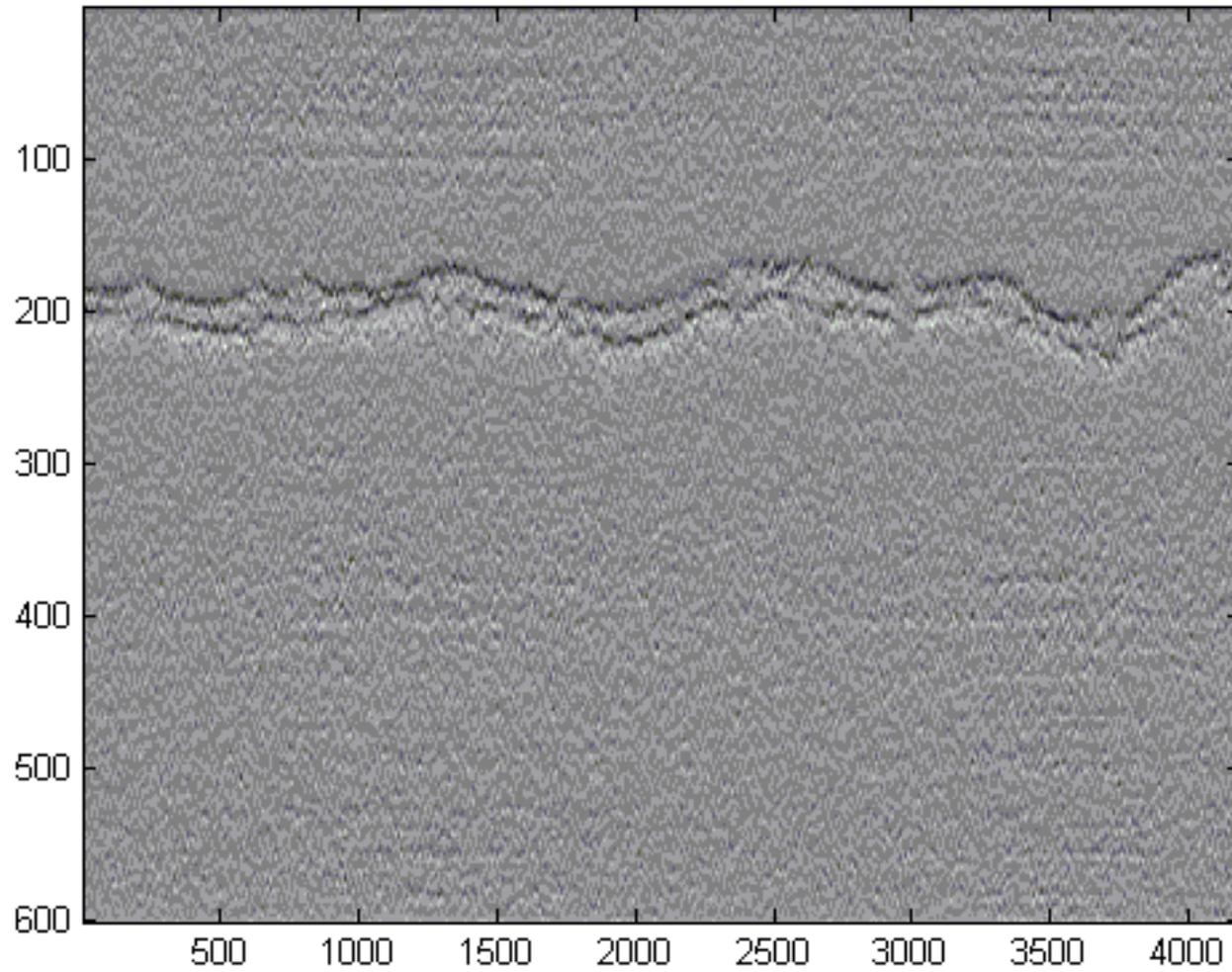
Processing

Echogram 0409, Fairbanks to Thule, 04/05/2009

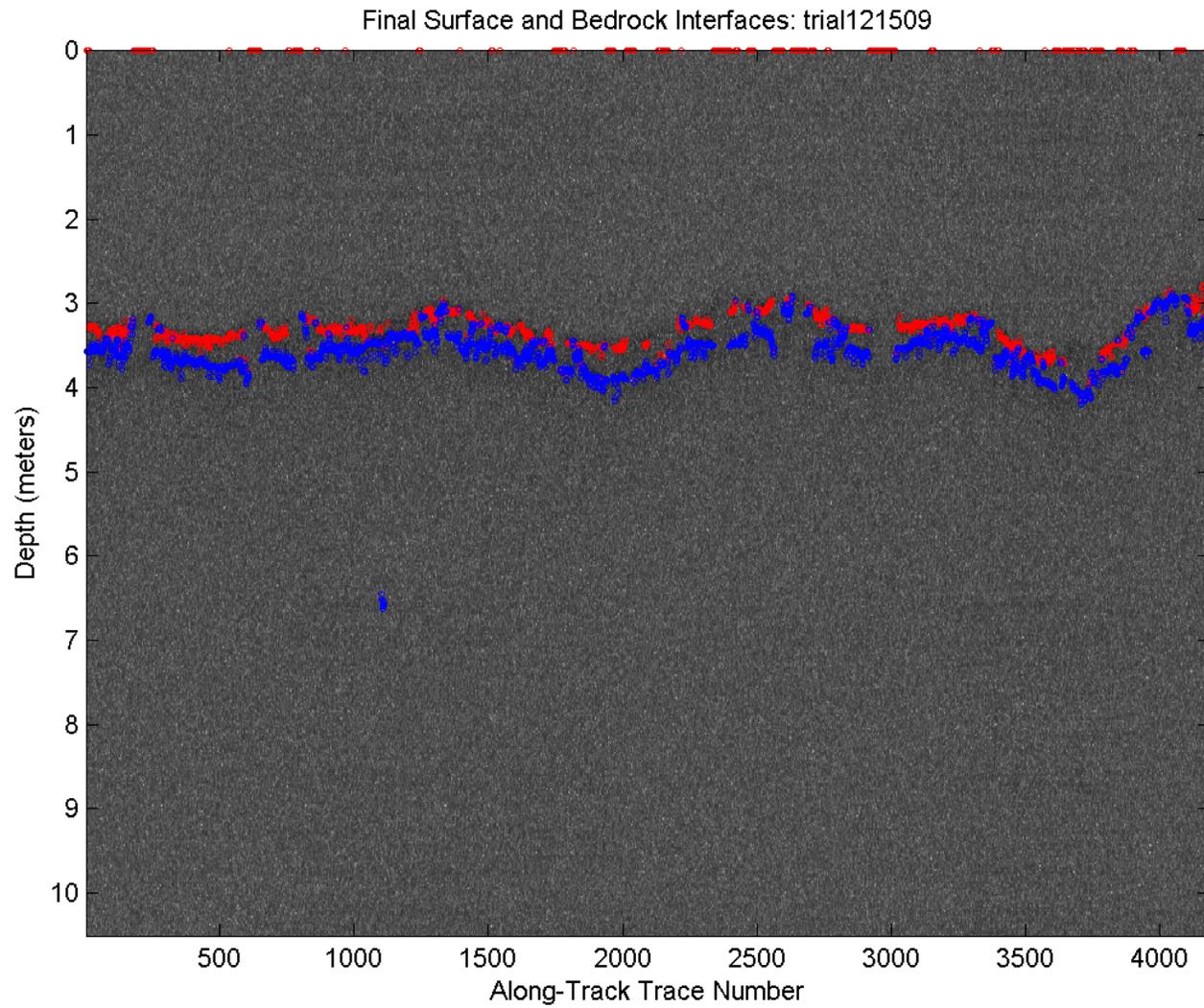


Processing

Vertical Gradient



Processing



Status and Schedule

- Greenland 2009 sea ice data has been processed to form echograms.
 - not final product
 - Incorporate aircraft motion correction
- Sample data for Antarctica land and sea ice processed for quality assessment.
- February 5th - Full processing code
 - (pulse compression, coherent integration, and incoherent integration) with altitude correction and calibration.
- February 12th - Greenland sea ice processed
- February 19th - Greenland land ice processed
- February 26th - Antarctic sea ice processed
- March 5th - Antarctic land ice processed
- March 26th - Preliminary layer picking

Additional Images

