Status and Recent Results From the CReSIS Ku-Band and Snow Radars

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Outline

- Data Products
- System Hardware Changes
- Snow Thickness
- Ku-Band Analysis
- Summary

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Data Products

Season	Snow Radar	Ku-band Altimeter		
2009 Greenland P3	Old	No Data		
2010 Greenland DC8	Old	Old	**Old**	Processed, old
2010 Greenland P3	Old	Old		format
2011 Greenland P3	New	New	**New**	Processed
2012 Greenland P3	Raw	Raw	**Raw**	To be processed
2009 Antarctica DC8	Old	Raw		
2010 Antarctica DC8	Old	Old		
2011 Antarctica DC8	New	New		
2012 Antarctica DC8	Raw	Raw		

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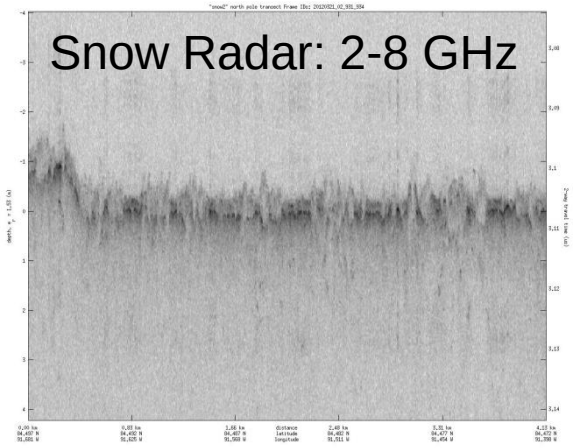
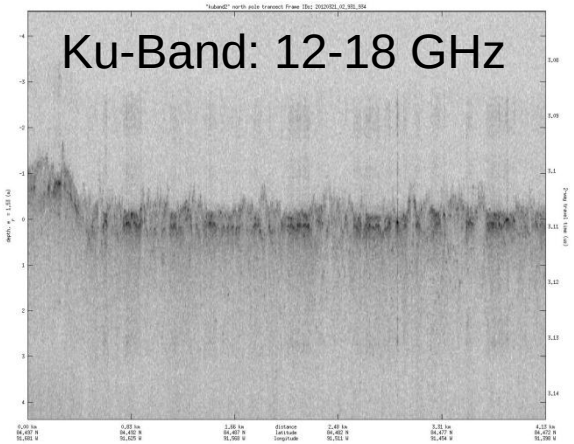
Combined Ultra-Wideband
Ku-Band Altimeter & Snow Radar

- **Snow Cover over Sea Ice**
- **Internal Layering**
- **Fine Resolution**
- **CryoSat-II Simulator**
- **Surface Topography**





OLD SYSTEMS

Bandwidth

Ku-Band: 6 GHz

Snow: 4 GHz

Independent sweep, timing, GPS, acquisition

NEW SYSTEM

Bandwidth

Dual 6-GHz Bands

Coherent Sweeps.

Synchronized timing, GPS, acquisition.

Combined Instrument.

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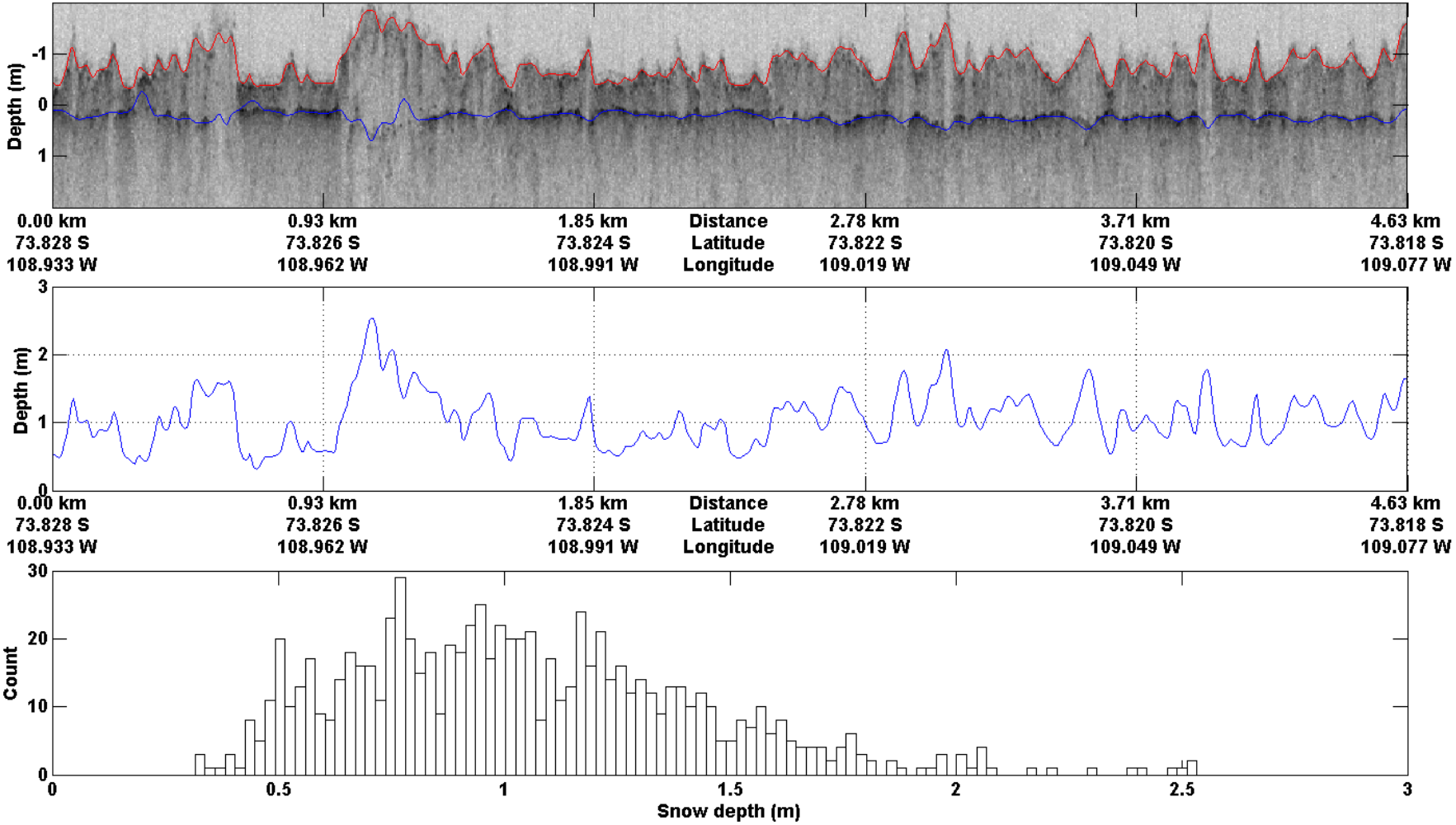
Interface tracker overview

- Works with the new format Snow Radar processed output
- User-defined threshold above the noise power for the air-snow interface
  - Look to further range to make sure the returned pick is not a leading-edge sidelobe
- Range compensation
  - Data beyond the air-snow pick is weighted to remove any attenuation due to the snow cover
  - Snow-ice interface is taken to be the peak with the largest magnitude
- Both interfaces are filtered over a user-defined range line aperture where the filtering weights are taken from the respective scattering magnitudes

Tracker output



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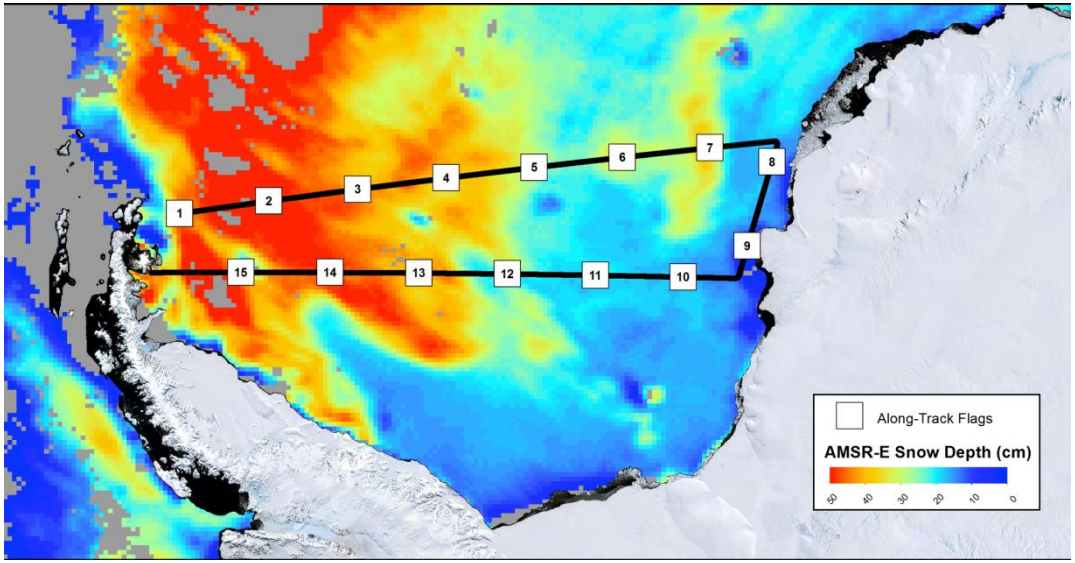
Tracker output

- .mat file containing
  - Latitude, Longitude, Air/snow range bin and scattering magnitude, Snow/ice range bin and scattering magnitude, and Range bin size
- After vetting, a comma-delimited file is produced that contains
  - Latitude, Longitude, and Snow depth
  - Currently available for 2010 and 2011 Antarctica
- Snow depth is calculated assuming a constant density
  - Snow depth can be rescaled easily for other densities

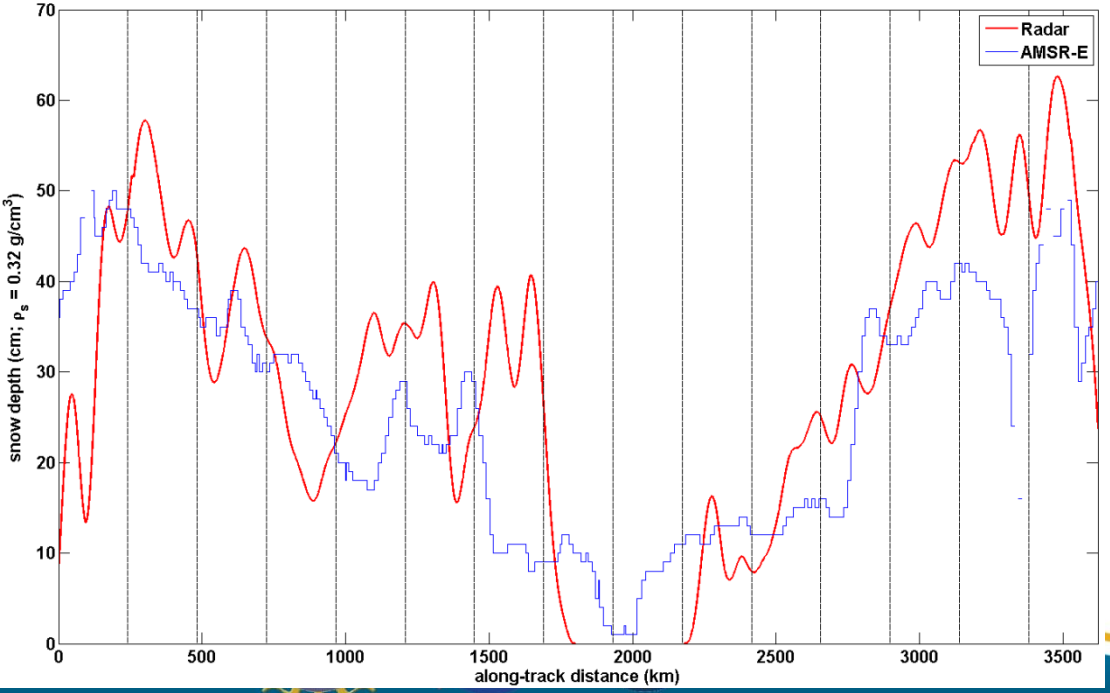
Issues to be dealt with

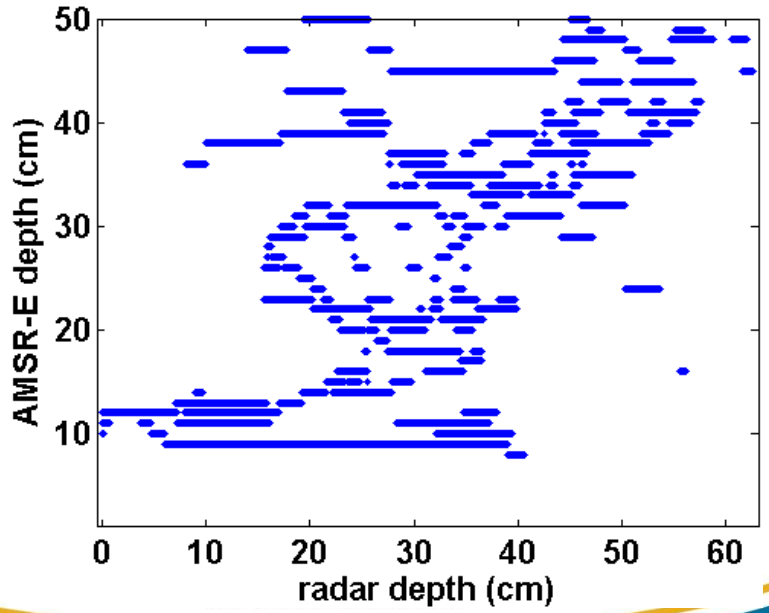
- Data need to be reprocessed with a different coherent noise removal technique
- No means of discriminating between snow cover and open water at the time
  - Scattering magnitude is comparable to the air/snow interface
  - Easy to identify bare ice which can be used for range calibration purposes

10/25/11 – Weddell Sea



Segment	AMSR Mean	Radar Mean
1-2	40.22	31.30
2-3	41.00	49.28
3-4	34.85	36.54
4-5	29.04	22.35
5-6	21.08	31.19
6-7	24.43	29.08
7-8	12.67	33.34
8-9	8.28	3.61
9-10	5.94	0.00
10-11	12.43	8.32
11-12	13.57	17.16
12-13	24.97	28.18
13-14	37.02	45.99
14-15	30.80	52.29
15-END	33.39	49.37

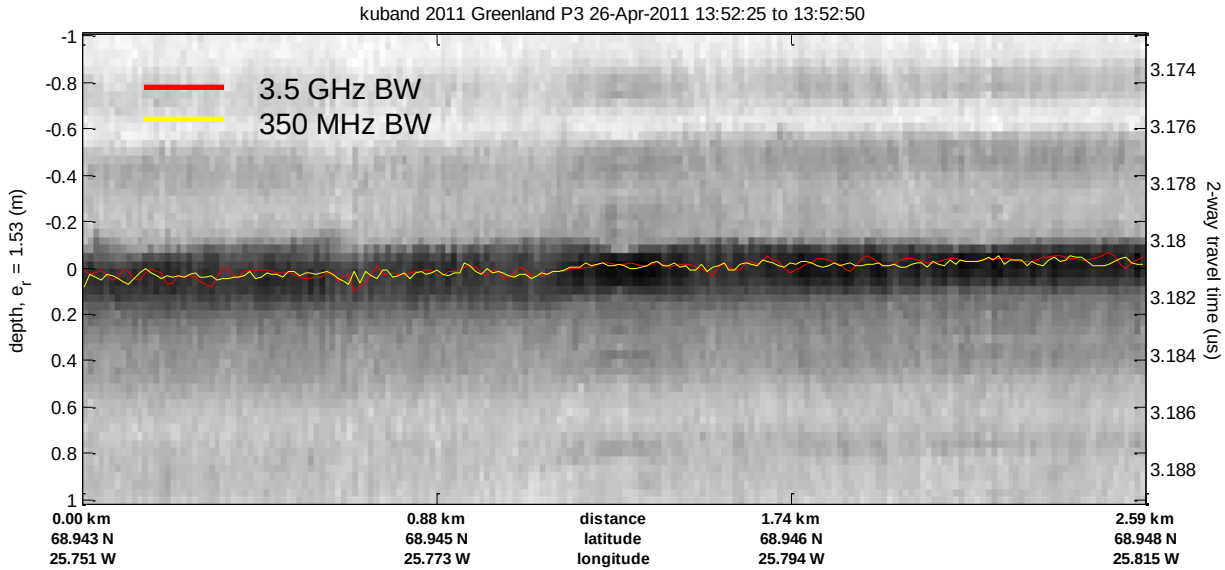


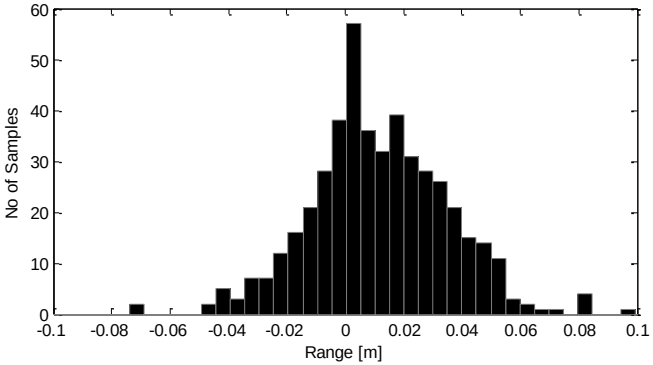


Ku-band vs. SIRAL band

-Ku-band data sub-band corresponding to SIRAL band
-Processed data for Ku-band 3.5 GHz and 350 MHz BW
-Results compared for high 3.5GHz BW and low 350 MHz BW resolution
    -over grease ice
    -wet, percolation and dry snow zones
    -sea ice

Over grease ice





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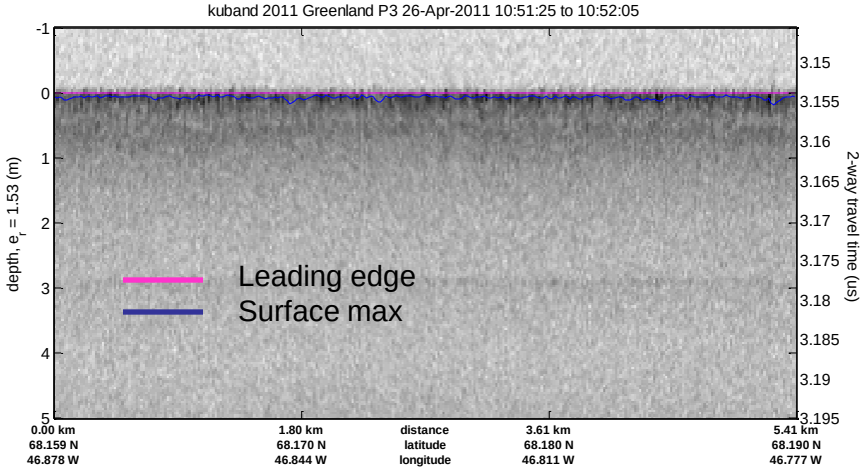
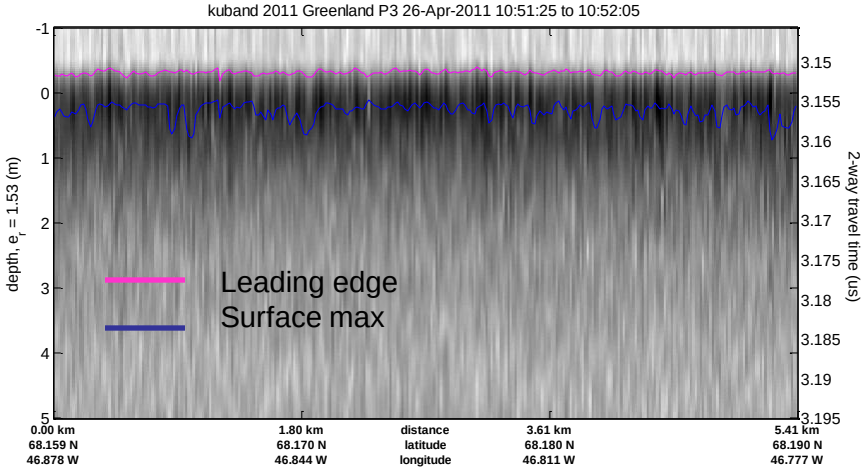
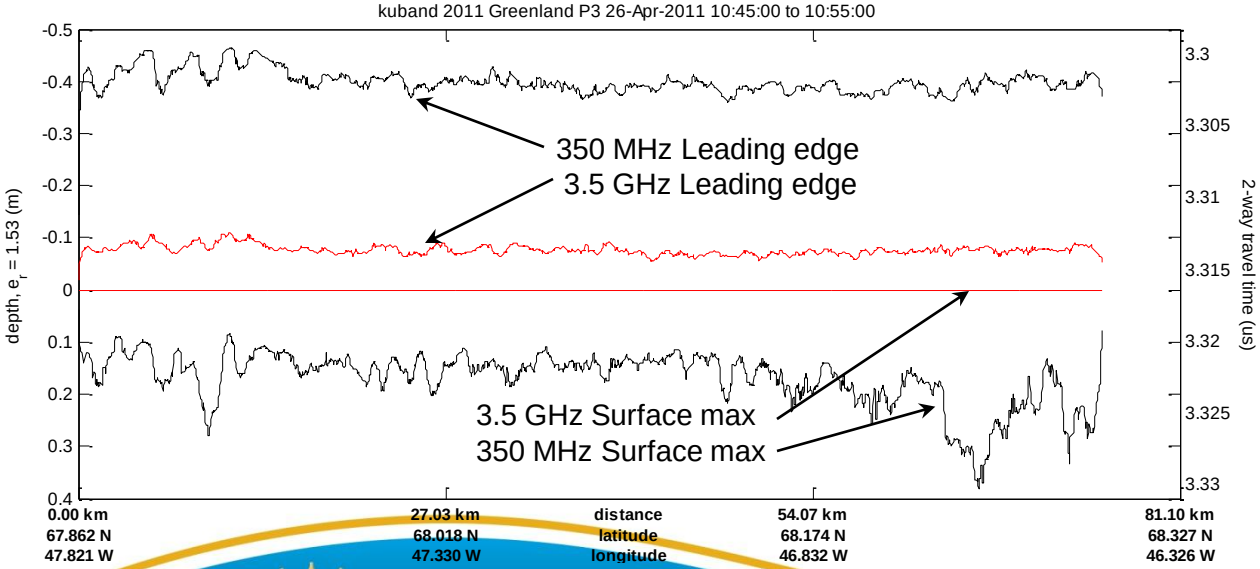
Wet snow zone

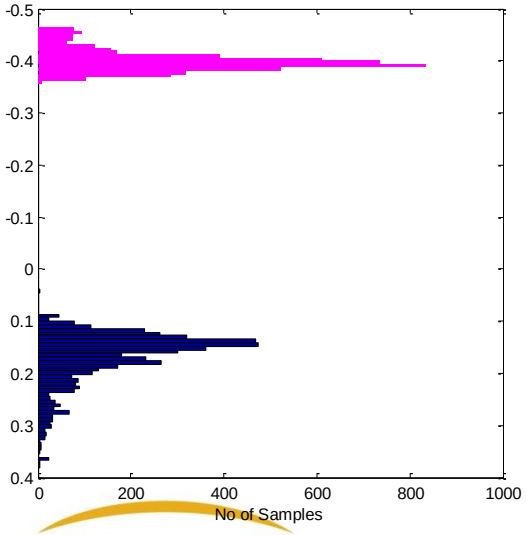
3.5 GHz bandwidth



350 MHz bandwidth







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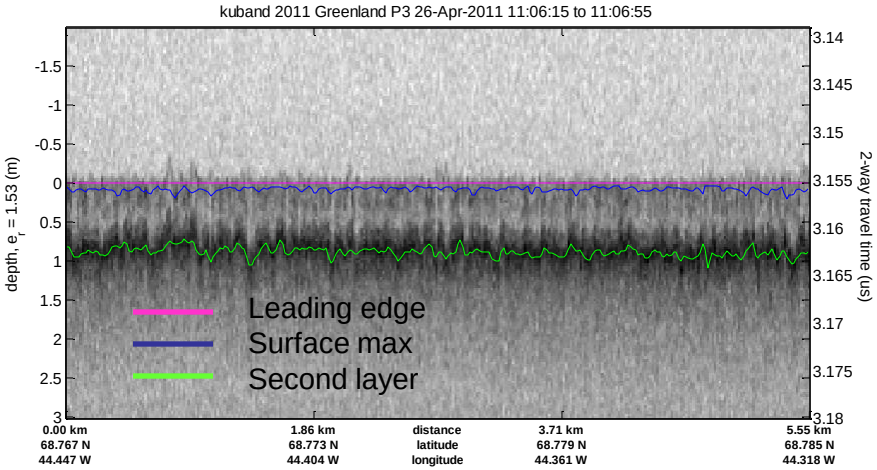
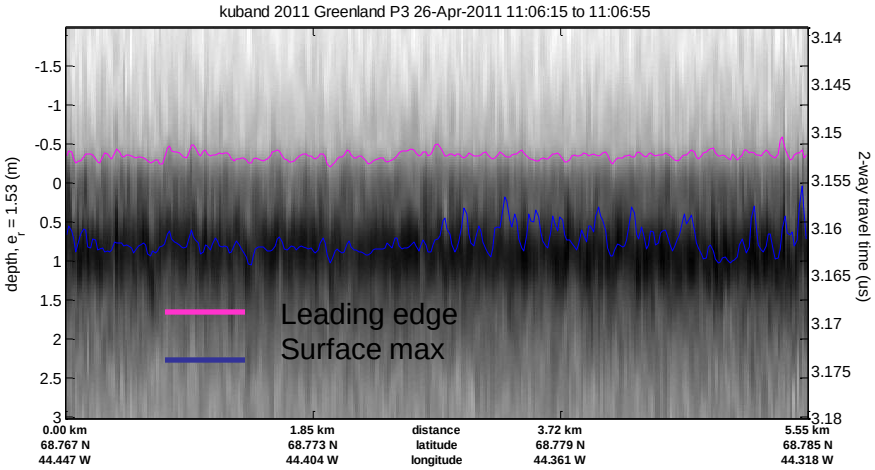
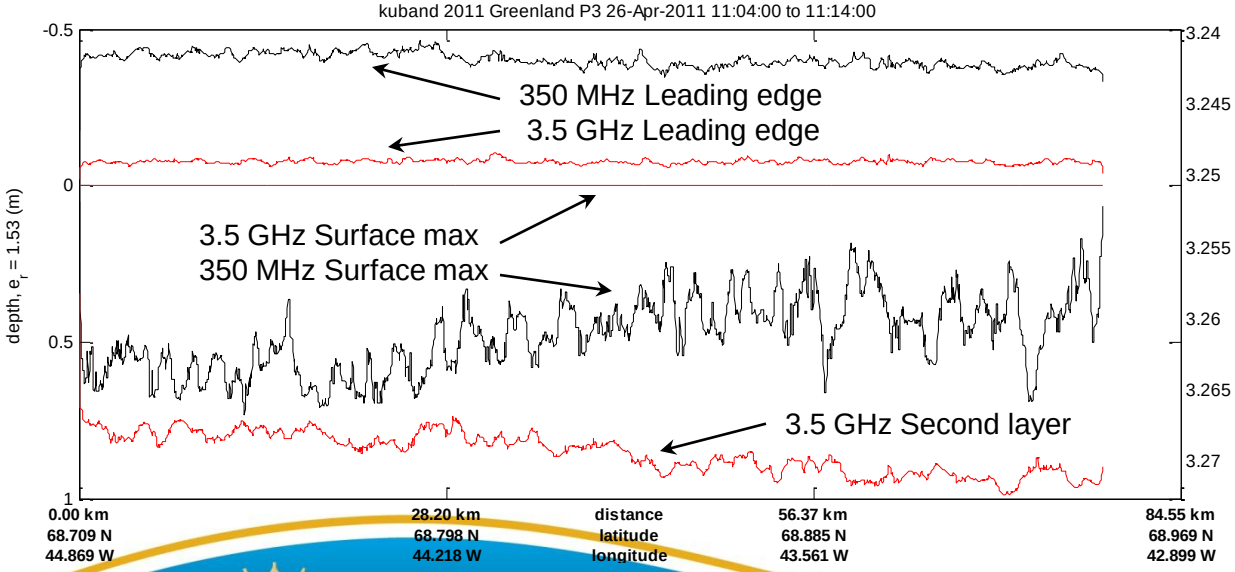
Percolation zone

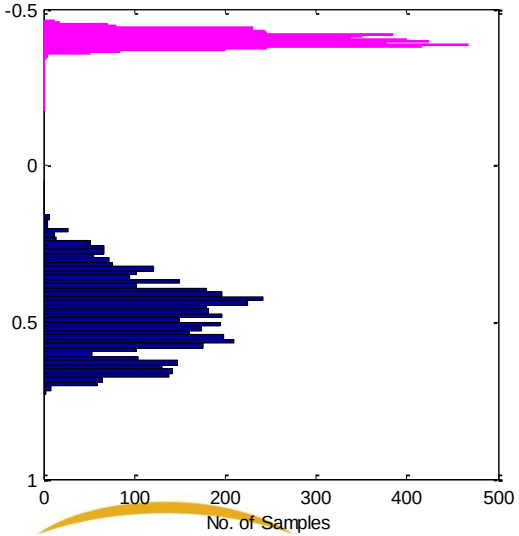
3.5 GHz bandwidth



350 MHz bandwidth







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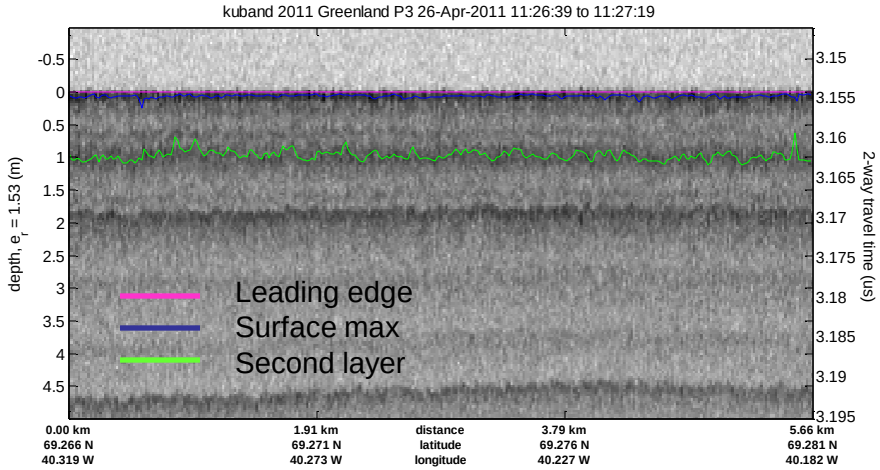
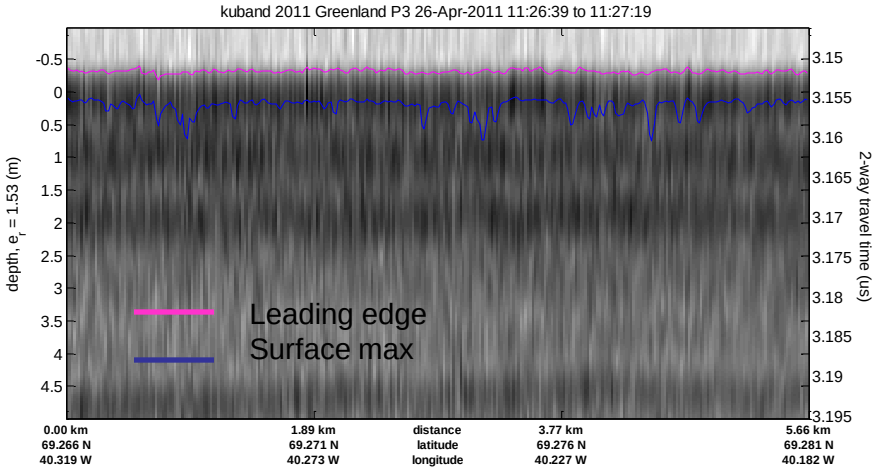
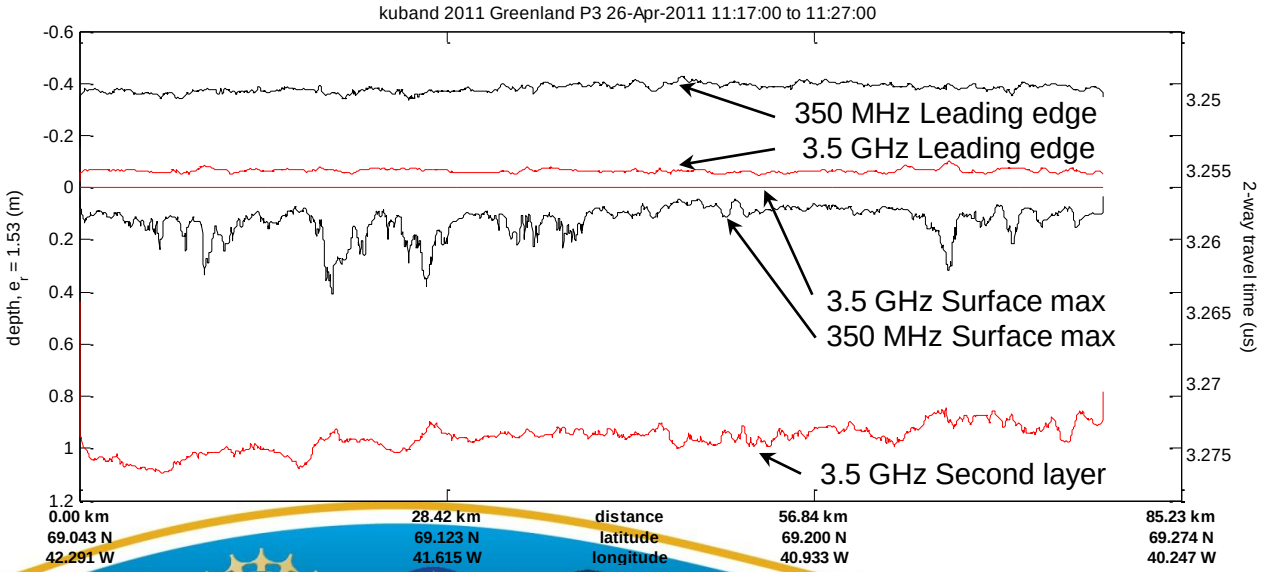
Dry snow zone

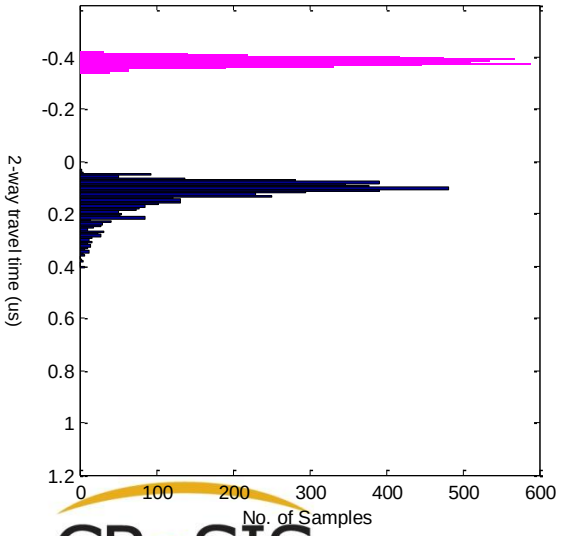
3.5 GHz bandwidth



350 MHz bandwidth







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Summary

- Snow radar interface tracker is providing snow thickness product.
  - Needs interaction
  - 2010/11 Antarctica data available
- Continue to work on other dataset and post results.

- Ku band sub-bandwidth processing indicates primary scattering surface over a variety of snow types.
- Directly applicable to Cryosat-2 data interpretations.
- Investigate results over more areas and sea ice.

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