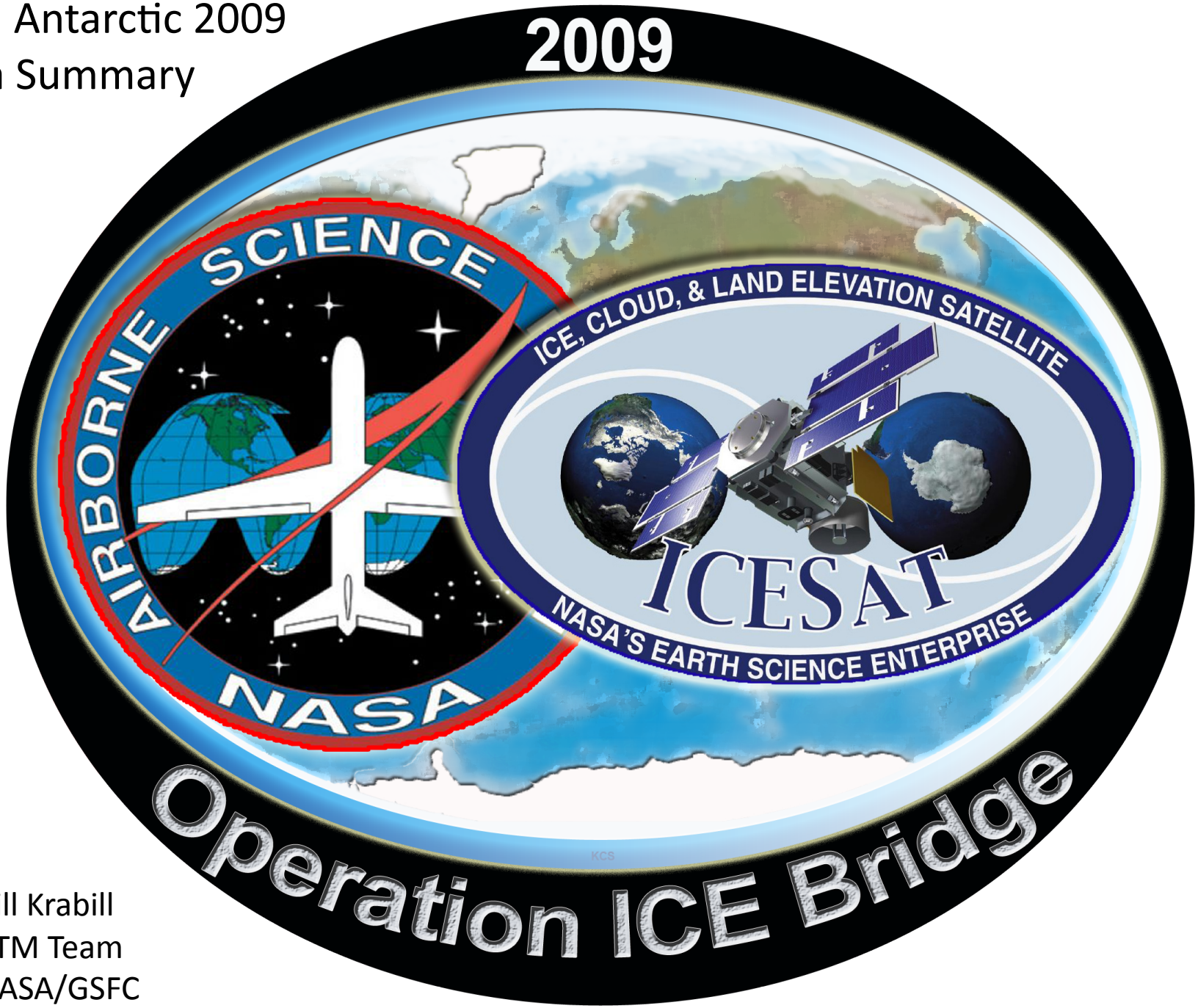
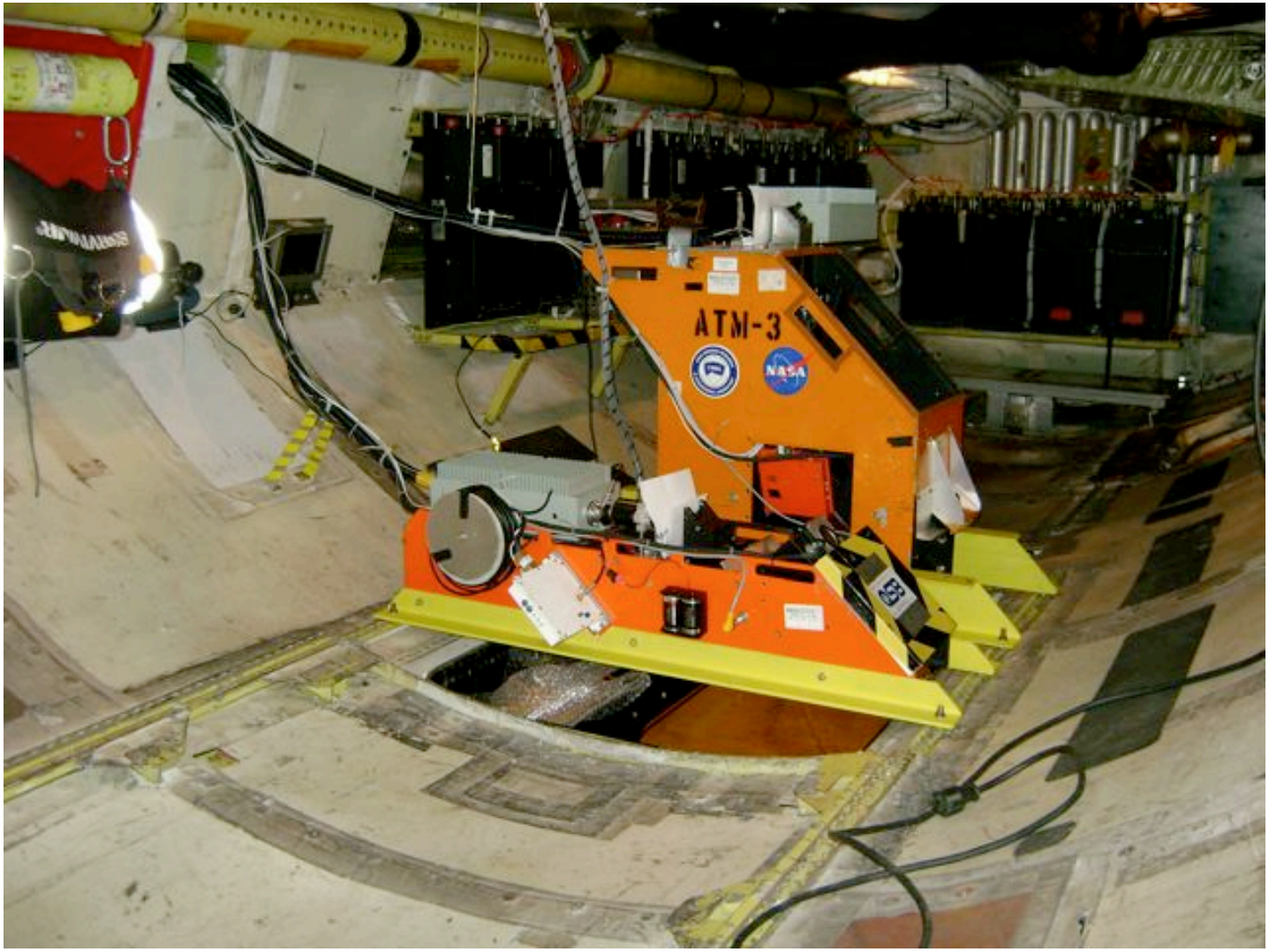
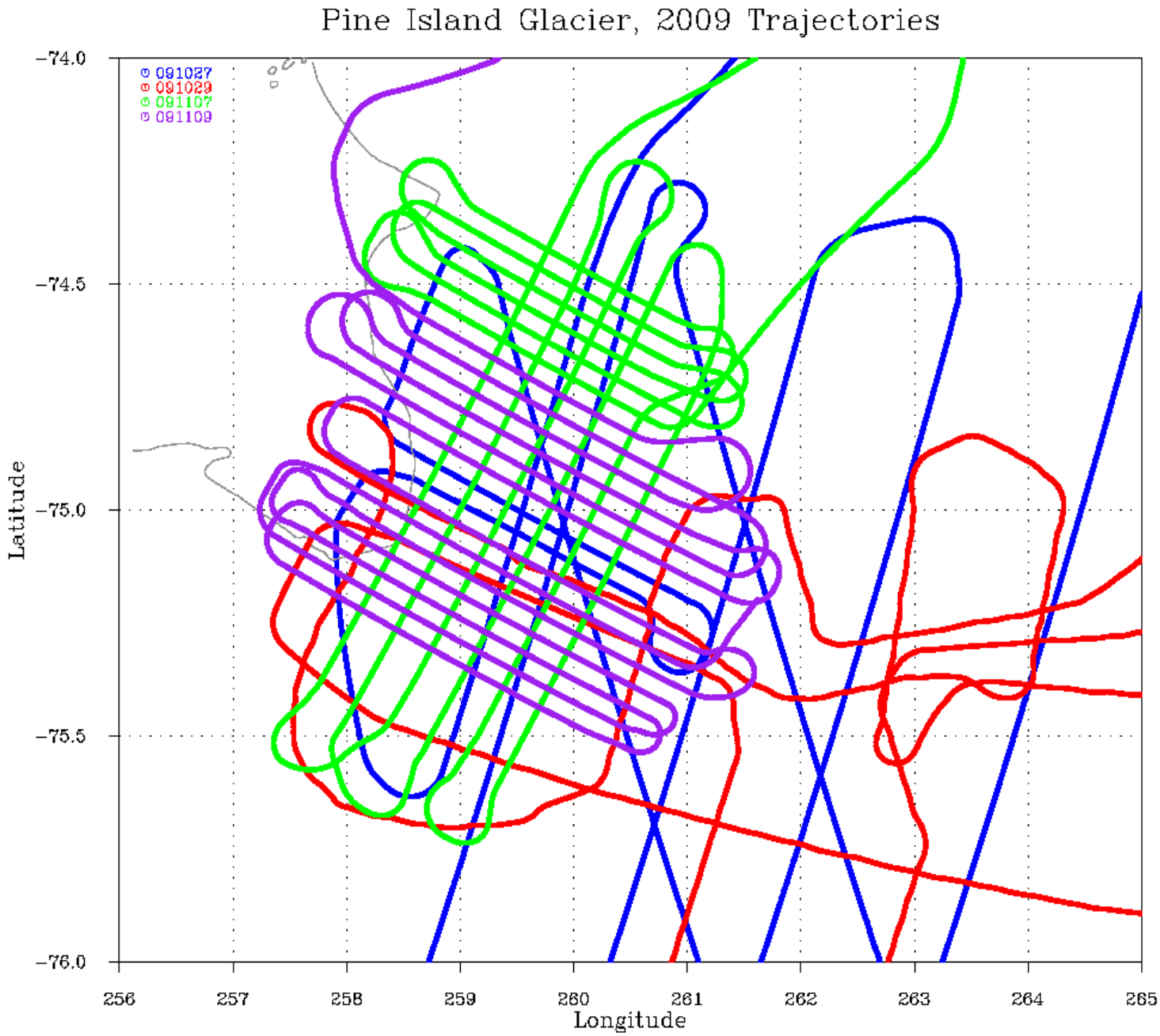
ATM Antarctic 2009
Data Summary



Bill Krabill
ATM Team
NASA/GSFC


ATM-3
NASA


Pine Island Glacier, 2009 Trajectories
091027
091029
091107
091109
-74.0
-74.5
-75.0
-75.5
-76.0
Latitude
256
257
258
259
260
261
262
263
264
265
Longitude

Crossover analysis

- Minimum of 4000 points
- Post fit rms 99 cm or less
- Crossing angles 40 deg or greater
- Estimated range bias not considered
- (no sea ice missions had crossings)

Using Litton LTN100 attitude data

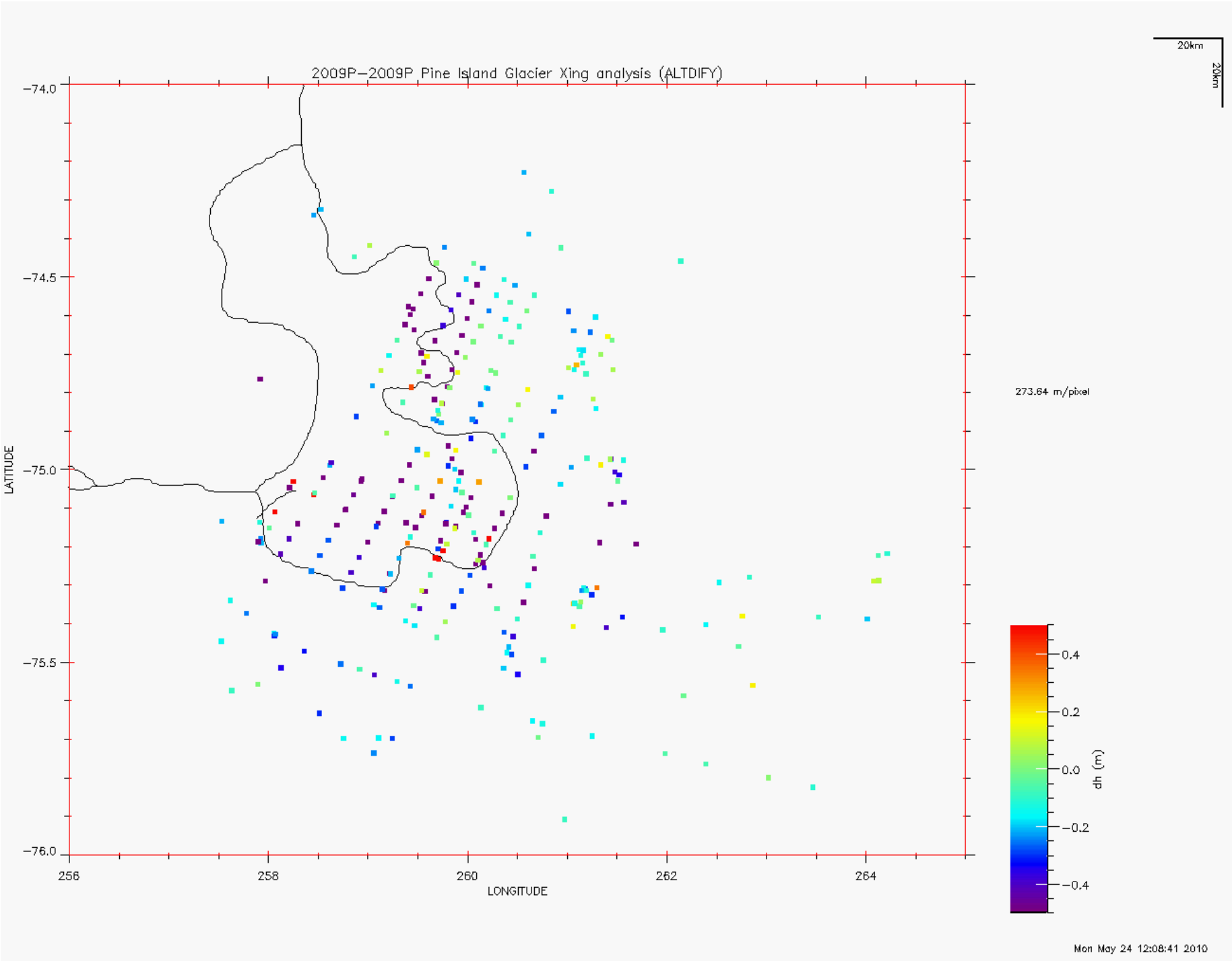
Date	DOY	Xings	Avg. Pitch	RMS Pitch	Avg. Roll	RMS Roll
91027	301	38	-0.025	0.012	-0.021	0.027
91018	292	9	-0.027	0.017	-0.039	0.014
91028	302	27	-0.024	0.009	-0.025	0.022
91029	303	36	-0.012	0.016	-0.016	0.023
91031	305	7	-0.016	0.029	-0.023	0.008
91102	307	25	-0.007	0.006	-0.021	0.022
91103	308	16	-0.004	0.013	-0.022	0.020
91104	309	41	-0.021	0.019	-0.028	0.017
91107	312	87	-0.004	0.010	-0.016	0.017
91109	314	37	-0.004	0.005	-0.008	0.005
91112	317	16	0.001	0.008	-0.002	0.004
91115	320	2	0.000	0.001	-0.022	0.017
91116	321	46	-0.002	0.006	-0.006	0.010
91118	323	17	-0.003	0.008	-0.009	0.010
All	All	404	-0.010	0.015	-0.017	0.019

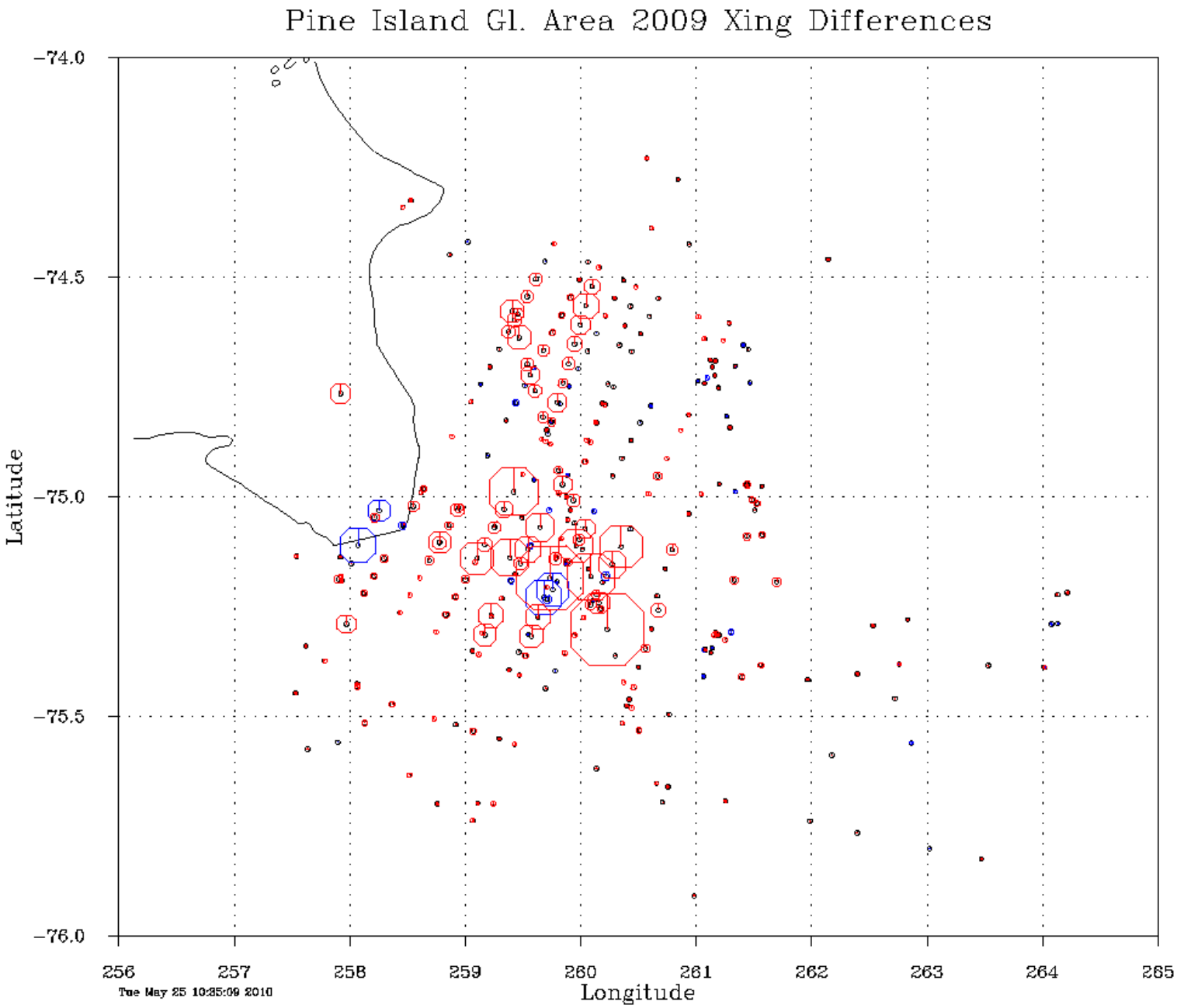
Using Applanix 510 attitude data

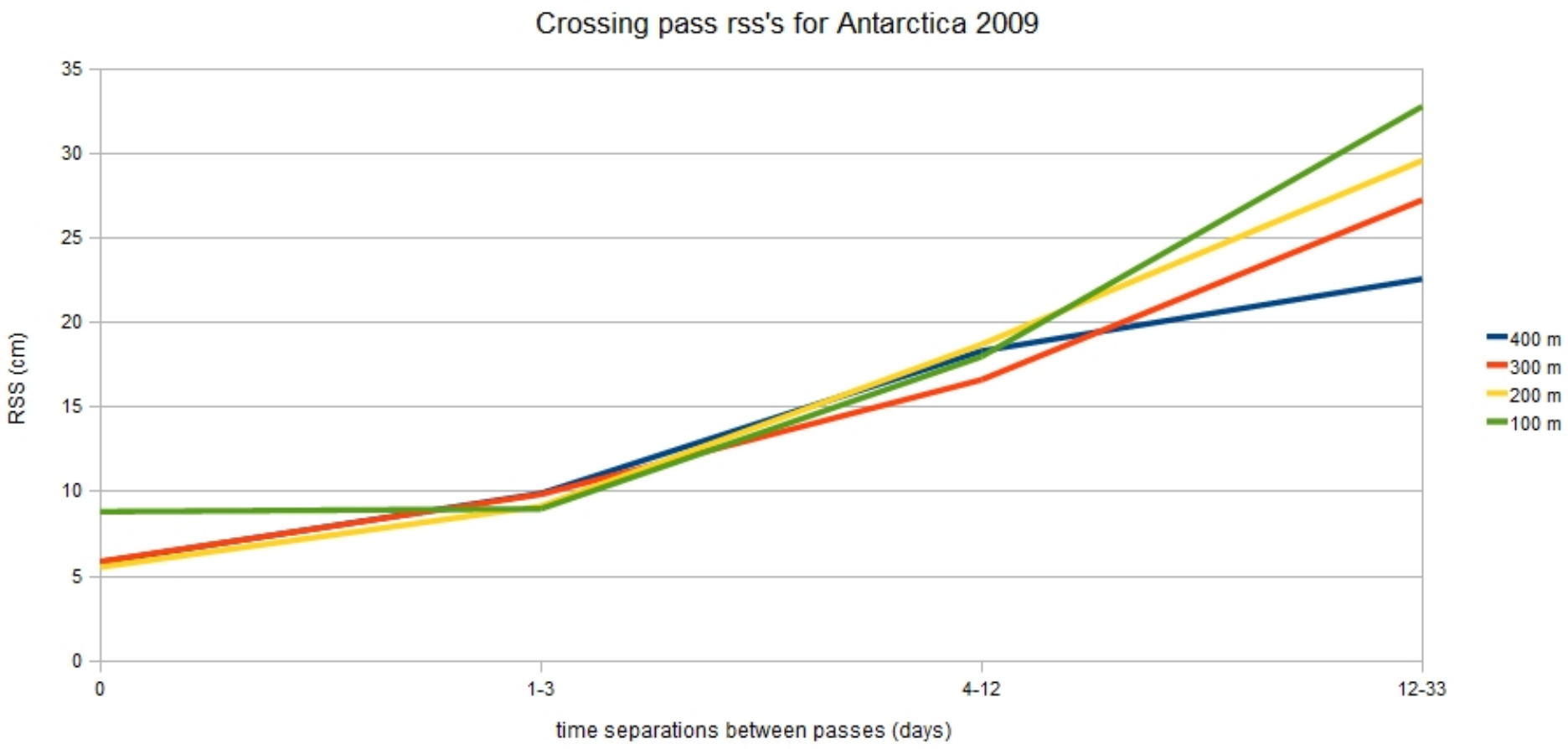
Date	DOY	Xings	Avg. Pitch	RMS Pitch	Avg. Roll	RMS Roll
91016	290	2	0.009	0.016	-0.038	0.005
91027	301	48	-0.012	0.007	-0.012	0.019
91018	292	8	-0.002	0.006	-0.025	0.009
91028	302	28	-0.012	0.014	-0.001	0.020
91029	303	39	-0.002	0.005	-0.010	0.018
91031	305	6	-0.007	0.006	-0.015	0.010
91102	307	25	0.004	0.008	-0.014	0.019
91103	308	16	-0.002	0.005	-0.014	0.012
91104	309	43	-0.014	0.006	-0.016	0.015
91107	312	89	0.001	0.006	-0.009	0.012
91109	314	43	-0.004	0.005	-0.006	0.006
91112	317	16	-0.002	0.004	-0.002	0.002
91115	320	4	0.000	0.002	-0.015	0.012
91116	321	45	-0.002	0.004	-0.005	0.010
91118	323	20	-0.005	0.007	-0.006	0.006
All	All	432	-0.004	0.009	-0.010	0.015

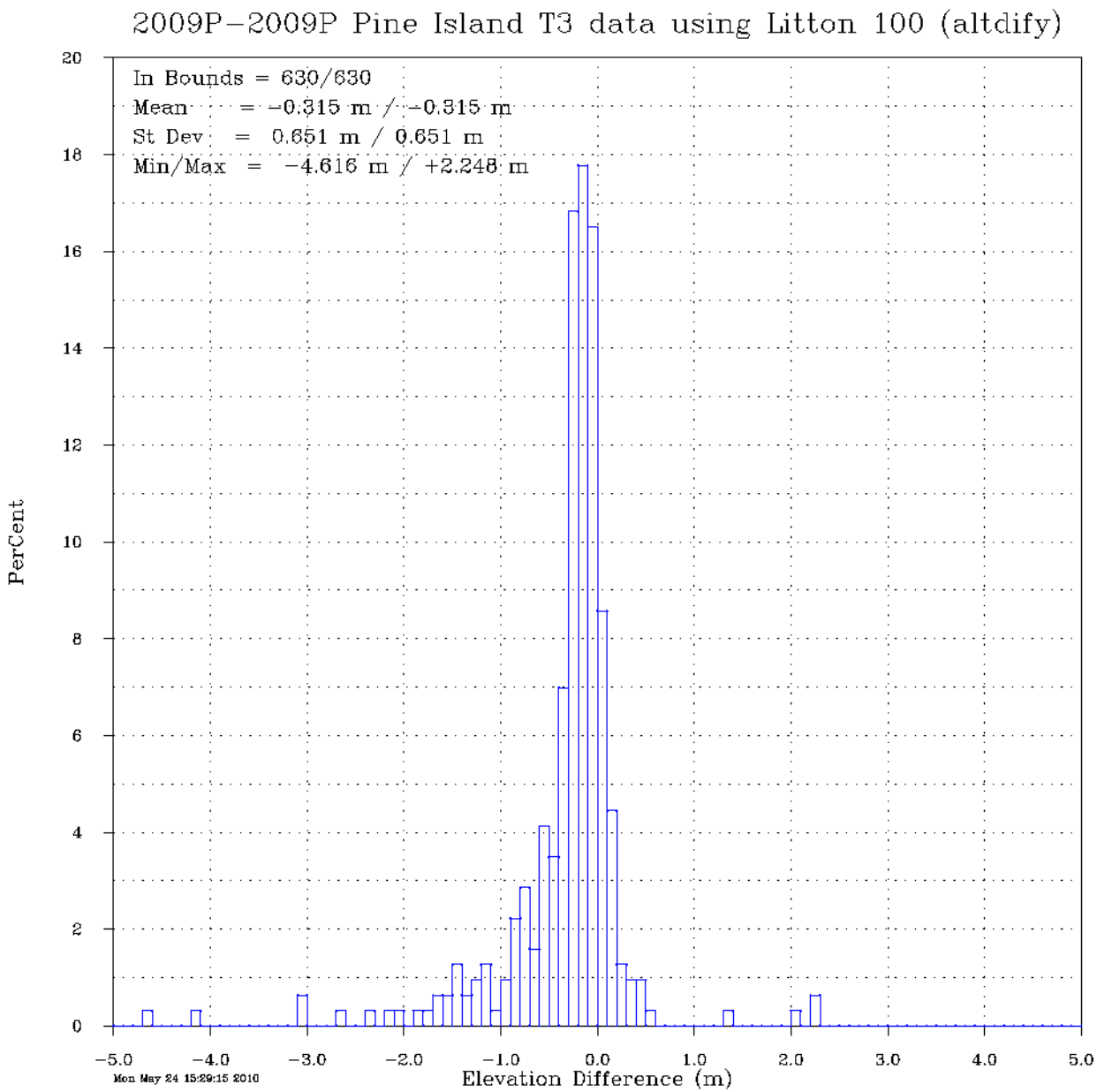
Bottom Line

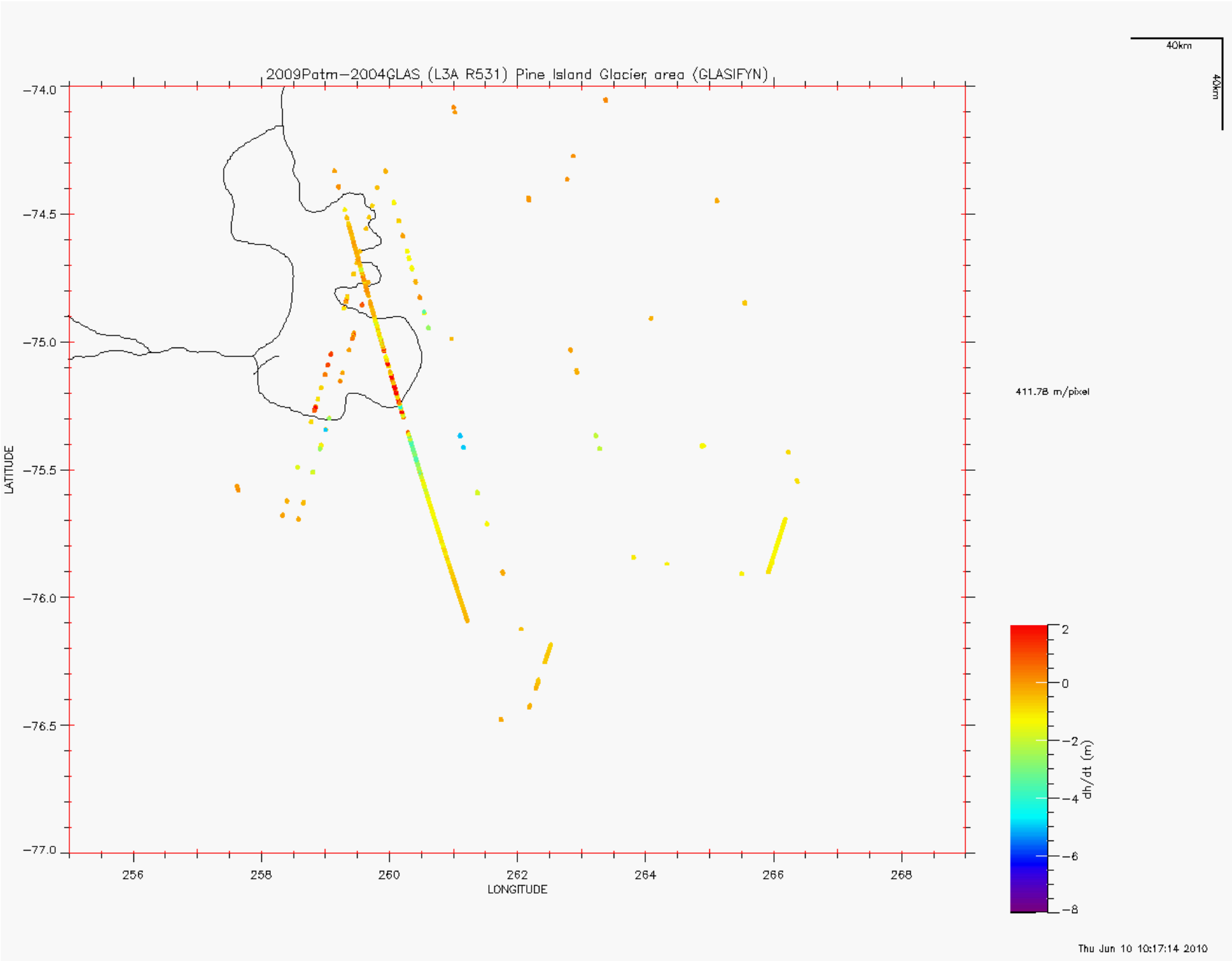
Attitude Instrument	Avg. Pitch	RMS Pitch	Avg. Roll	RMS Roll
Litton LTN100	-0.010	0.015	-0.017	0.019
Applanix 510	-0.004	0.009	-0.010	0.015

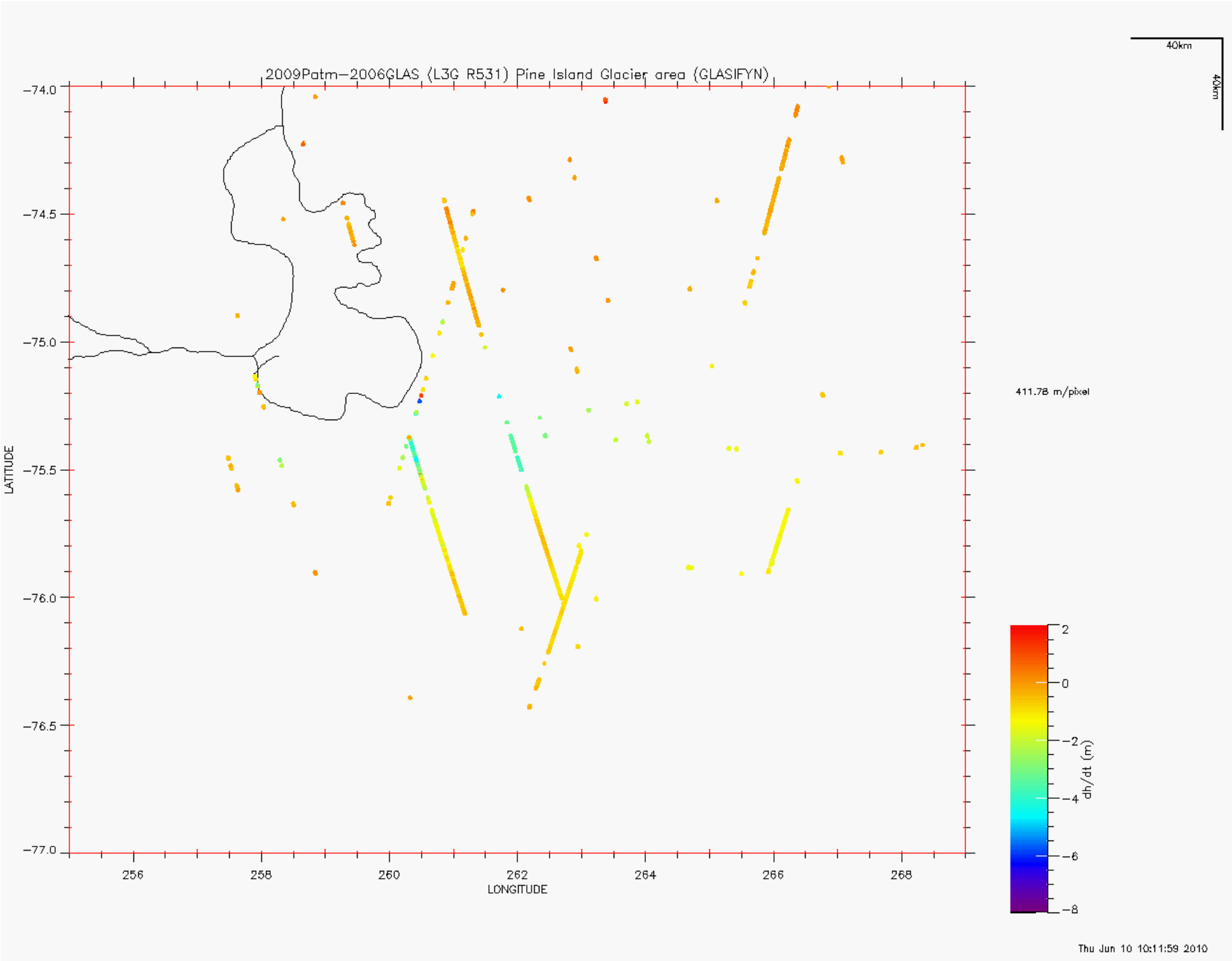

2009P–2009P Pine Island Glacier Xing analysis (ALTDIFY)
20km
20km
273.64 m/pixel
LATITUDE
LONGITUDE
−74.0
−74.5
−75.0
−75.5
−76.0
256
258
260
262
264
0.4
0.2
0.0
−0.2
−0.4
dh (m)
Mon May 24 12:08:41 2010

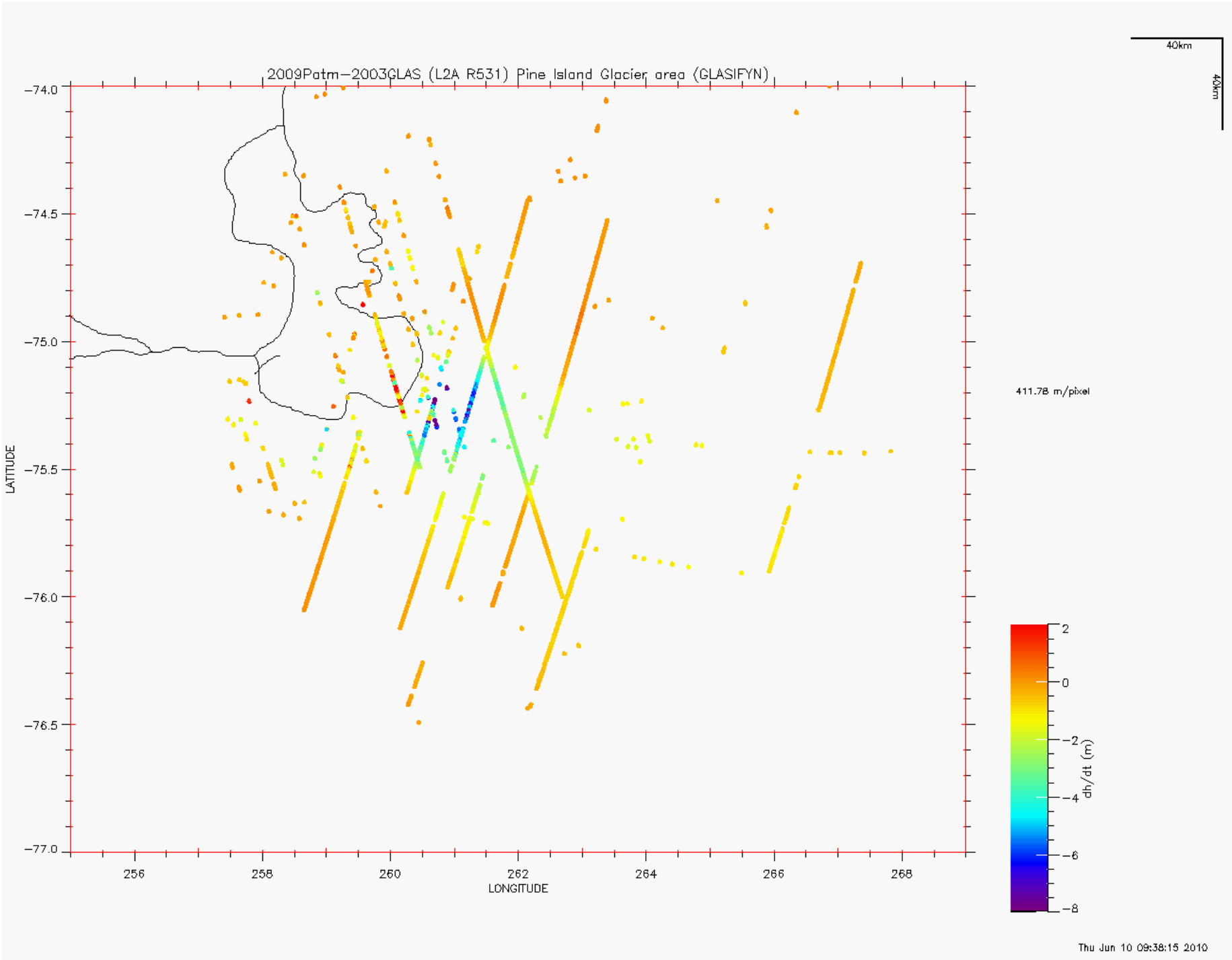

Pine Island Gl. Area 2009 Xing Differences
-74.0
-74.5
-75.0
-75.5
-76.0
Latitude
256
257
258
259
260
261
262
263
264
265
Longitude
Tue May 25 10:35:09 2010

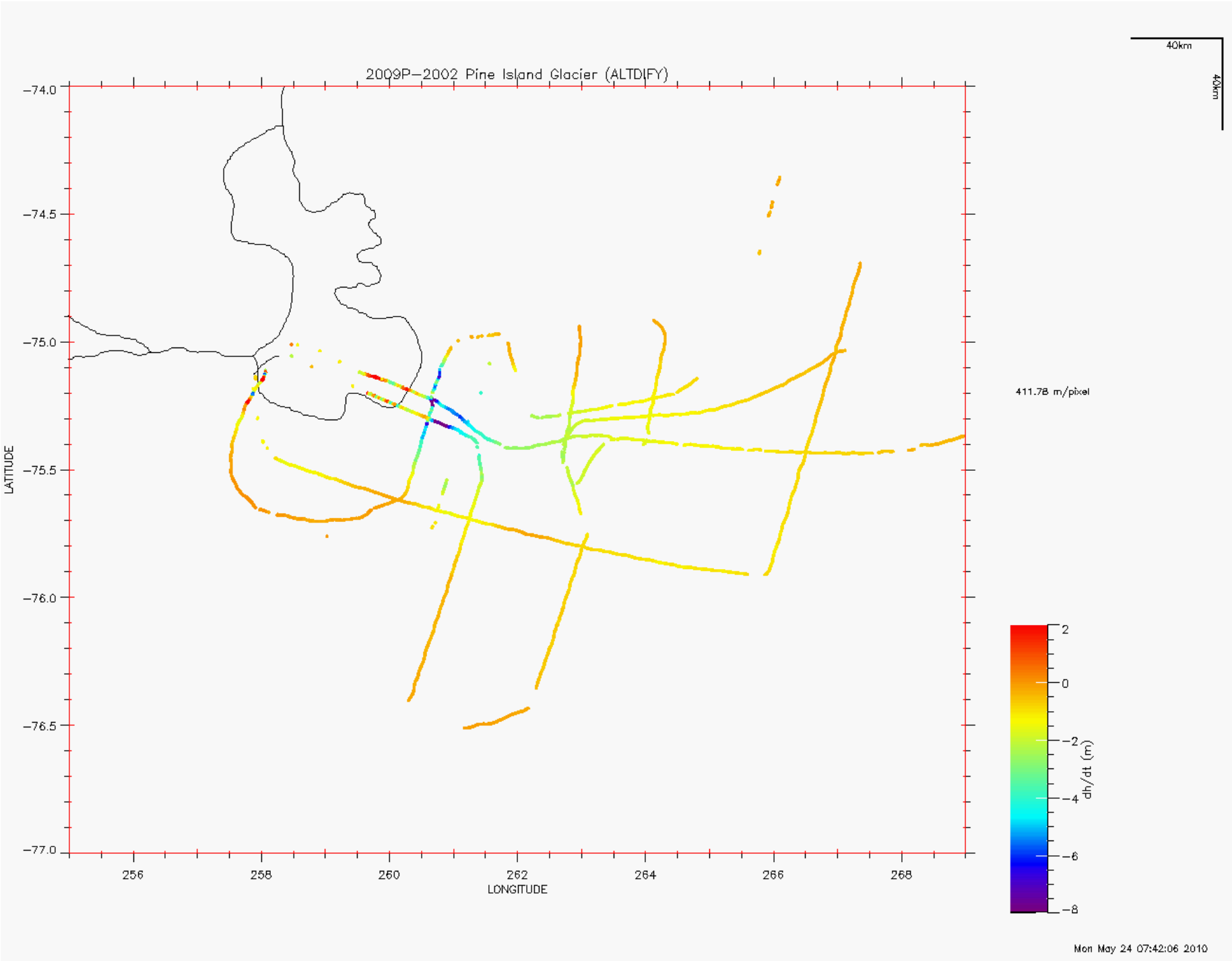

Crossing pass rss's for Antarctica 2009
RSS (cm)
35
30
25
20
15
10
5
0
0
1-3
4-12
12-33
time separations between passes (days)
400 m
300 m
200 m
100 m

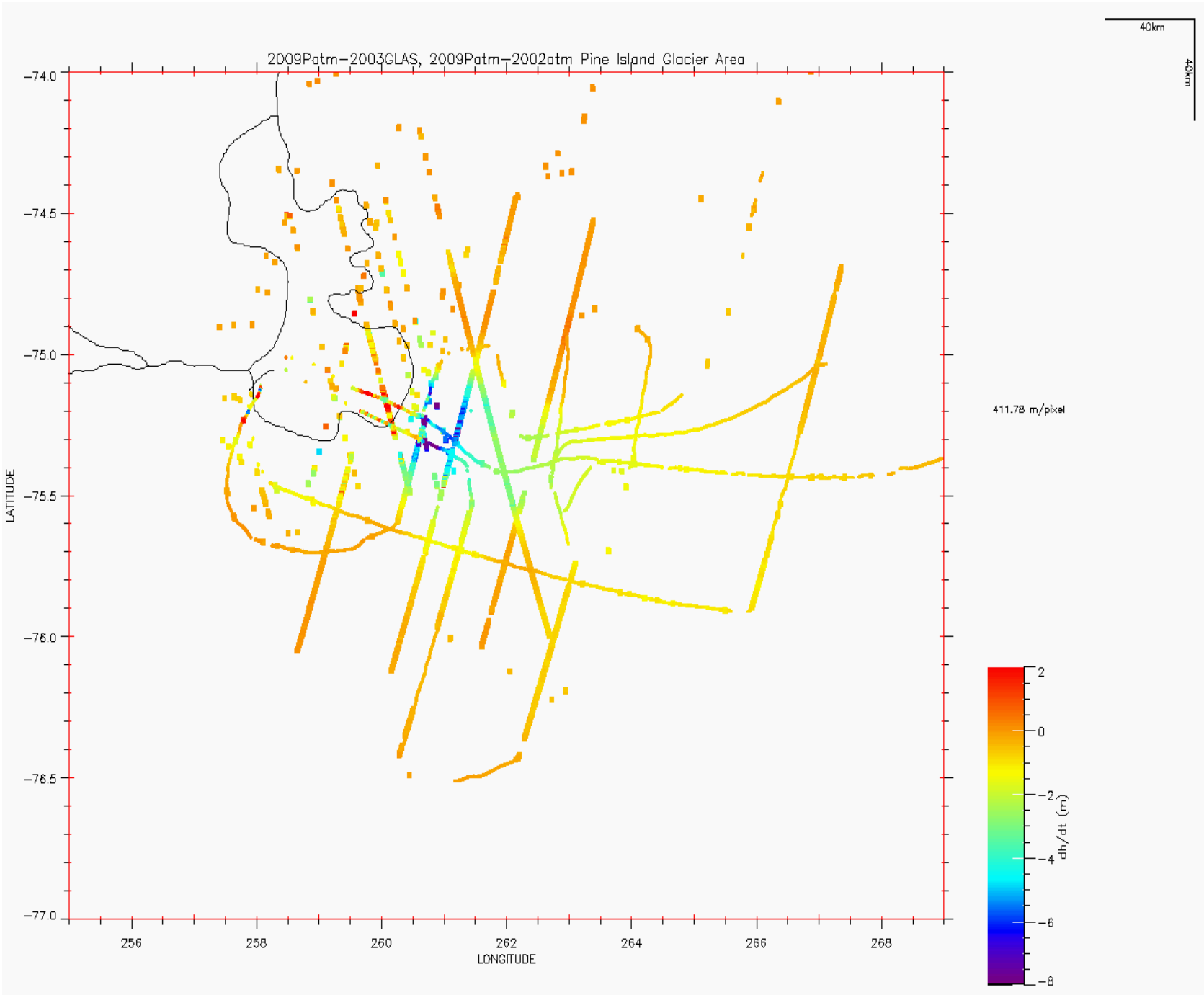

2009P−2009P Pine Island T3 data using Litton 100 (altdify)
In Bounds = 630/630
Mean = −0.315 m / −0.315 m
St Dev = 0.651 m / 0.651 m
Min/Max = −4.616 m / +2.248 m
PerCent
Elevation Difference (m)
Mon May 24 15:29:15 2010


2009Patm−2004GLAS (L3A R531) Pine Island Glacier area (GLASIFYN)
40km
40km
411.78 m/pixel
LATITUDE
−74.0
−74.5
−75.0
−75.5
−76.0
−76.5
−77.0
LONGITUDE
256
258
260
262
264
266
268
dh/dt (m)
2
0
−2
−4
−6
−8
Thu Jun 10 10:17:14 2010

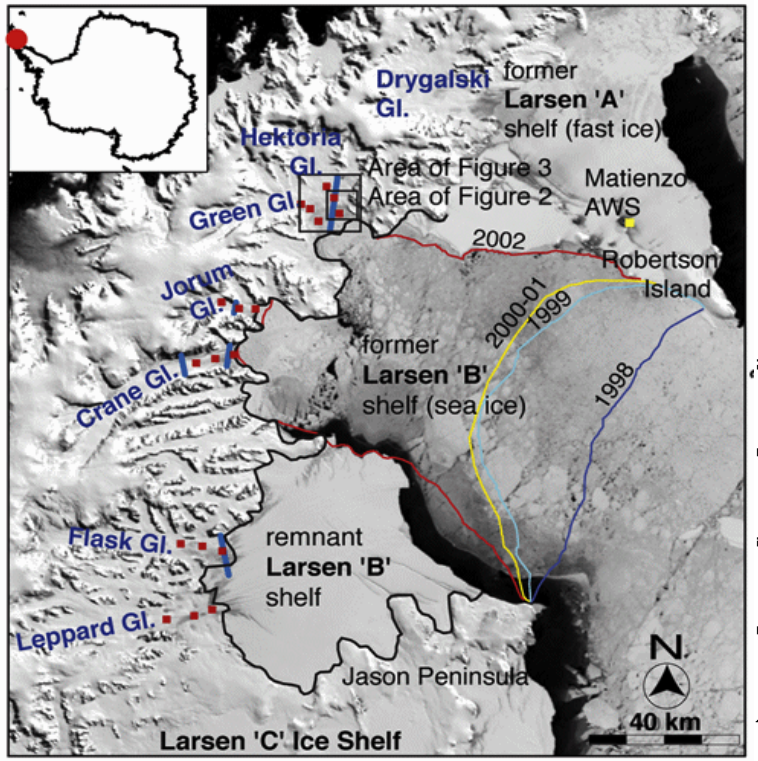

2009Patm−2006GLAS (L3G R531) Pine Island Glacier area (GLASIFYN)
40km
40km
411.78 m/pixel
LATITUDE
−74.0
−74.5
−75.0
−75.5
−76.0
−76.5
−77.0
LONGITUDE
256
258
260
262
264
266
268
dh/dt (m)
2
0
−2
−4
−6
−8
Thu Jun 10 10:11:59 2010


2009Patm−2003GLAS (L2A R531) Pine Island Glacier area (GLASIFYN)
40km
40km
411.78 m/pixel
LATITUDE
−74.0
−74.5
−75.0
−75.5
−76.0
−76.5
−77.0
256
258
260
262
264
266
268
LONGITUDE
2
0
−2
−4
−6
−8
dh/dt (m)
Thu Jun 10 09:38:15 2010

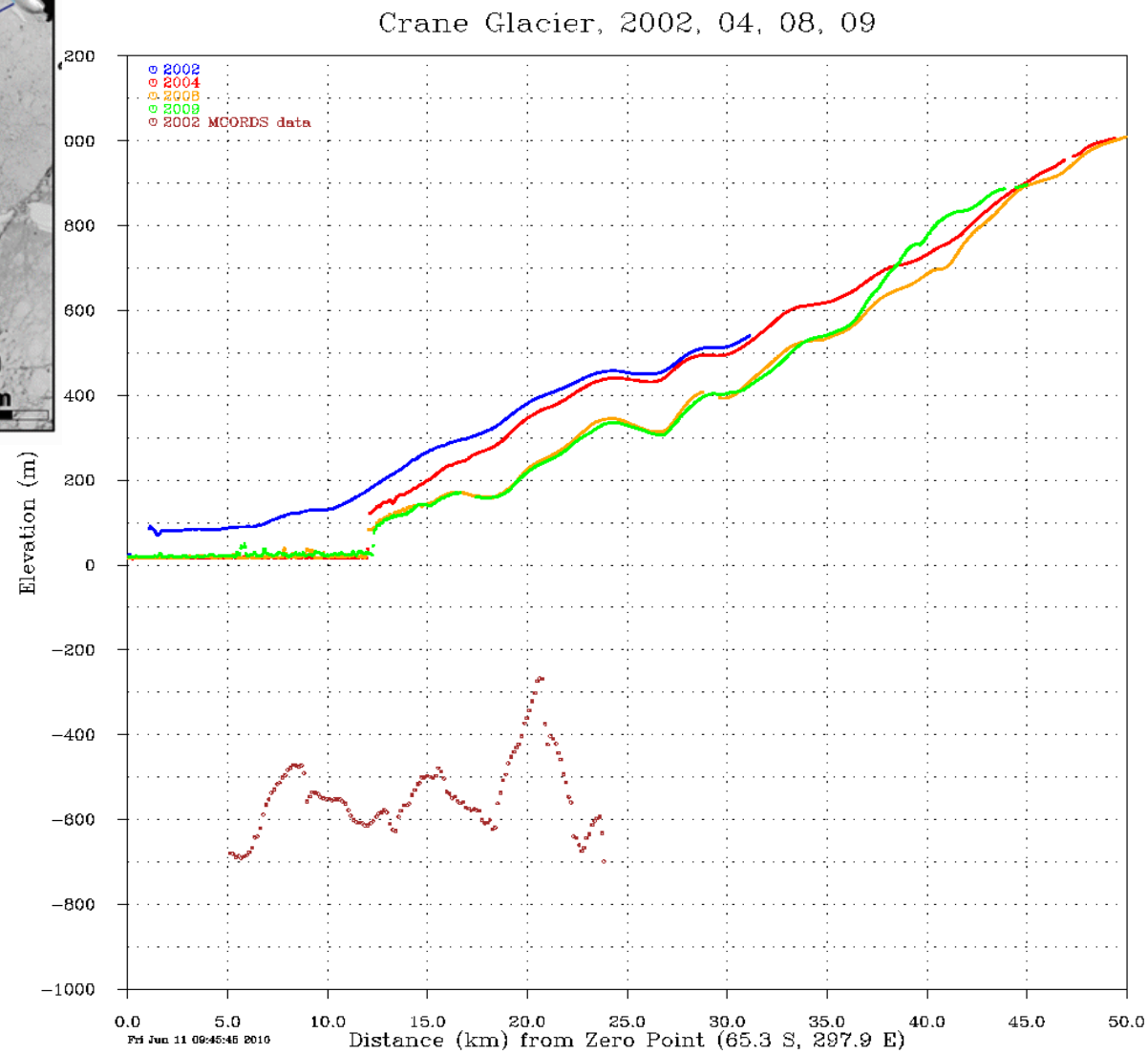

2009P−2002 Pine Island Glacier (ALTDIFY)
40km
40km
411.78 m/pixel
LATITUDE
−74.0
−74.5
−75.0
−75.5
−76.0
−76.5
−77.0
LONGITUDE
256
258
260
262
264
266
268
dh/dt (m)
2
0
−2
−4
−6
−8
Mon May 24 07:42:06 2010


2009Patm−2003GLAS, 2009Patm−2002atm Pine Island Glacier Area
40km
40km
411.78 m/pixel
LATITUDE
−74.0
−74.5
−75.0
−75.5
−76.0
−76.5
−77.0
LONGITUDE
256
258
260
262
264
266
268
dh/dt (m)
2
0
−2
−4
−6
−8

Crane Glacier acceleration after Larsen breakup in Antarctica

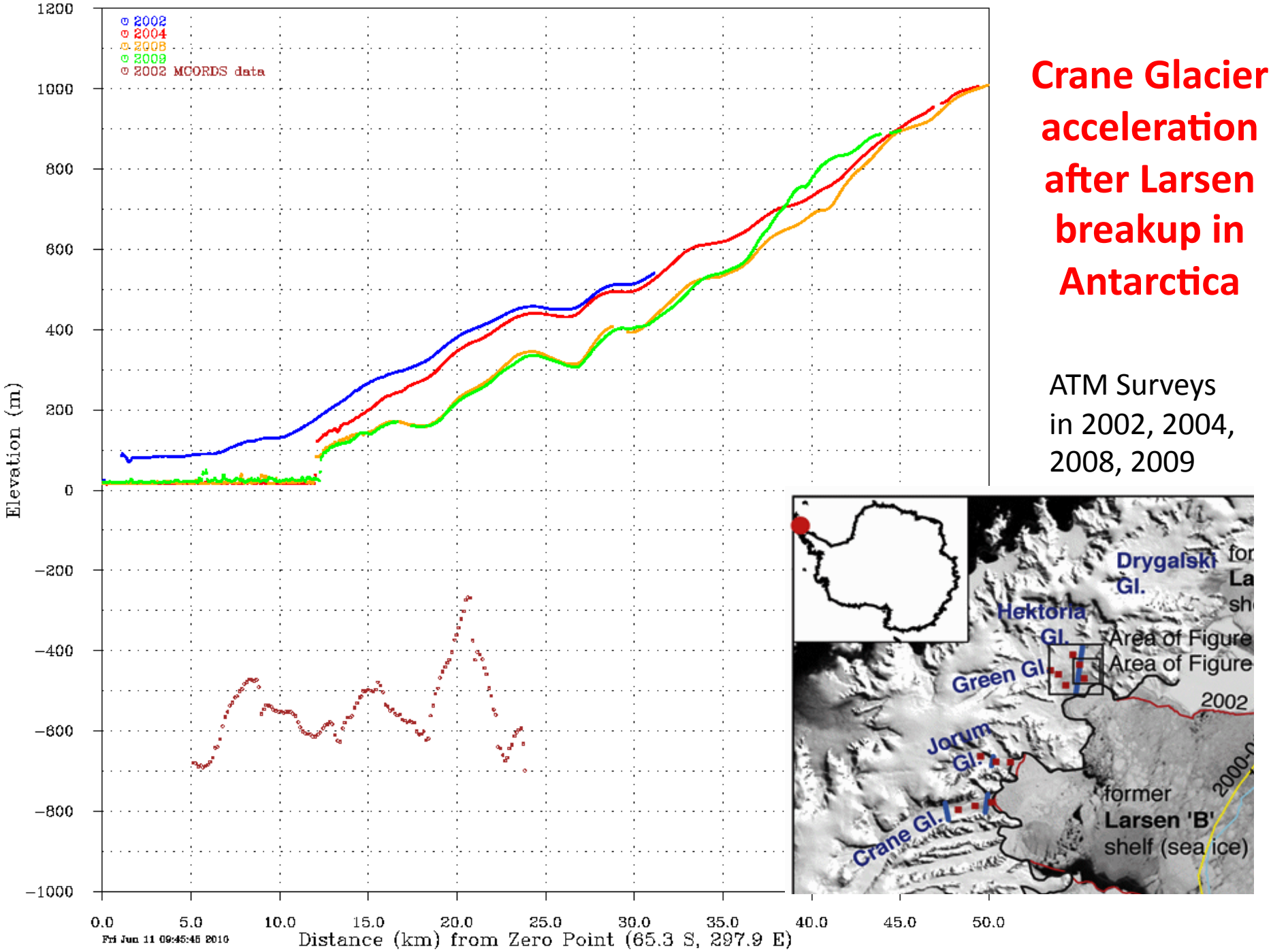


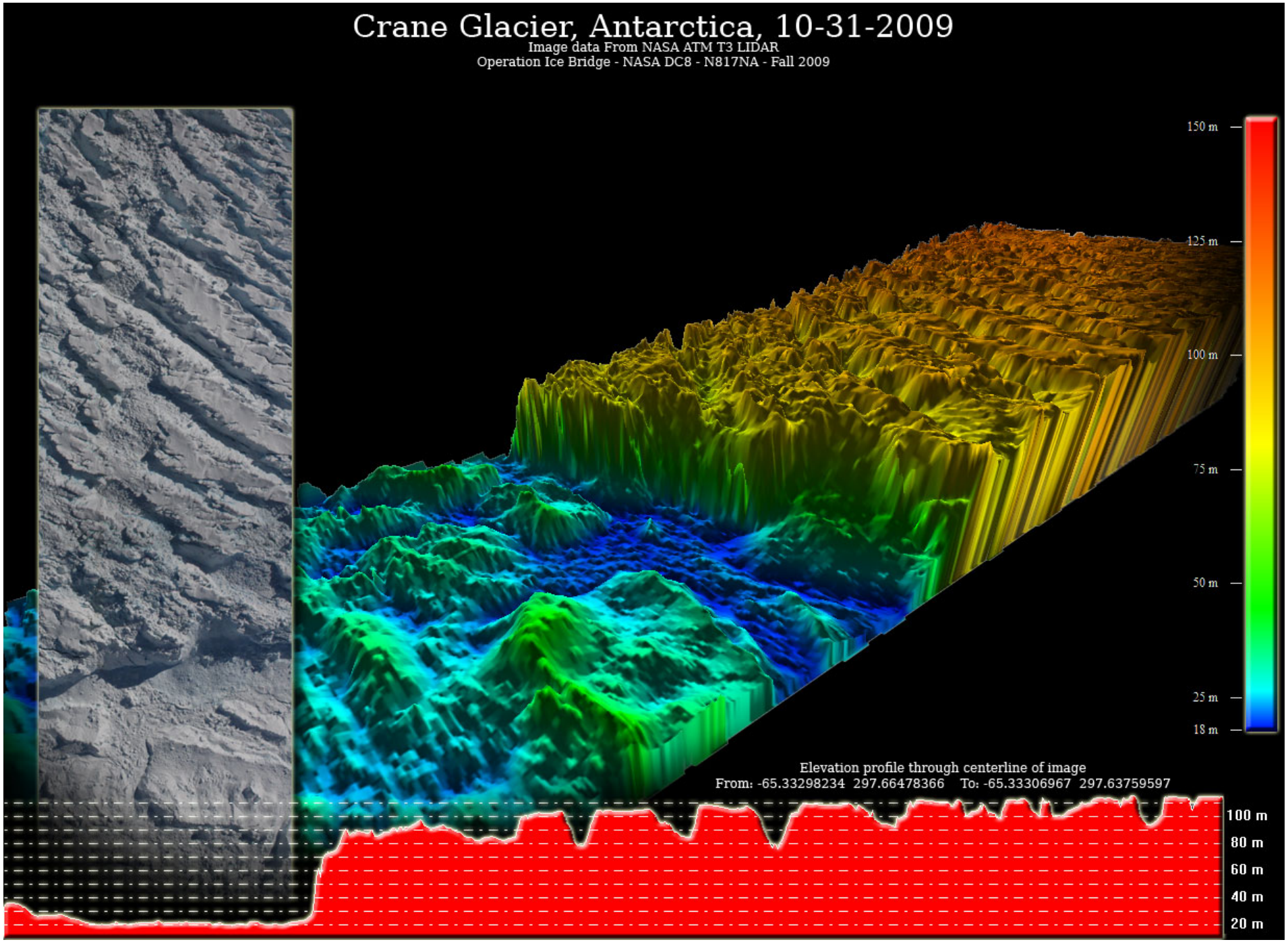
9-km ice-front retreat in 2 years

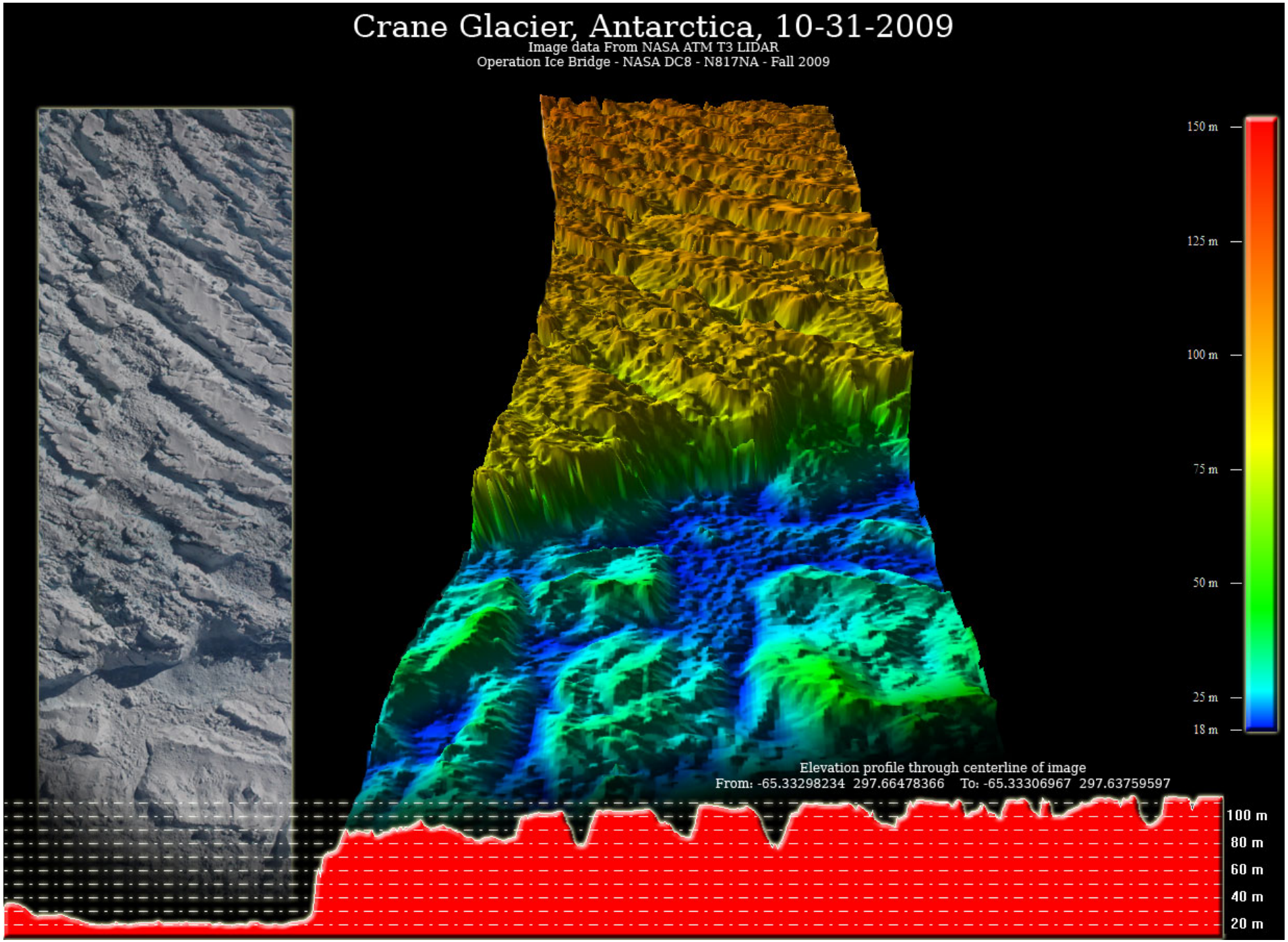


Crane Glacier acceleration after Larsen breakup in Antarctica

ATM Surveys in 2002, 2004, 2008, 2009




Crane Glacier, Antarctica, 10-31-2009
Image data From NASA ATM T3 LIDAR
Operation Ice Bridge - NASA DC8 - N817NA - Fall 2009
150 m
125 m
100 m
75 m
50 m
25 m
18 m
Elevation profile through centerline of image
From: -65.33298234 297.66478366 To: -65.33306967 297.63759597
100 m
80 m
60 m
40 m
20 m


Crane Glacier, Antarctica, 10-31-2009
Image data From NASA ATM T3 LIDAR
Operation Ice Bridge - NASA DC8 - N817NA - Fall 2009
150 m
125 m
100 m
75 m
50 m
25 m
18 m
Elevation profile through centerline of image
From: -65.33298234 297.66478366 To: -65.33306967 297.63759597
100 m
80 m
60 m
40 m
20 m

ATM IceBridge Data Processing Status

Date	ATM MISSION NAME	ATM DATA STATUS	Raw ATM Volume	CAMERA STATUS
20090331	Seaice 3	NSIDC 5/7/10	68.6	NSIDC 6/9/10
20090401	E.Central icecap	NSIDC 5/11/10	71.9	NSIDC 6/9/10
20090402	Seaice Thule – Fairbanks	NSIDC 5/10/10	81.8	NSIDC 6/9/10
20090405	Seaice Fairbanks – Thule	NSIDC 5/12/10	87.7	NSIDC 6/9/10
20090406	NW glaciers	NSIDC 5/19/10	97.8	NSIDC 6/9/10
20090417	SW glaciers	NSIDC 5/13/10	88.5	NSIDC 6/9/10
20090420	NE glaciers	NSIDC 5/13/10	109.8	NSIDC 6/9/10
20090421	seaice ENVI	NSIDC 5/26/10	63.3	NSIDC 6/9/10
20090422	N glaciers	NSIDC 5/19/10	98.8	NSIDC 6/9/10
20090423	E glaciers	NSIDC 5/19/10	95.1	NSIDC 6/9/10
20090424	E glaciers2	NSIDC 5/19/10	96.1	NSIDC 6/9/10
20090425	Seaice AO icecamp	NSIDC 5/25/10	64.3	NSIDC 6/9/10
20090427	Kanger (JakNS) (transit)	NSIDC 6/23/10	88.7	NSIDC 6/9/10
20090428	Jak EW	NSIDC 6/10/10	89.4	NSIDC 6/9/10
20090501	E glaciers3	NSIDC 6/3/10	83.0	NSIDC 6/9/10
20090502	S glaciers	NSIDC 5/26/10	71.4	NSIDC 6/9/10
20090505	P3-G3 system intercompare	NSIDC 5/26/10	46.9	NSIDC 6/9/10
Total			1403.1	

PARIS 2009 Radar Data Processing Status

Date	MISSION NAME	PARIS Data Status
20090331	Seaice 3	NSIDC 6/4/10
20090401	E.Central icecap	NSIDC 6/4/10
20090402	Seaice Thule – Fairbanks	NSIDC 6/4/10
20090405	Seaice Fairbanks – Thule	NSIDC 6/4/10
20090406	NW glaciers	NSIDC 6/4/10
20090417	SW glaciers	NSIDC 6/4/10
20090420	NE glaciers	NSIDC 6/4/10
20090421	seaice ENVI	NSIDC 6/4/10
20090422	N glaciers	NSIDC 6/4/10
20090423	E glaciers	NSIDC 6/4/10
20090424	E glaciers2	NSIDC 6/4/10
20090425	Seaice AO icecamp	NSIDC 6/4/10
20090427	Kanger (JakNS) (transit)	
20090428	Jak EW	NSIDC 6/4/10
20090501	E glaciers3	NSIDC 6/4/10
20090502	S glaciers	NSIDC 6/4/10
20090505	P3-G3 system intercompare	NSIDC 6/4/10
Total		

IceBridge 2009 Antarctic Deployment

DATE	ATM MISSION NAME	ATM Volume	ATM DATA STATUS	CAMERA STATUS
20091016	Getz Ice Shelf	48	NSIDC 6/28/10	ARCHIVE
20091018	Pine Island	53.5	Level 2 Pending QA	ARCHIVE
20091020	Pine Island Glacier LVIS			ARCHIVE
20091021	Sea Ice Bellingshausen Amundsen	84.6	Level 2 Pending QA	ARCHIVE
20091024	Sea Ice Wendell	110.8	Level 2 Pending QA	ARCHIVE
20091025	86 Parallel LVIS			ARCHIVE
20091027	Pine Island Glacier	61.3	Level 2 Pending QA	ARCHIVE
20091028	Thwaites Smith Koehler	59.7	Level 2 Pending QA	ARCHIVE
20091029	Pine Island Glacier	80.9	Level 2 Pending QA	ARCHIVE
20091030	Sea Ice Wendell	105.2	Level 2 Pending QA	ARCHIVE
20091031	Antarctic Peninsula	66.3	Level 2 Pending QA	ARCHIVE
20091102	Thwaites Smith Koehler	64.5	Level 2 Pending QA	ARCHIVE
20091103	Antarctic Peninsula	77.9	Level 2 Pending QA	ARCHIVE
20091104	Antarctic Peninsula-Atlee, Larsen C	110.3	Level 2 Pending QA	ARCHIVE
20091105	Antarctic Peninsula LVIS			ARCHIVE
20091107	Pine Island Glacier Abbot Ice Shelf	78	Level 2 Pending QA	ARCHIVE
20091109	Pine Island Glacier	63.5	Level 2 Pending QA	ARCHIVE
20091112	Abbot Ice Shelf	62.3	Level 2 Pending QA	ARCHIVE
20091115	Antarctic Peninsula Drewry Evans	67.1	Level 2 Pending QA	ARCHIVE
20091116	Antarctic Peninsula Larsen C	94.8	Level 2 Pending QA	ARCHIVE
20091118	Thwaites Smith Koehler	48.9	Level 2 Pending QA	ARCHIVE
		1337.6		

IceBridge 2010 Greenland Deployment

DATE	ATM MISSION NAME	ATM Volume	ATM DATA STATUS	CAMERA STATUS
20100323	Sea Ice 5	74	Level 1 CVALID	ARCHIVE
20100324	Petermann	93	Level 1 CVALID	ARCHIVE
20100326	SeaIce 3	80	Level 1 CVALID	ARCHIVE
20100329	NE LVIS	0	Level 1 CVALID	ARCHIVE
20100330	NEIS	100	Level 1 CVALID	ARCHIVE
20100402	NW Passage SeaIce	90	Level 1 CVALID	ARCHIVE
20100405	SeaIce6	78	Level 1 CVALID	ARCHIVE
20100409	Rinks LVIS	0	Level 1 CVALID	ARCHIVE
20100412	Sea Ice 4	76	Level 1 CVALID	ARCHIVE
20100413	NEIS 2	93	Level 1 CVALID	ARCHIVE
20100414	SE LVis	0	Level 1 CVALID	ARCHIVE
20100419	Sea Ice 1	60	Level 1 CVALID	ARCHIVE
20100420	Cyrosat	68	Level 1 CVALID	ARCHIVE
20100421	Sea Ice 2	52	Level 1 CVALID	ARCHIVE
				ARCHIVE
20100507	Geikie	100	ARCHIVE	ARCHIVE
20100508	Kanger	60	ARCHIVE	ARCHIVE
20100509	Russell	65	ARCHIVE	ARCHIVE
20100512	SE Greenland	82	ARCHIVE	ARCHIVE
20100513	South Greenland	62	ARCHIVE	ARCHIVE
20100514	Jakobshavn	58	ARCHIVE	ARCHIVE
20100515	Russell Sukertoppen	32	ARCHIVE	ARCHIVE
20100517	Thule transit	40	ARCHIVE	ARCHIVE
20100519	NW Greenland	50	ARCHIVE	ARCHIVE
20100520	NW Greenland Coast	45	ARCHIVE	ARCHIVE
20100521	NW Greenland Coast	45	ARCHIVE	ARCHIVE
20100525	NE Icestream	49	ARCHIVE	ARCHIVE
21010526	NE Icestream		ARCHIVE	ARCHIVE

ICESat transmitted 1,984,210,719 shots over its lifetime

ICESat transmitted 1,984,210,719 shots over its lifetime

Since IceBridge started, the ATM's have transmitted
Over 12,000,000,000 shots

ATM IceBridge Data Processing Status

IceBridge 2009 Greenland Deployment

ATM qfit and icessn data products

Date	ATM MISSION NAME	ATM DATA STATUS	Raw ATM Volume	CAMERA STATUS
20090331	Seaice 3	NSIDC 5/7/10	68.6	NSIDC 6/9/10
20090401	E.Central icecap	NSIDC 5/11/10	71.9	NSIDC 6/9/10
20090402	Seaice Thule – Fairbanks	NSIDC 5/10/10	81.8	NSIDC 6/9/10
20090405	Seaice Fairbanks – Thule	NSIDC 5/12/10	87.7	NSIDC 6/9/10
20090406	NW glaciers	NSIDC 5/19/10	97.8	NSIDC 6/9/10
20090417	SW glaciers	NSIDC 5/13/10	88.5	NSIDC 6/9/10
20090420	NE glaciers	NSIDC 5/13/10	109.8	NSIDC 6/9/10
20090421	seaice ENVI	NSIDC 5/26/10	63.3	NSIDC 6/9/10
20090422	N glaciers	NSIDC 5/19/10	98.8	NSIDC 6/9/10
20090423	E glaciers	NSIDC 5/19/10	95.1	NSIDC 6/9/10
20090424	E glaciers2	NSIDC 5/19/10	96.1	NSIDC 6/9/10
20090425	Seaice AO icecamp	NSIDC 5/25/10	64.3	NSIDC 6/9/10
20090427	Kanger (JakNS) (transit)		88.7	NSIDC 6/9/10
20090428	Jak EW	NSIDC 6/10/10	89.4	NSIDC 6/9/10
20090501	E glaciers3	NSIDC 6/3/10	83.0	NSIDC 6/9/10
20090502	S glaciers	NSIDC 5/26/10	71.4	NSIDC 6/9/10
20090505	P3-G3 system intercompare	NSIDC 5/26/10	46.9	NSIDC 6/9/10
Total			1403.1	

PARIS Radar Data Processing Status

IceBridge 2009 Greenland Deployment

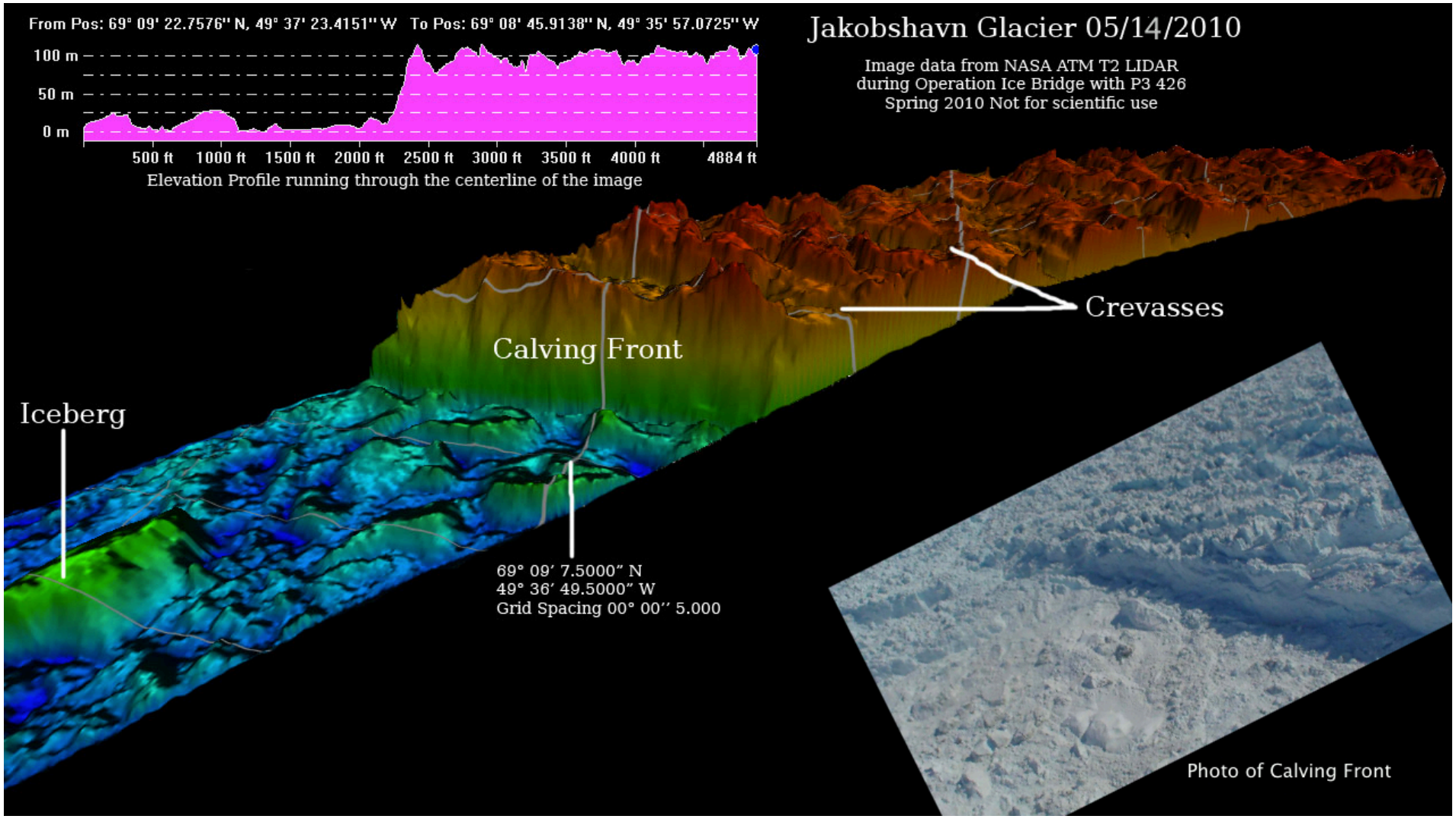
Date	MISSION NAME	PARIS Data Status
20090331	Seaice 3	NSIDC 6/4/10
20090401	E.Central icecap	NSIDC 6/4/10
20090402	Seaice Thule – Fairbanks	NSIDC 6/4/10
20090405	Seaice Fairbanks – Thule	NSIDC 6/4/10
20090406	NW glaciers	NSIDC 6/4/10
20090417	SW glaciers	NSIDC 6/4/10
20090420	NE glaciers	NSIDC 6/4/10
20090421	seaice ENVI	NSIDC 6/4/10
20090422	N glaciers	NSIDC 6/4/10
20090423	E glaciers	NSIDC 6/4/10
20090424	E glaciers2	NSIDC 6/4/10
20090425	Seaice AO icecamp	NSIDC 6/4/10
20090427	Kanger (JakNS) (transit)	
20090428	Jak EW	NSIDC 6/4/10
20090501	E glaciers3	NSIDC 6/4/10
20090502	S glaciers	NSIDC 6/4/10
20090505	P3-G3 system intercompare	NSIDC 6/4/10
Total		

IceBridge 2009 Antarctic Deployment

DATE	ATM MISSION NAME	ATM Volume	ATM DATA STATUS	CAMERA STATUS
20091016	Getz Ice Shelf	48	Pending QA	
20091018	Pine Island	53.5	Pending QA	
20091020	Pine Island Glacier LVIS			
20091021	Sea Ice Bellingshausen Amundsen	84.6	Pending QA	
20091024	Sea Ice Wendell	110.8	Pending QA	
20091025	86 Parallel LVIS			
20091027	Pine Island Glacier	61.3	Pending QA	
20091028	Thwaites Smith Koehler	59.7	Pending QA	
20091029	Pine Island Glacier	80.9	Pending QA	
20091030	Sea Ice Wendell	105.2	Pending QA	
20091031	Antarctic Peninsula	66.3	Pending QA	
20091102	Thwaites Smith Koehler	64.5	Pending QA	
20091103	Antarctic Peninsula	77.9	Pending QA	
20091104	Antarctic Peninsula-Atlee, Larsen C	110.3	Pending QA	
20091105	Antarctic Peninsula LVIS			
20091107	Pine Island Glacier Abbot Ice Shelf	78	Pending QA	
20091109	Pine Island Glacier	63.5	Pending QA	
20091112	Abbot Ice Shelf	62.3	Pending QA	
20091115	Antarctic Peninsula Drewry Evans	67.1	Pending QA	
20091116	Antarctic Peninsula Larsen C	94.8	Pending QA	
20091118	Thwaites Smith Koehler	48.9	Pending QA	
		1337.6		

IceBridge 2010 Greenland Deployment

DATE	ATM MISSION NAME	ATM Volume	ATM DATA STATUS	CAMERA STATUS
20100323	Sea Ice 5	74	CVALID	
20100324	Petermann	93	CVALID	
20100326	SeaIce 3	80	CVALID	
20100329	NE LVIS	0	CVALID	
20100330	NEIS	100	CVALID	
20100402	NW Passage SeaIce	90	CVALID	
20100405	SeaIce6	78	CVALID	
20100409	Rinks LVIS	0	CVALID	
20100412	Sea Ice 4	76	CVALID	
20100413	NEIS 2	93	CVALID	
20100414	SE LVis	0	CVALID	
20100419	Sea Ice 1	60	CVALID	
20100420	Cyrosat	68	CVALID	
20100421	Sea Ice 2	52	CVALID	
20100507	Geikie	100	ARCHIVE	
20100508	Kanger	60	ARCHIVE	
20100509	Russell	65	ARCHIVE	
20100512	SE Greenland	82	ARCHIVE	
20100513	South Greenland	62	ARCHIVE	
20100514	Jakobshavn	58	ARCHIVE	
20100515	Russell Sukertoppen	32	ARCHIVE	
20100517	Thule transit	40	ARCHIVE	
20100519	NW Greenland	50	ARCHIVE	
20100520	NW Greenland Coast	45	ARCHIVE	
20100521	NW Greenland Coast	45	ARCHIVE	
20100525	NE Icestream	49	ARCHIVE	
21010526	NE Icestream		ARCHIVE	


From Pos: 69° 09' 22.7576'' N, 49° 37' 23.4151'' W To Pos: 69° 08' 45.9138'' N, 49° 35' 57.0725'' W
100 m
50 m
0 m
500 ft
1000 ft
1500 ft
2000 ft
2500 ft
3000 ft
3500 ft
4000 ft
4884 ft
Elevation Profile running through the centerline of the image
Jakobshavn Glacier 05/14/2010
Image data from NASA ATM T2 LIDAR
during Operation Ice Bridge with P3 426
Spring 2010 Not for scientific use
Crevasses
Calving Front
Iceberg
69° 09′ 7.5000″ N
49° 36′ 49.5000″ W
Grid Spacing 00° 00′′ 5.000
Photo of Calving Front