Cryosat-2 SAR-In altimetry for coastal sea level recovery - Results from the fjords of eastern Greenland.

- or COASTAL ALTIMETRY from an altimeter FLYING OVER LAND

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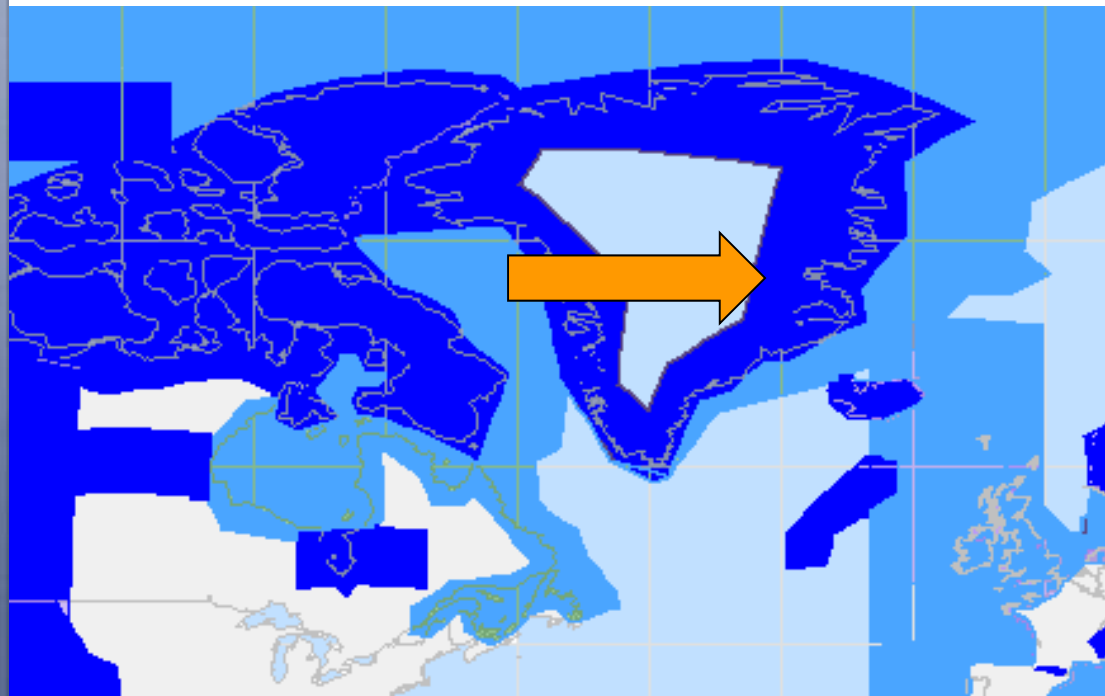
National Space Institute

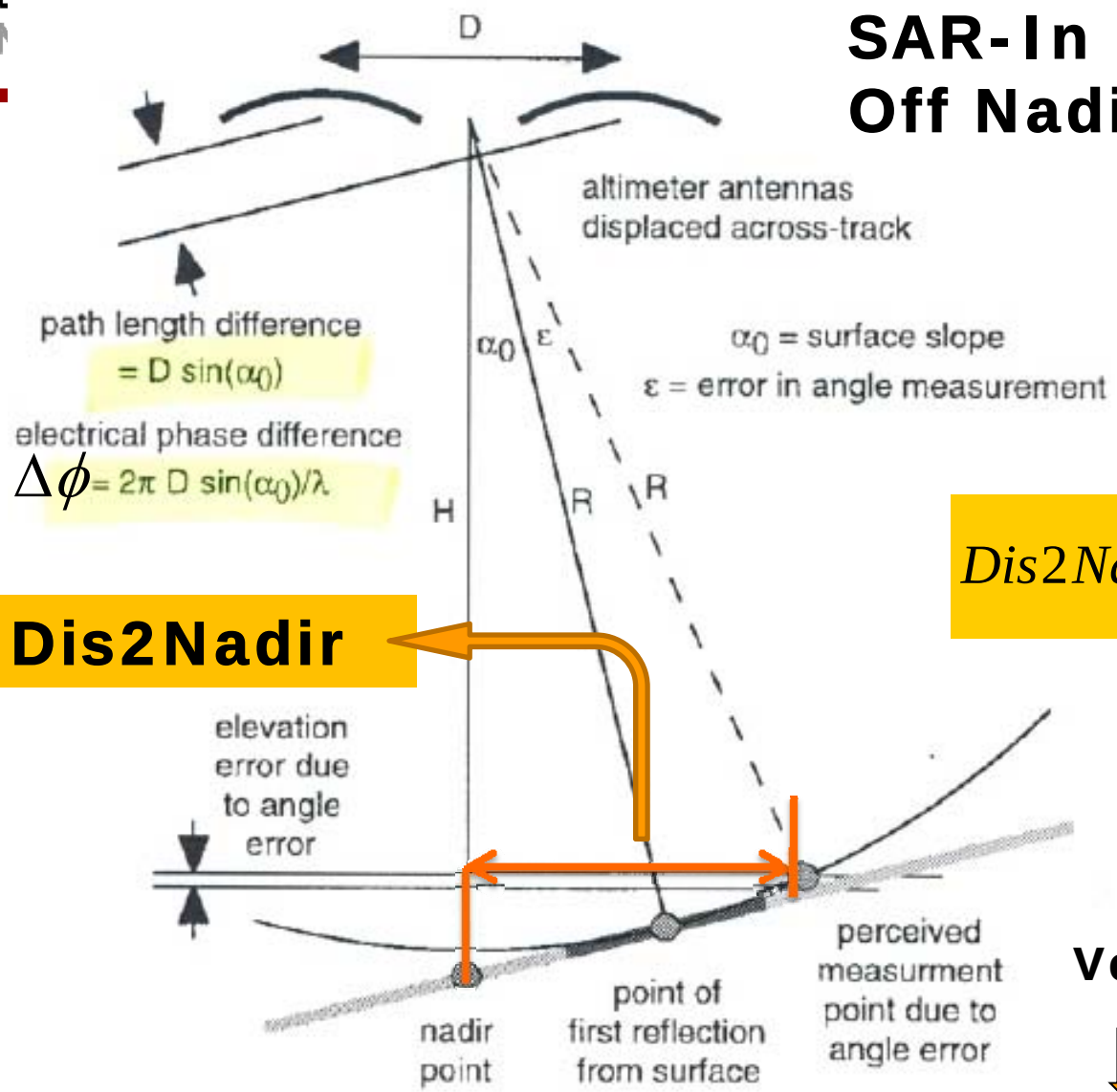
Overview

- Area (Eastern Greenland)
- SAR-in
- Cross-track height correction - distance to nadir correction
- Windows-delay problems.
- Fjord ”ice-season” time series.
- Conclusions




Point 1620
eland
Image Landsat
Google earth

SAR-In
Off Nadir observations



Dis2Nadir

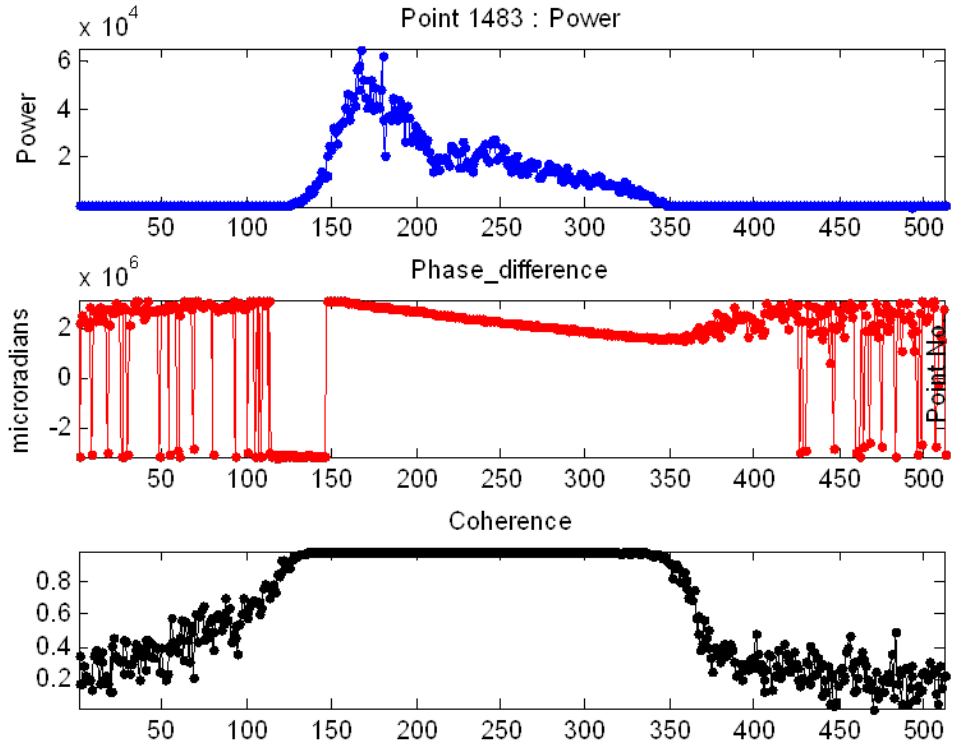
$$Dis2Nadir = \frac{(H_{sat} - SSH) \cdot \Delta\phi \cdot \lambda}{2\pi \cdot D}$$

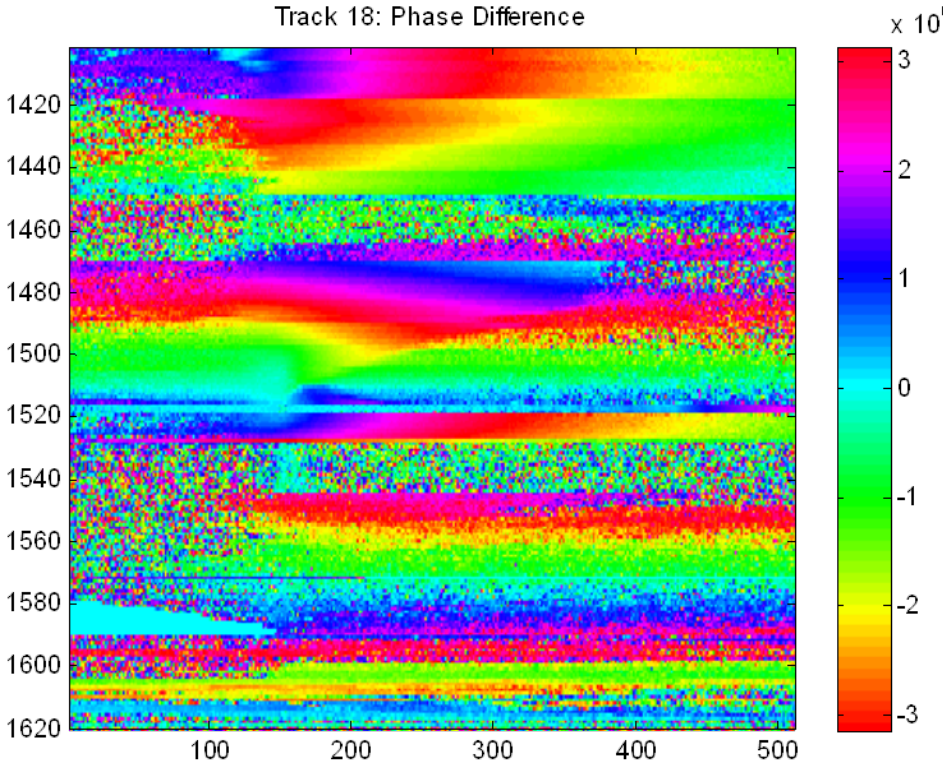
Very simple retracking

$$SSH = H_{Sat} - t_{wd} \times \frac{c}{2} - 0.234 \times (255 - \mathrm{BIN}_{MaxPower}) - Corr.$$

Phase and coherence

- SAR-in records in 512 bins of 0.23 m = 120 m range
- Tracking point around bin 150

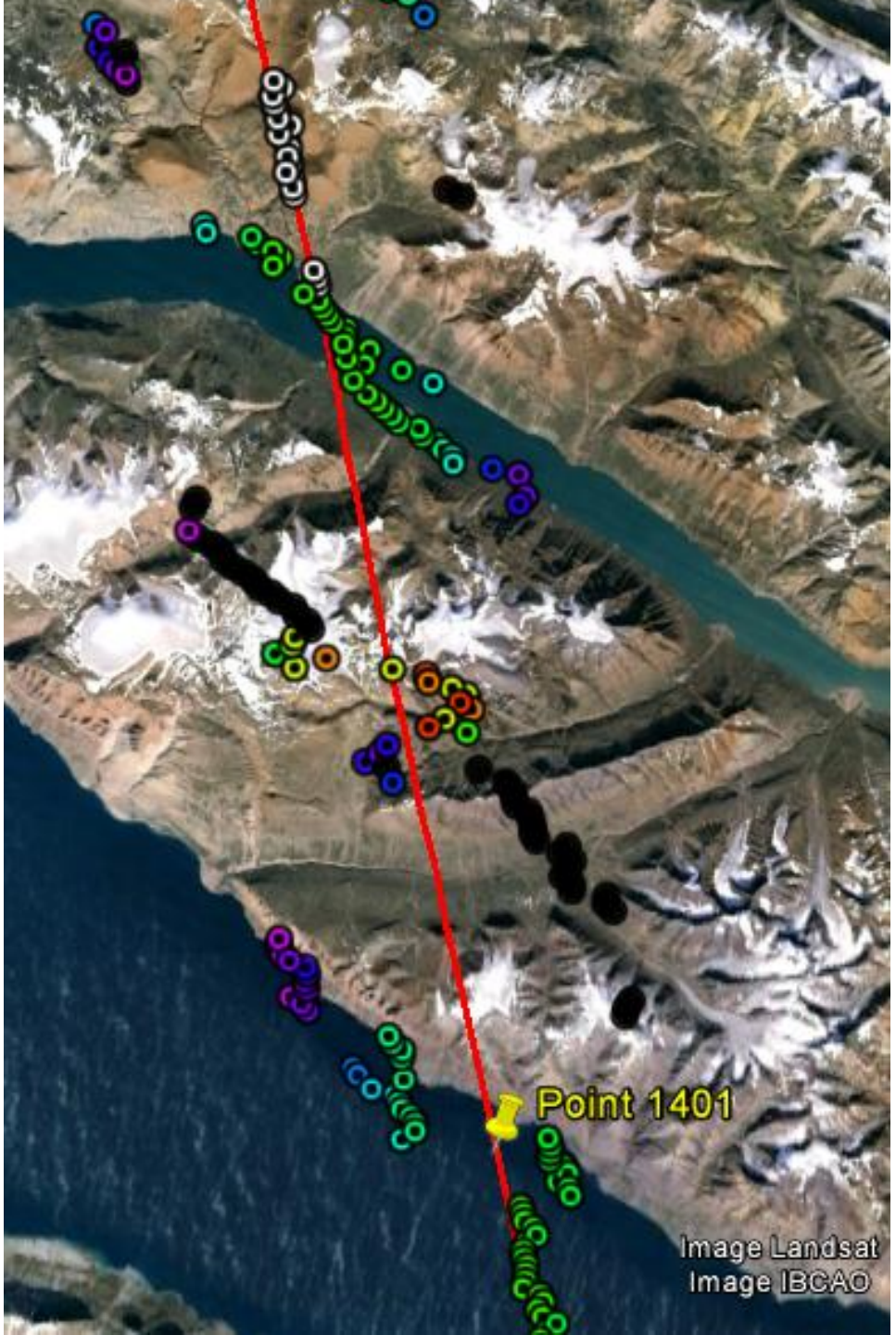




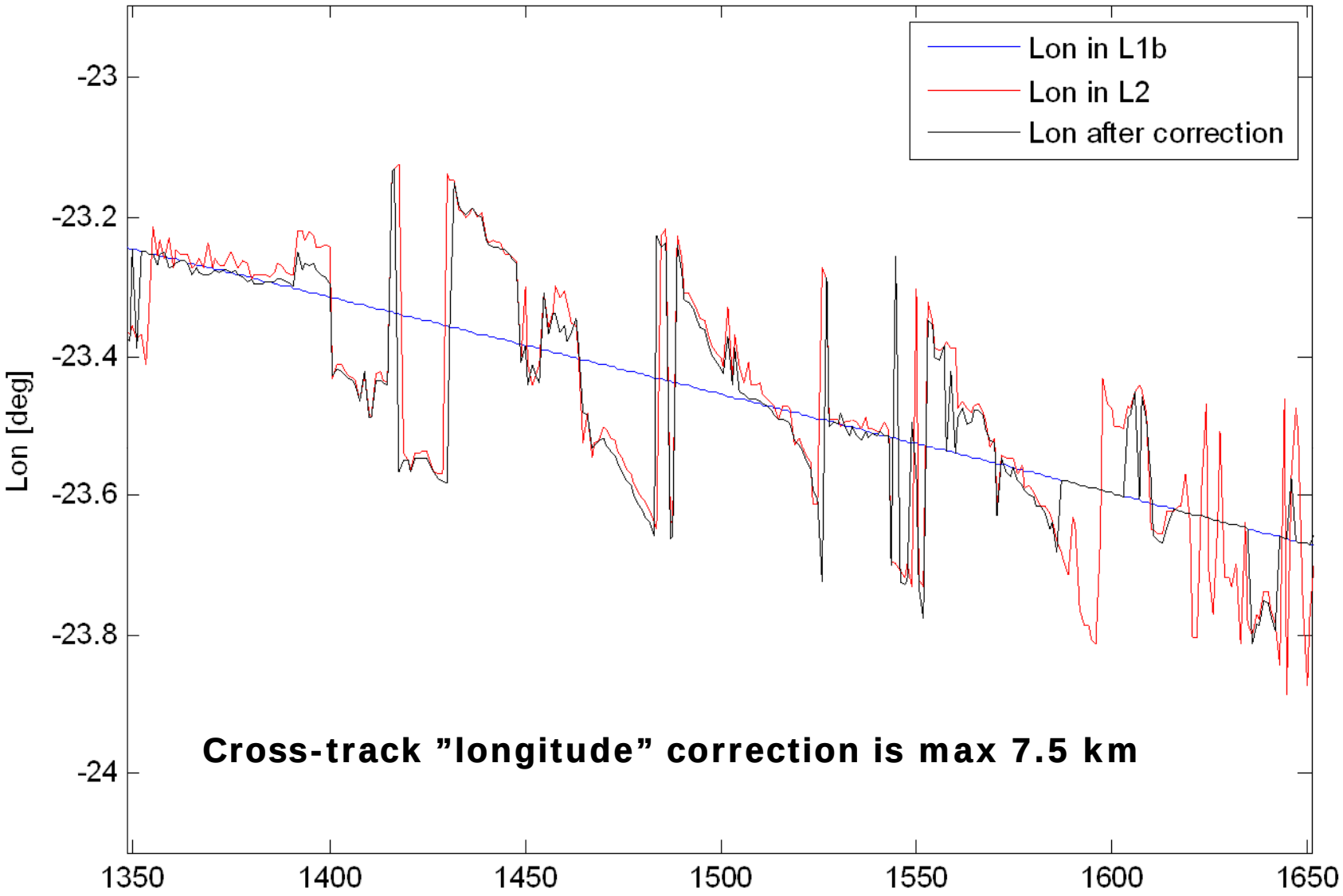
Repositioning using phase difference.

Dis2Nadir

X-track “Lontitude” correction applied !



Longitude vs ESA L2 longitude



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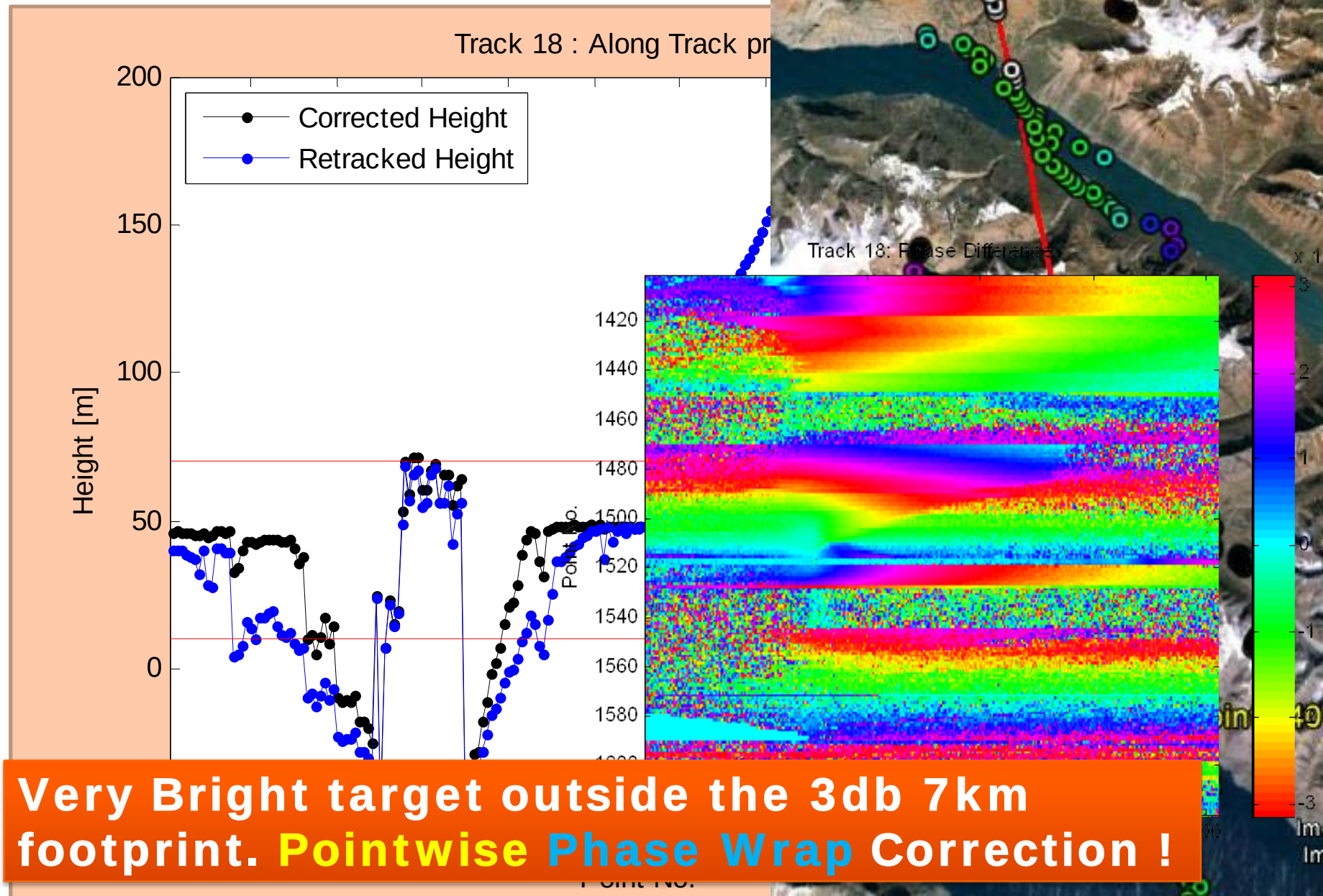
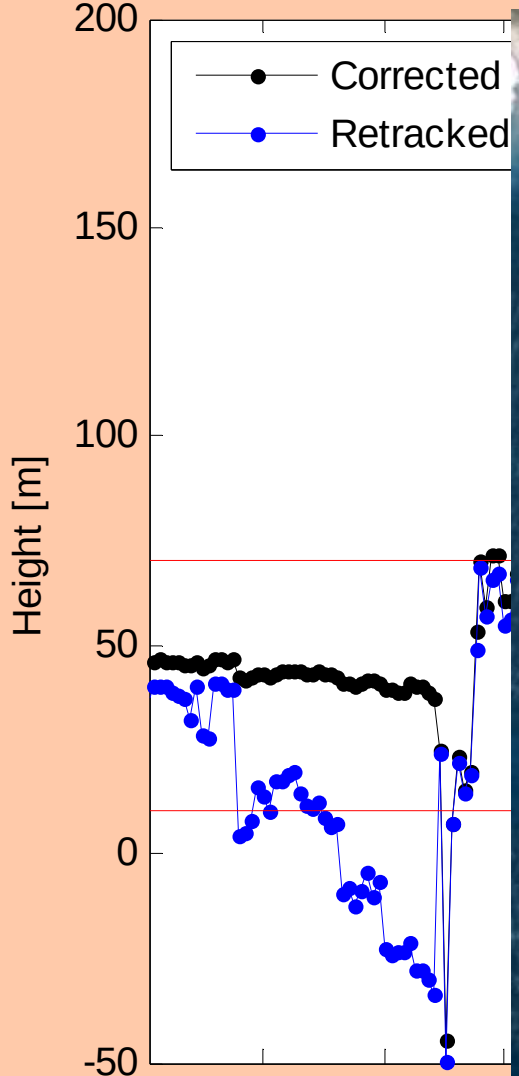
Off nadir corre



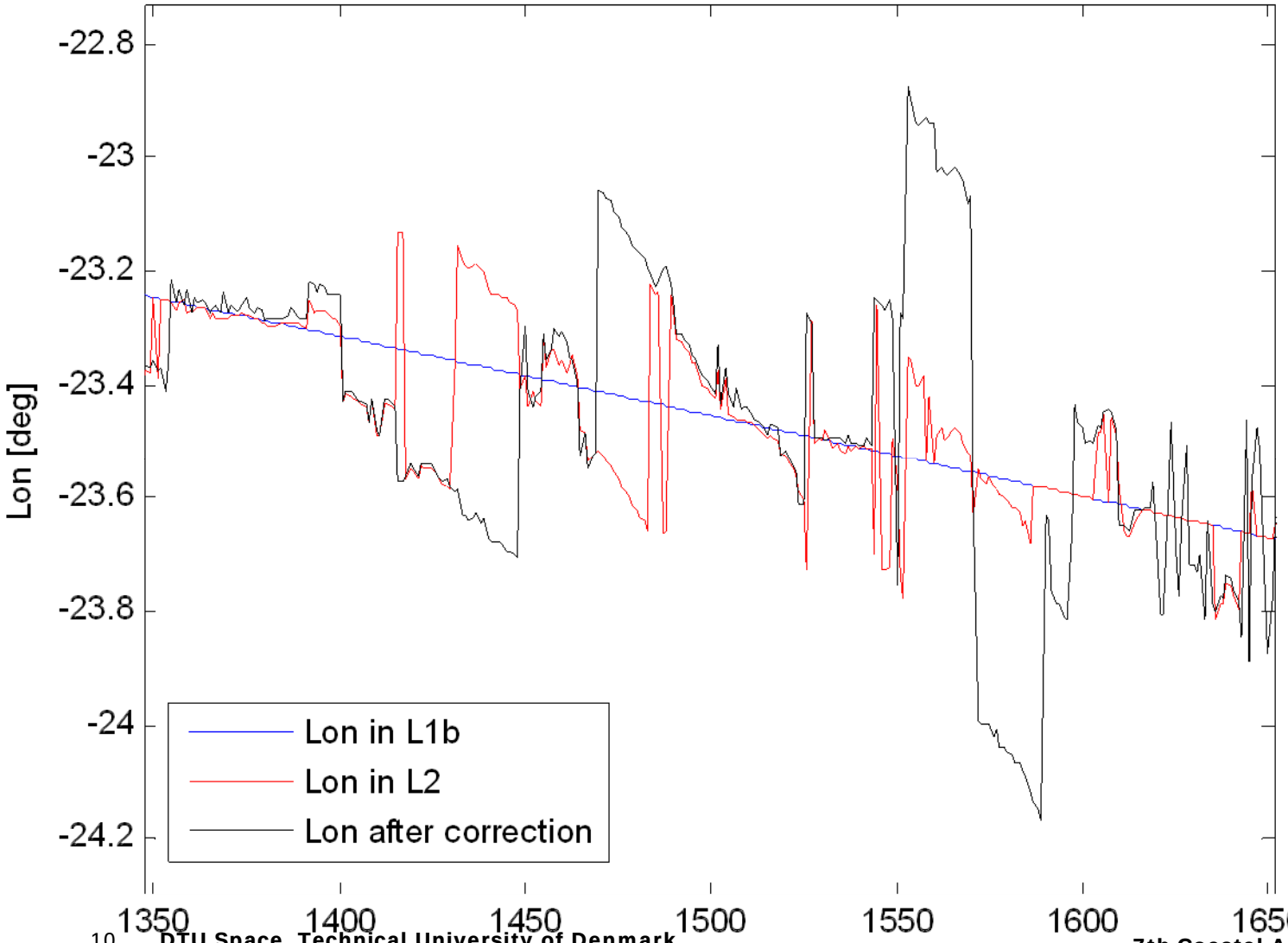
Very Bright target outside the 3db 7km footprint. Pointwise Phase Wrap Correction !

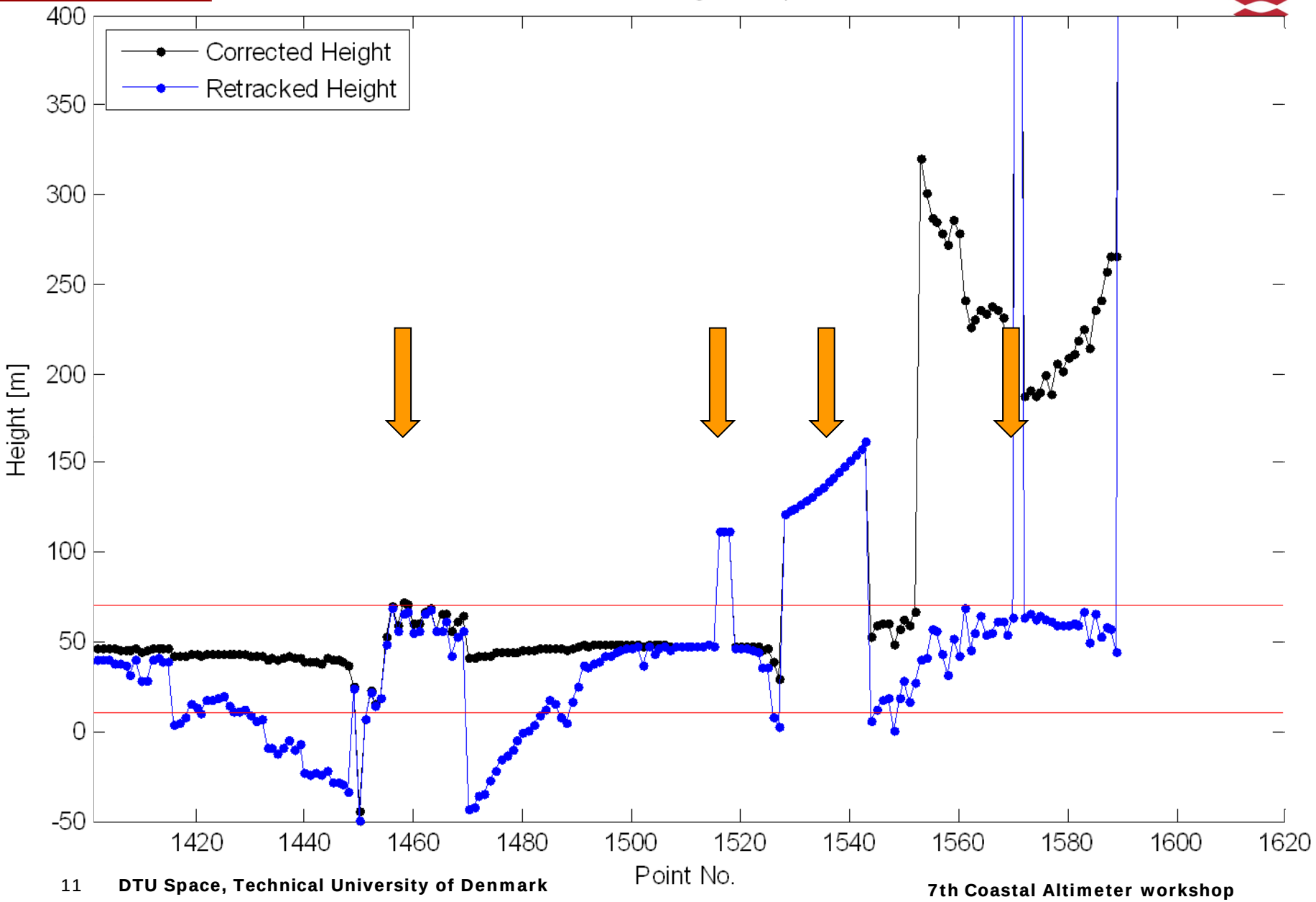
Phasewrapped heights

Track 18 : Along Track profile

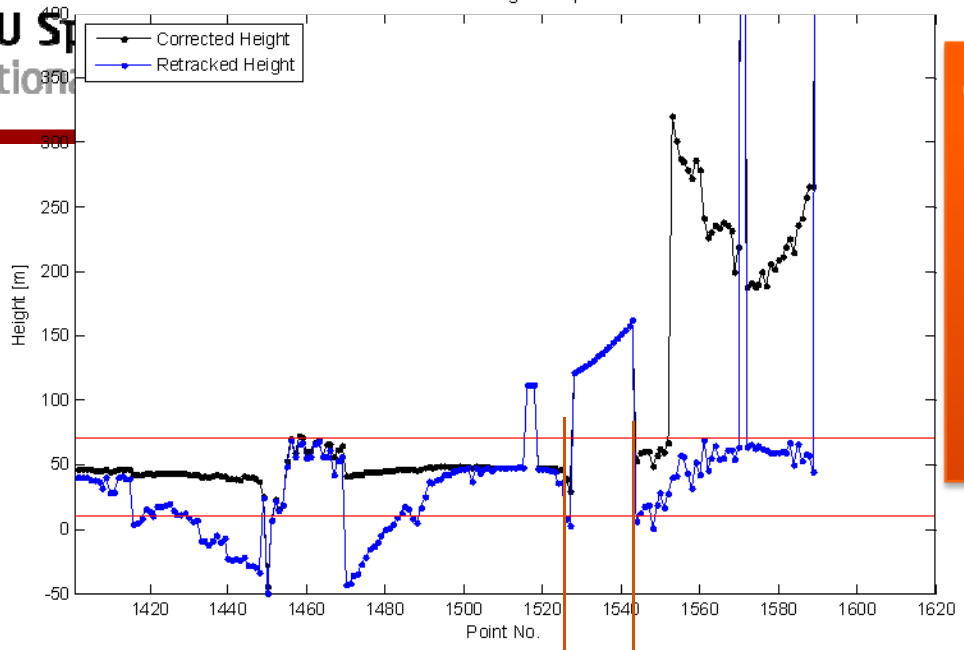


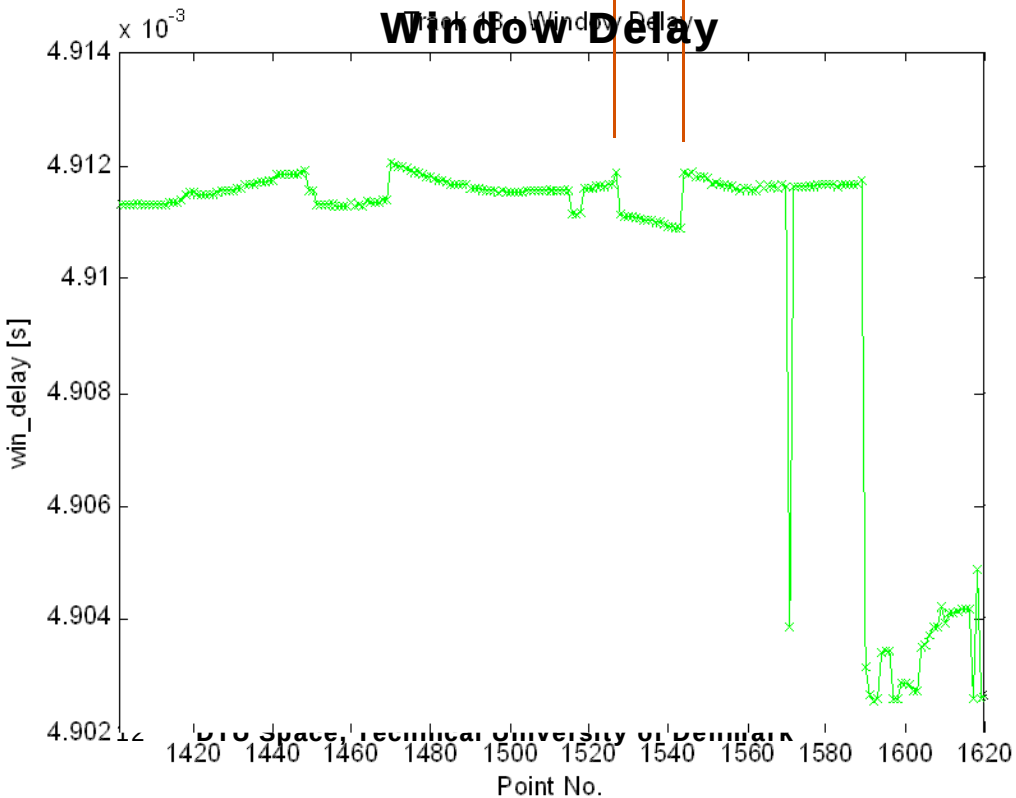
After Phase wrap Correction

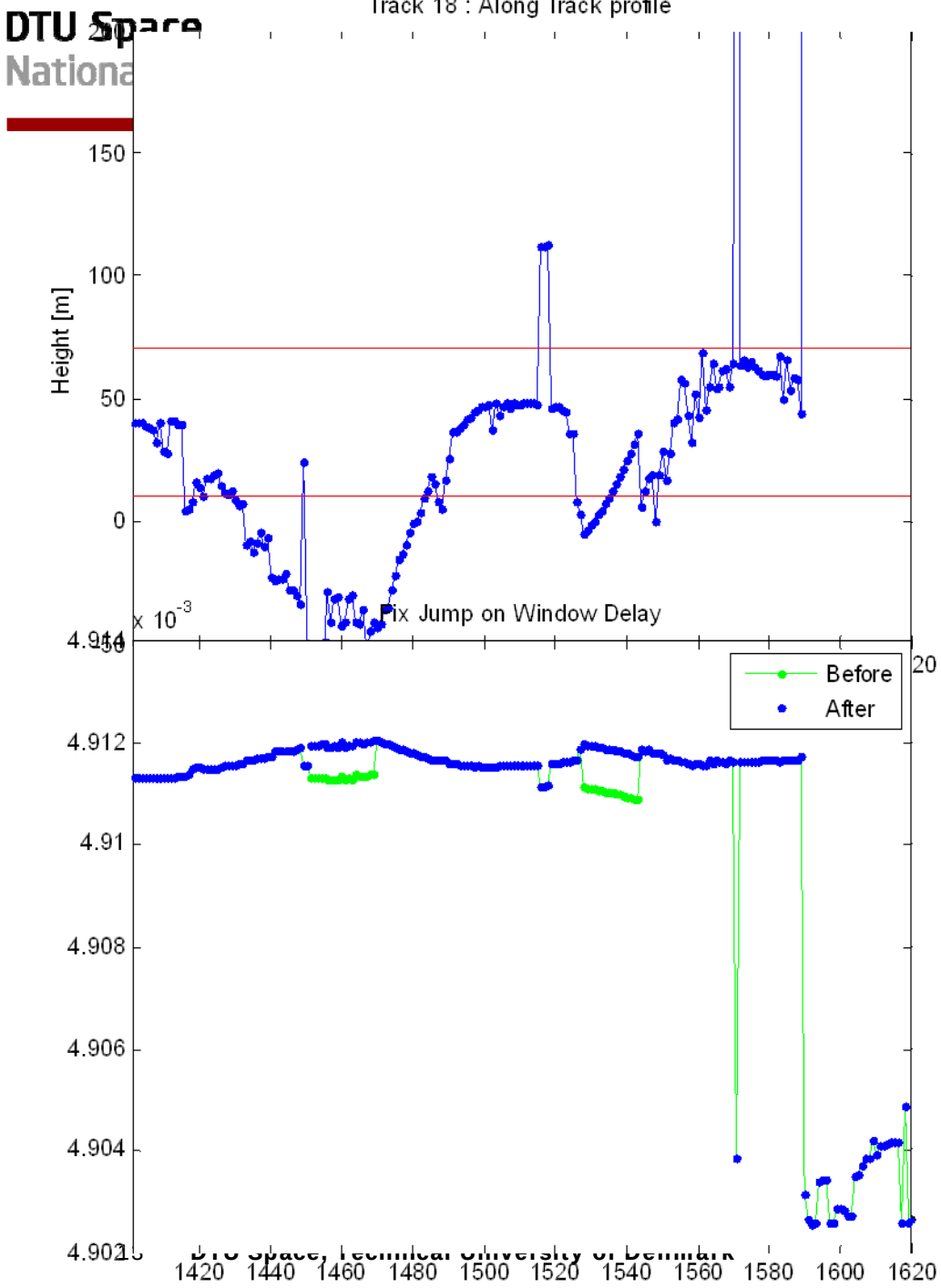



Track 18 : Along Track profile
Corrected Height
Retracked Height
Height [m]
Point No.
400
350
300
250
200
150
100
50
0
-50
1420
1440
1460
1480
1500
1520
1540
1560
1580
1600
1620

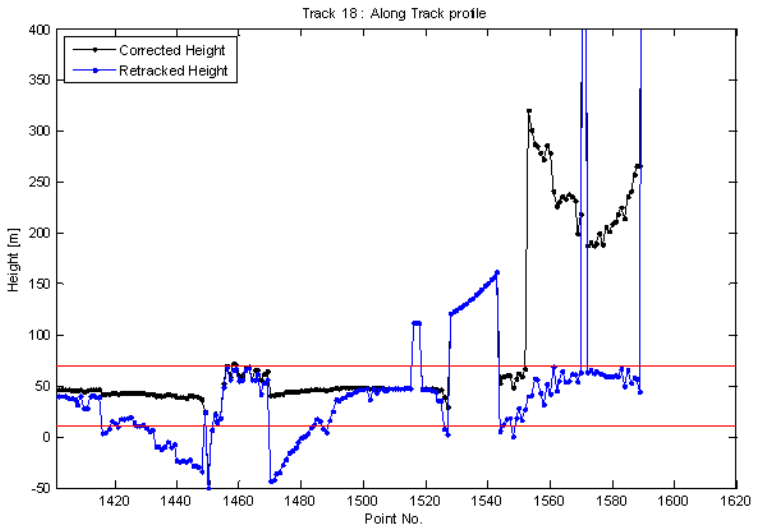
Cryosat-2 problem: Spurious Window delay jump causing Height jump







Correcting height for the window delay jump



"NOT" applicable !

But it works.....

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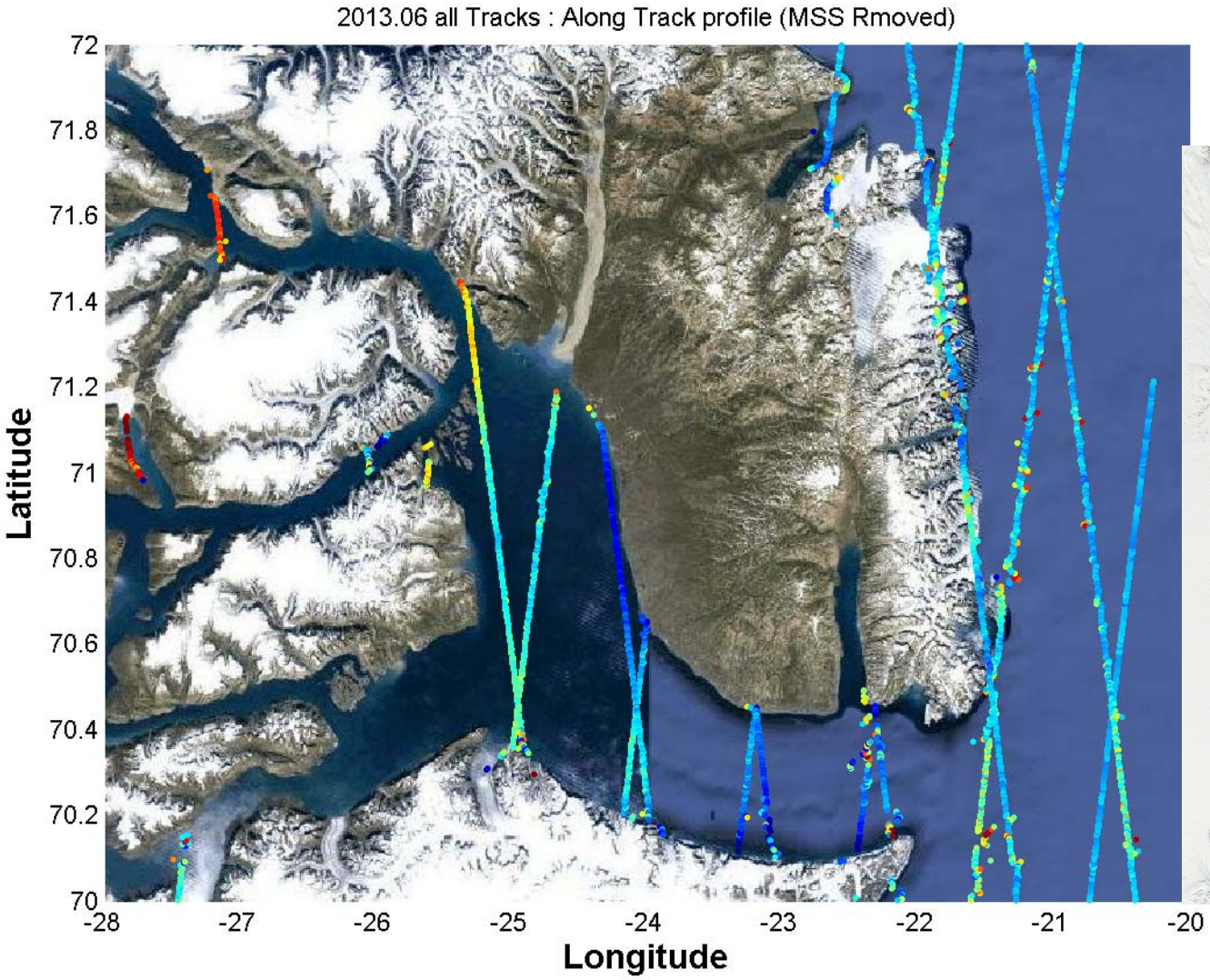
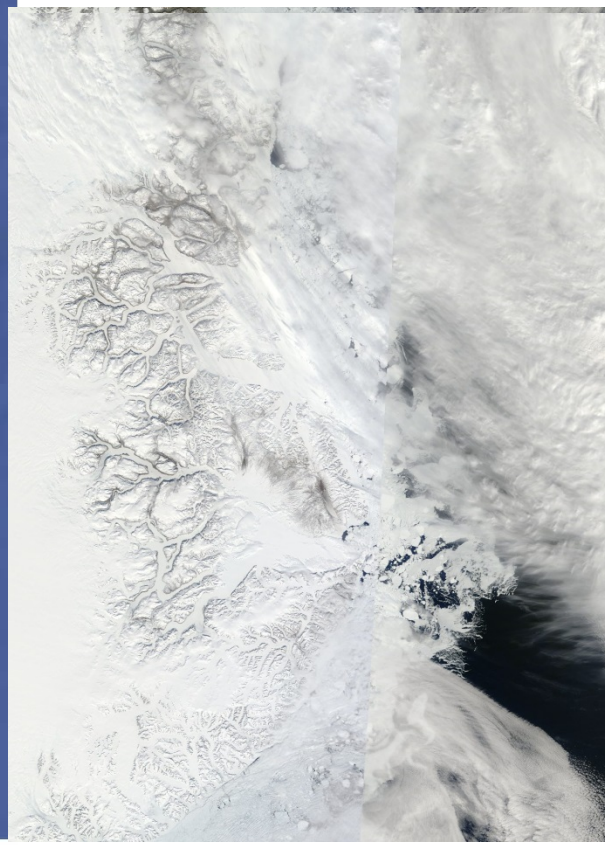
SAR-in East Greenland Fjord

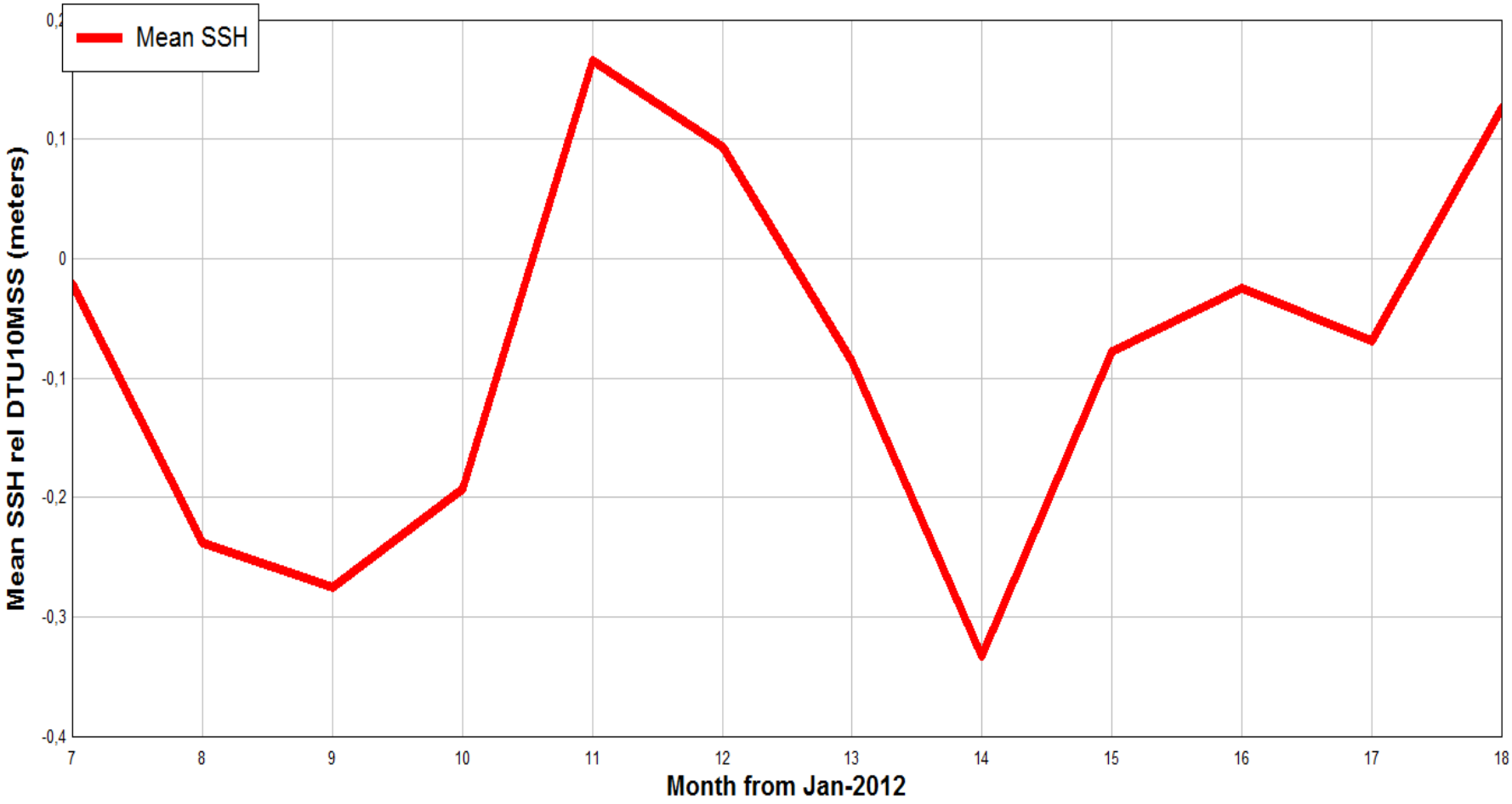
”Ice” season July 2012-Jun 2013





−1.0 1.0 m

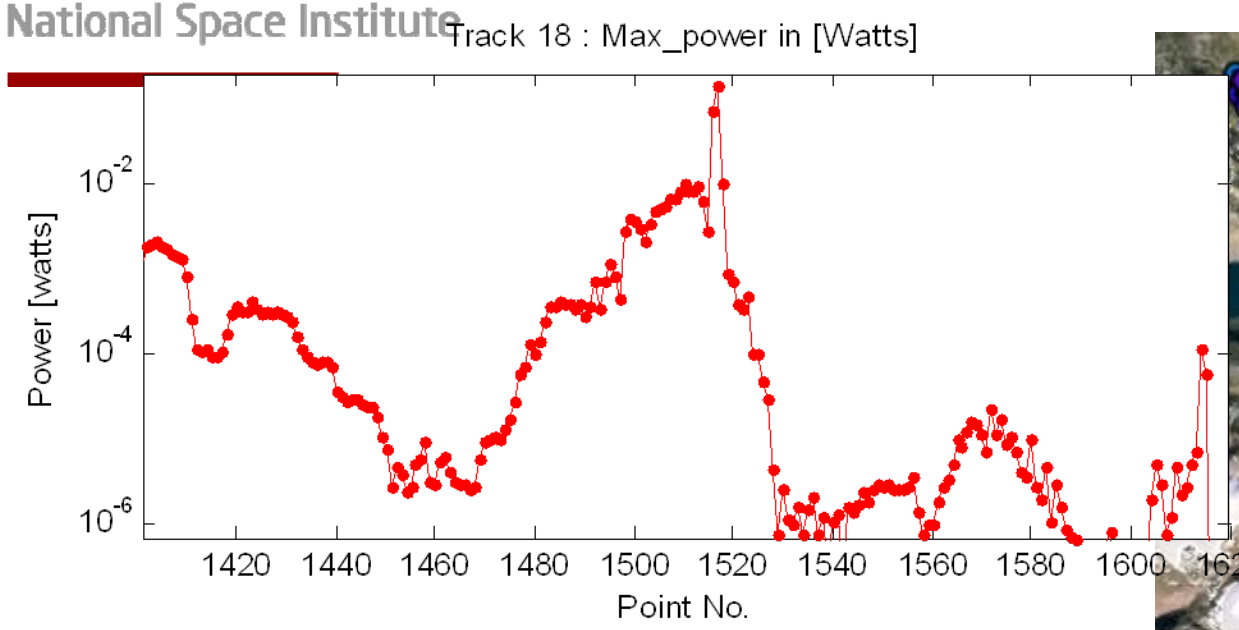
Fjord Height (Ice-season).

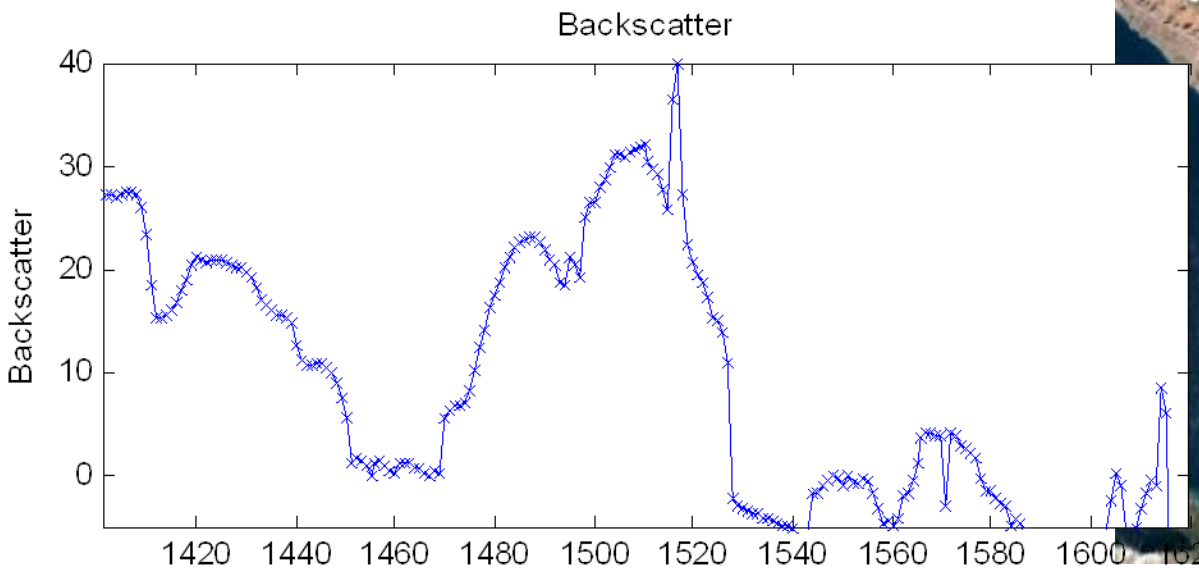


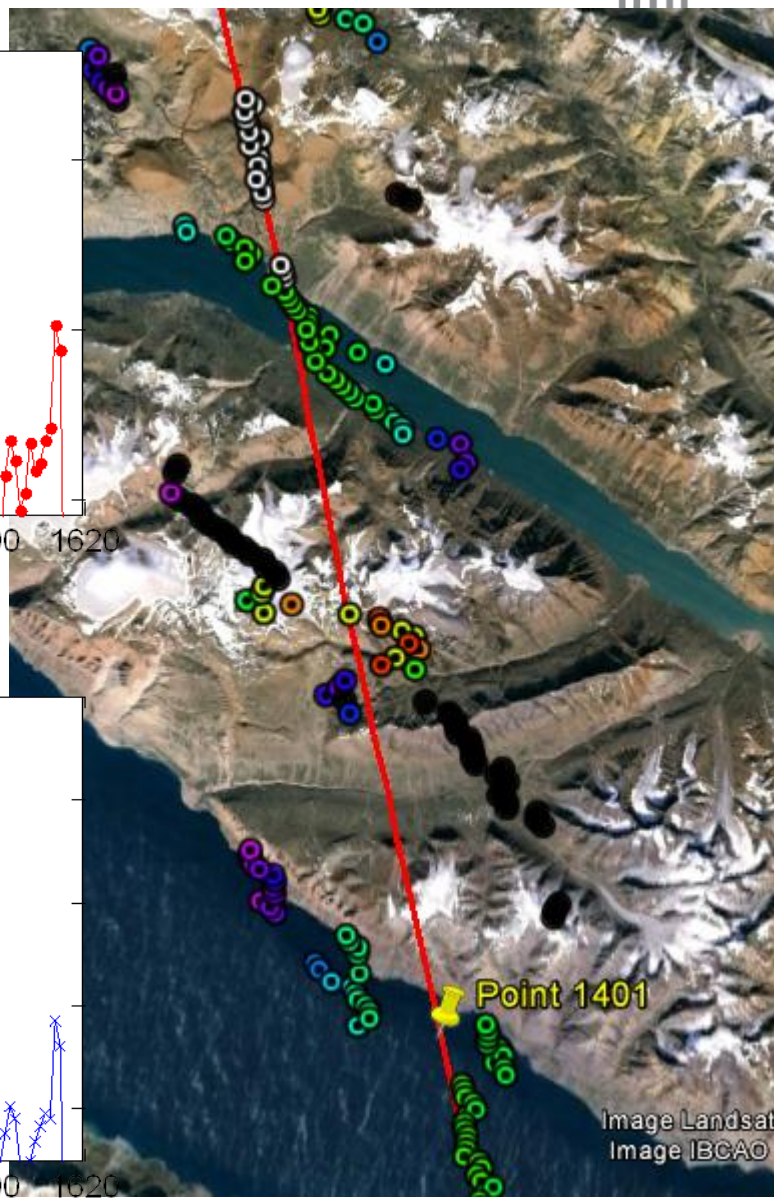
Conclusion.

- SAR-in offers fascinating new coastal altimeter data.
- SAR-in is able to map coastal zone from “inland”
- Up to 15 km with the phase wrap correction (assuming bright no other water bodies)
- Investigated the ”icy winter season” where no
- Optical images are available > ice-thickness.....

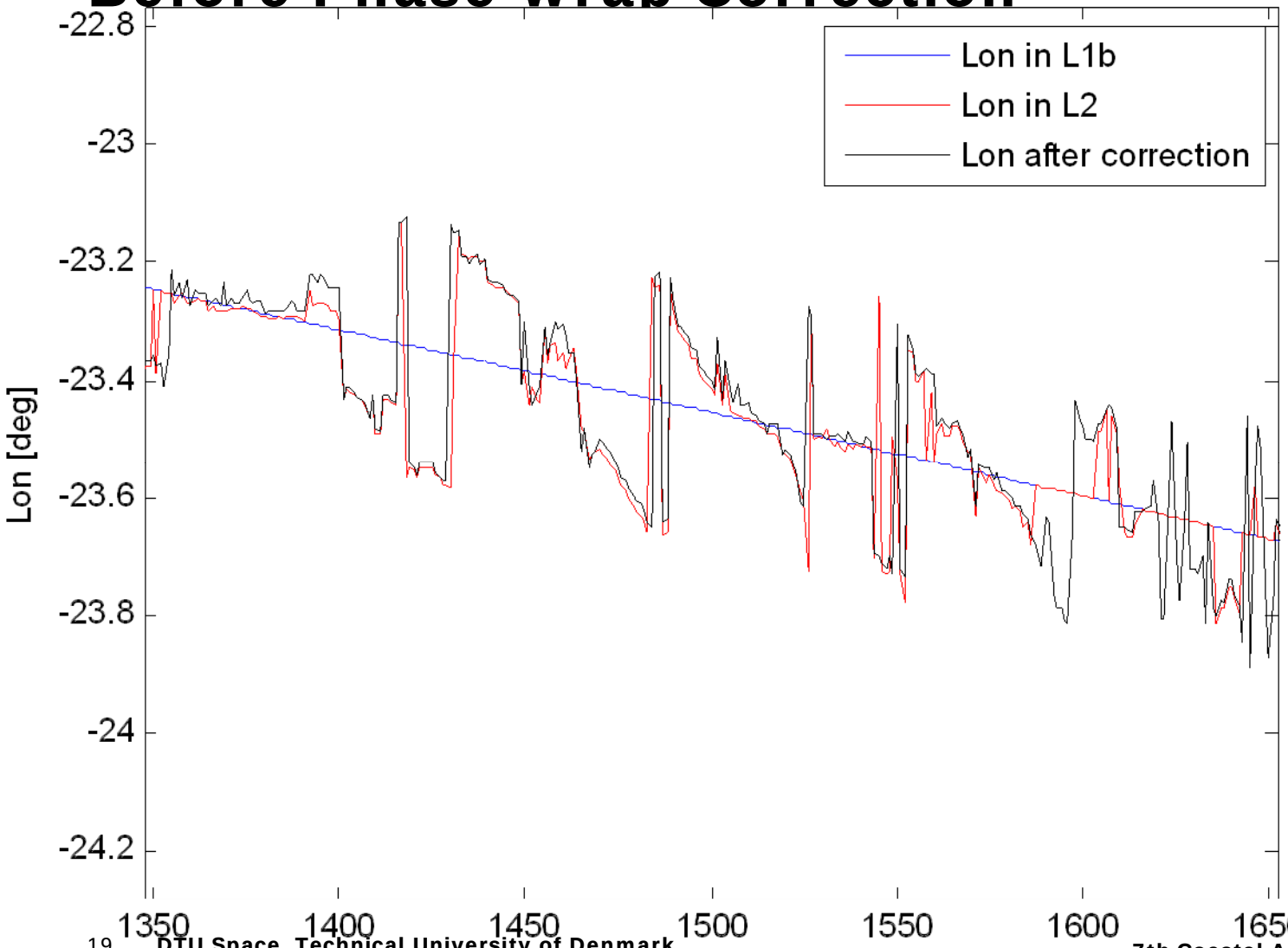
BACKUP slides

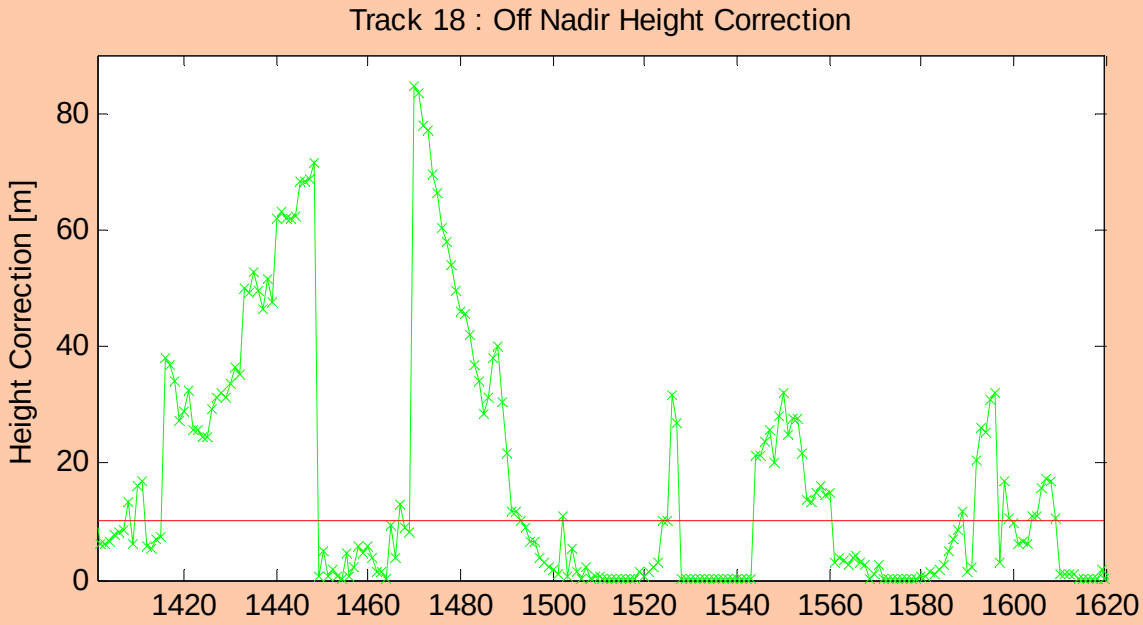

Track 18 : Max_power in [Watts]
Power [watts]
10^{-2}
10^{-4}
10^{-6}
1420 1440 1460 1480 1500 1520 1540 1560 1580 1600 1620
Point No.

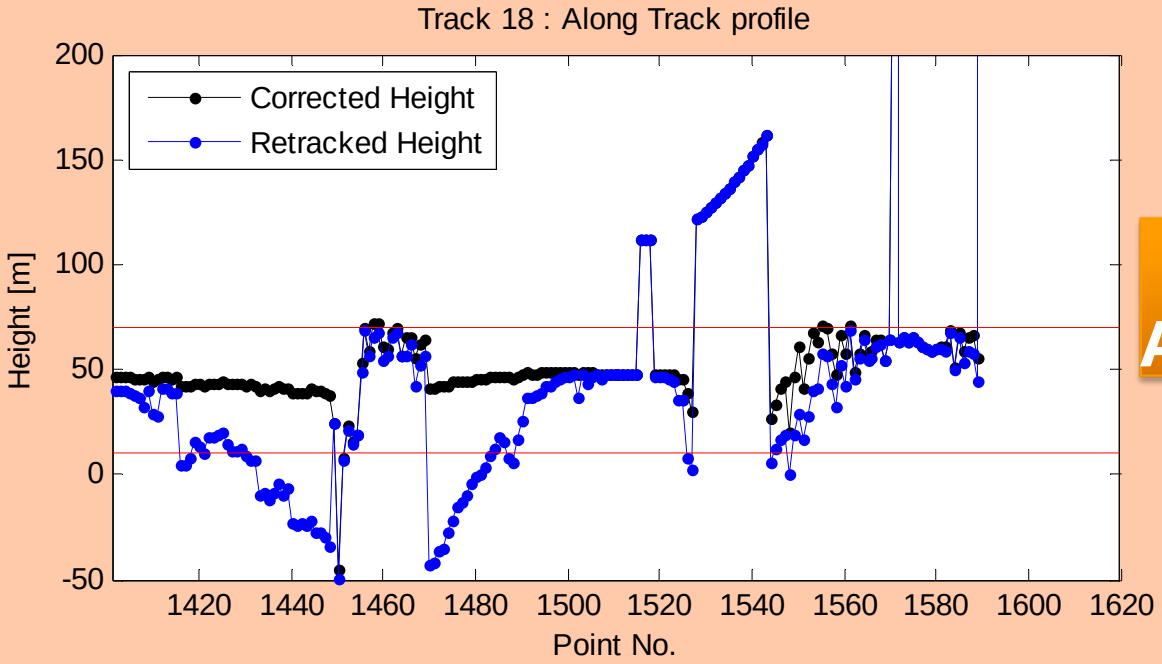

Backscatter
Backscatter
40
30
20
10
0
1420 1440 1460 1480 1500 1520 1540 1560 1580 1600 1620


Point 1401
Image Landsat
Image IBCAO

Before Phase wrap Correction

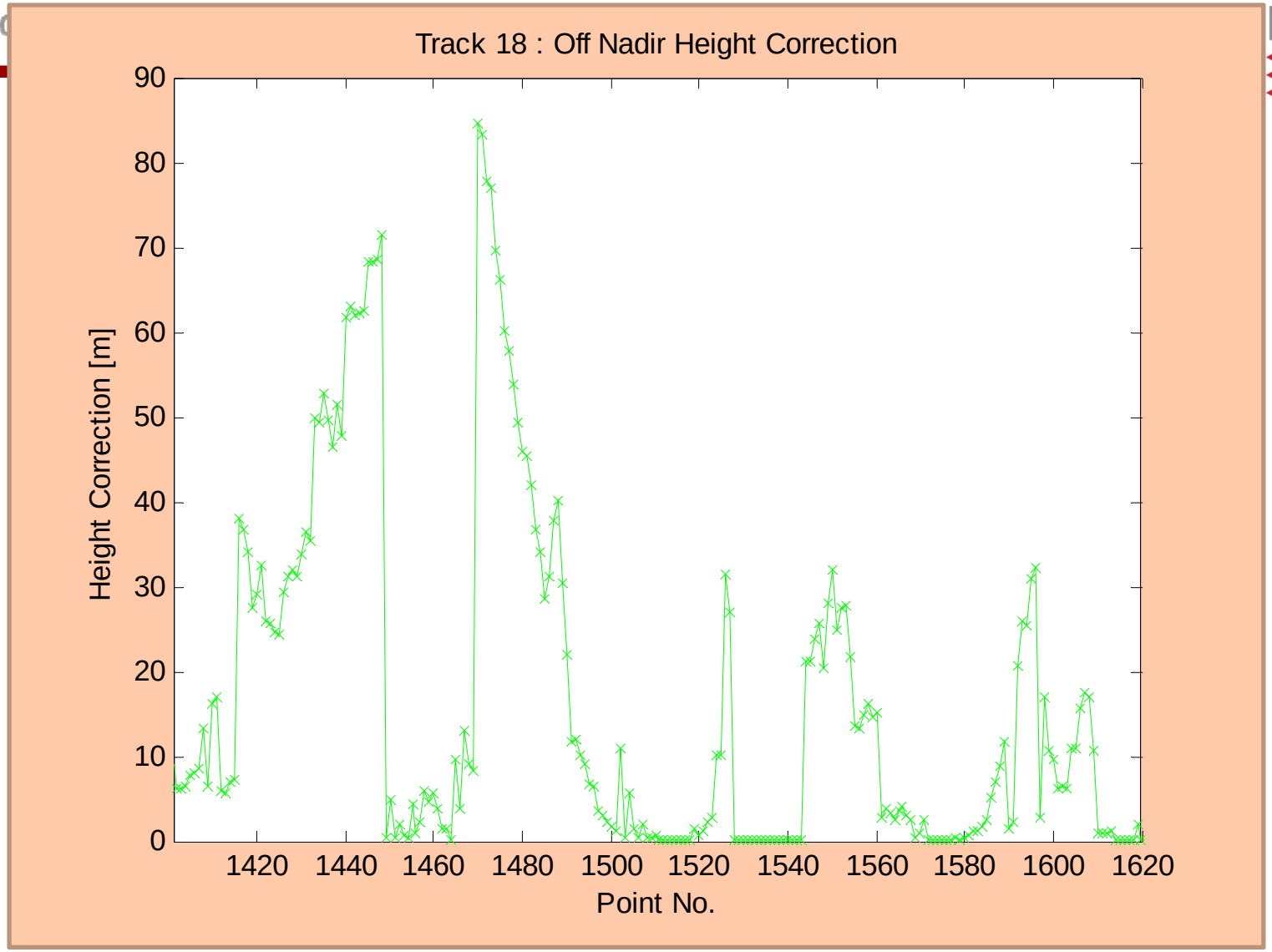






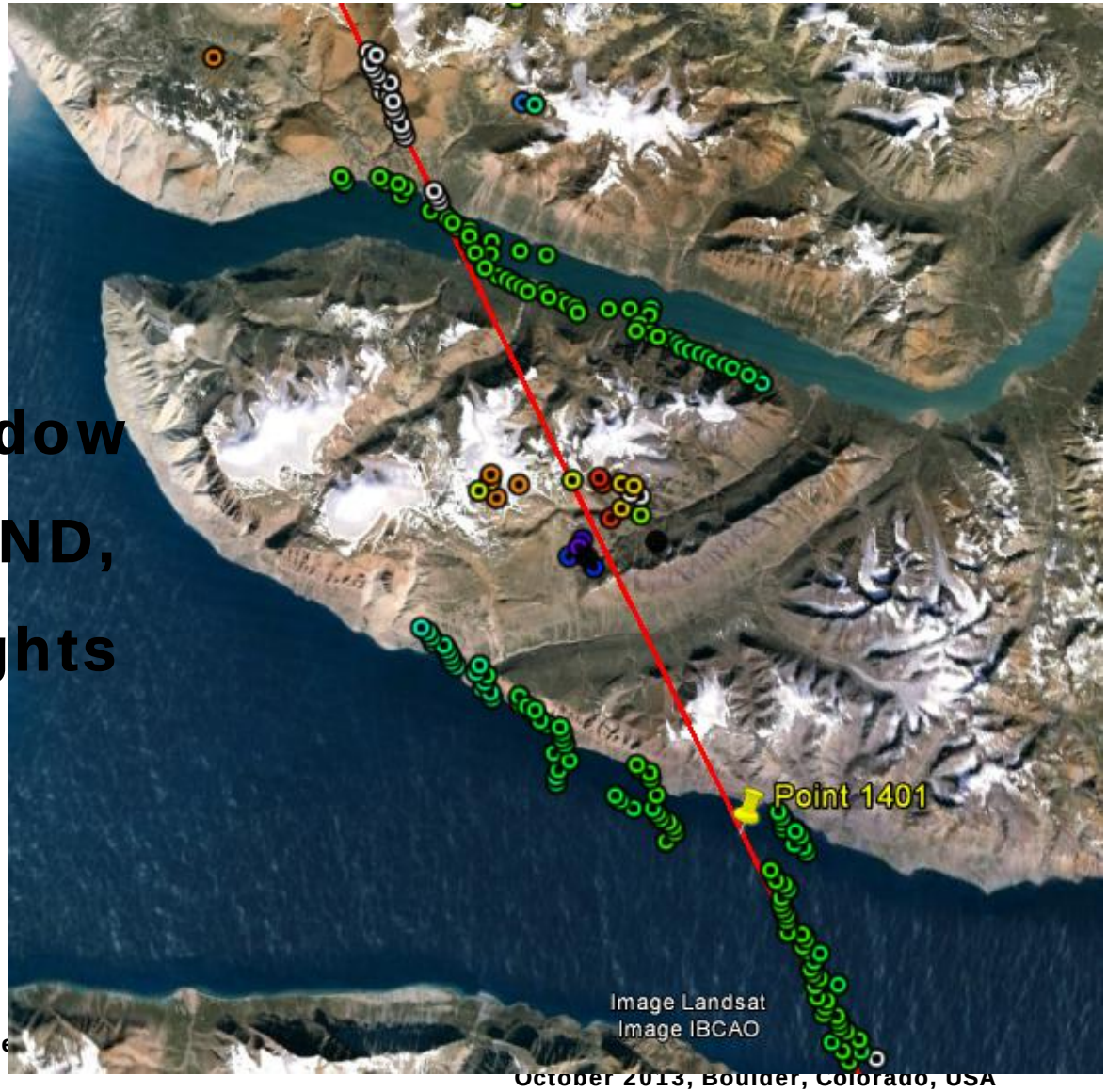
Phase wrap Correction

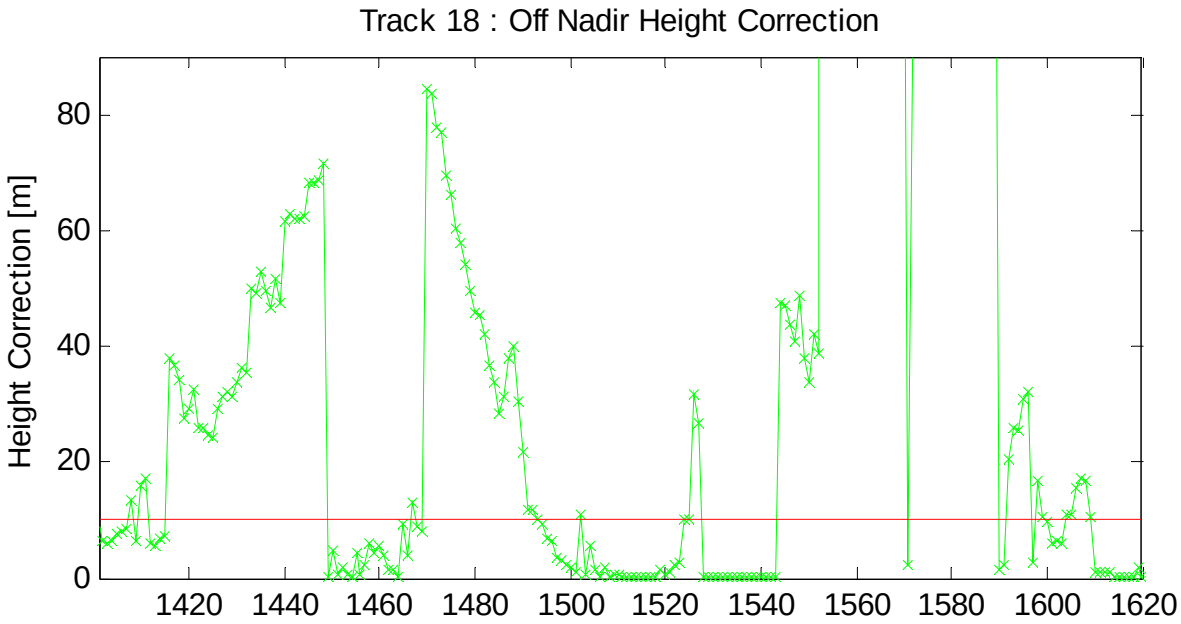
Acceptable ones

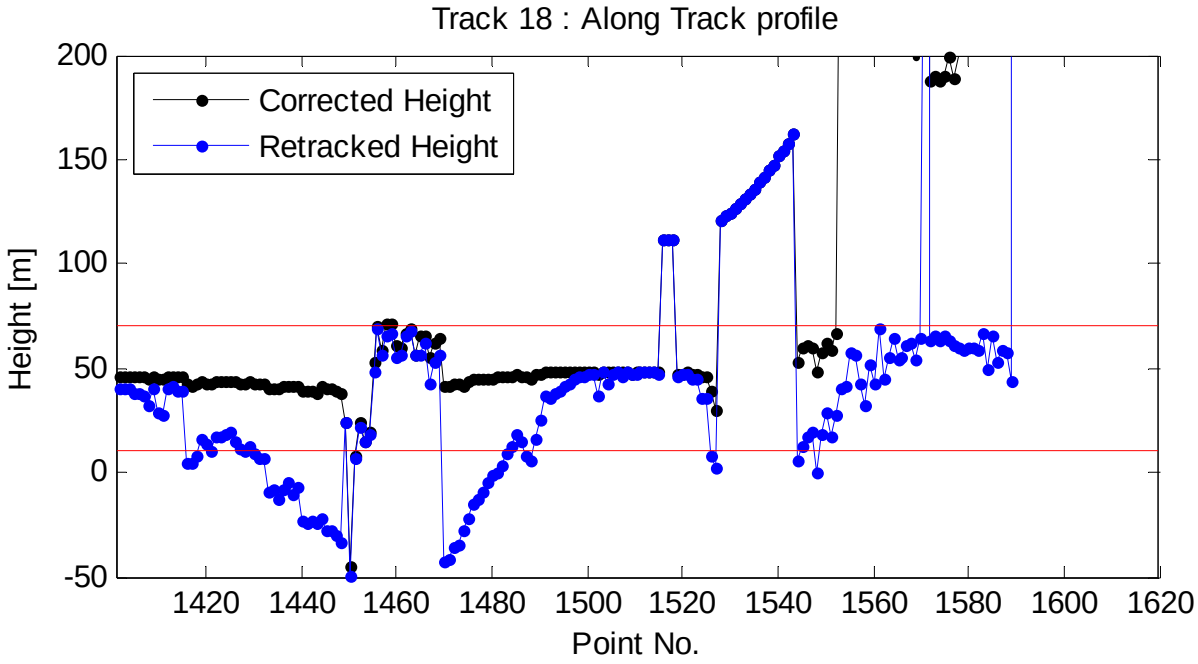

Track 18 : Off Nadir Height Correction
Height Correction [m]
Point No.
0
10
20
30
40
50
60
70
80
90
1420
1440
1460
1480
1500
1520
1540
1560
1580
1600
1620

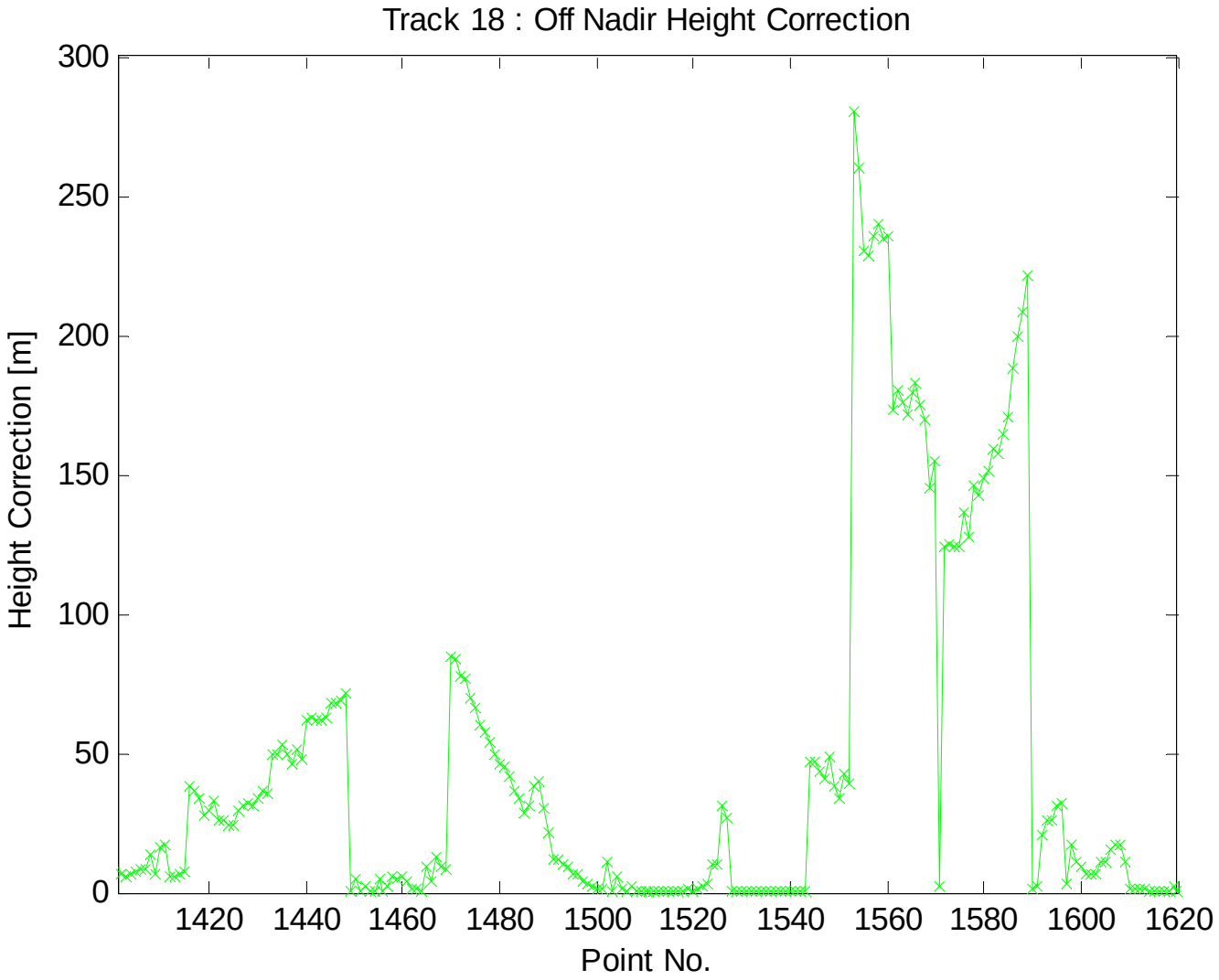
Final phasewrapped corrected height

Except for the window delay points on LAND, positions and heights are corrected !




Track 18 : Off Nadir Height Correction
Height Correction [m]
0
20
40
60
80
1420
1440
1460
1480
1500
1520
1540
1560
1580
1600
1620


Track 18 : Along Track profile
Corrected Height
Retracked Height
Height [m]
-50
0
50
100
150
200
1420
1440
1460
1480
1500
1520
1540
1560
1580
1600
1620
Point No.


Track 18 : Off Nadir Height Correction
Height Correction [m]
300
250
200
150
100
50
0
1420
1440
1460
1480
1500
1520
1540
1560
1580
1600
1620
Point No.