

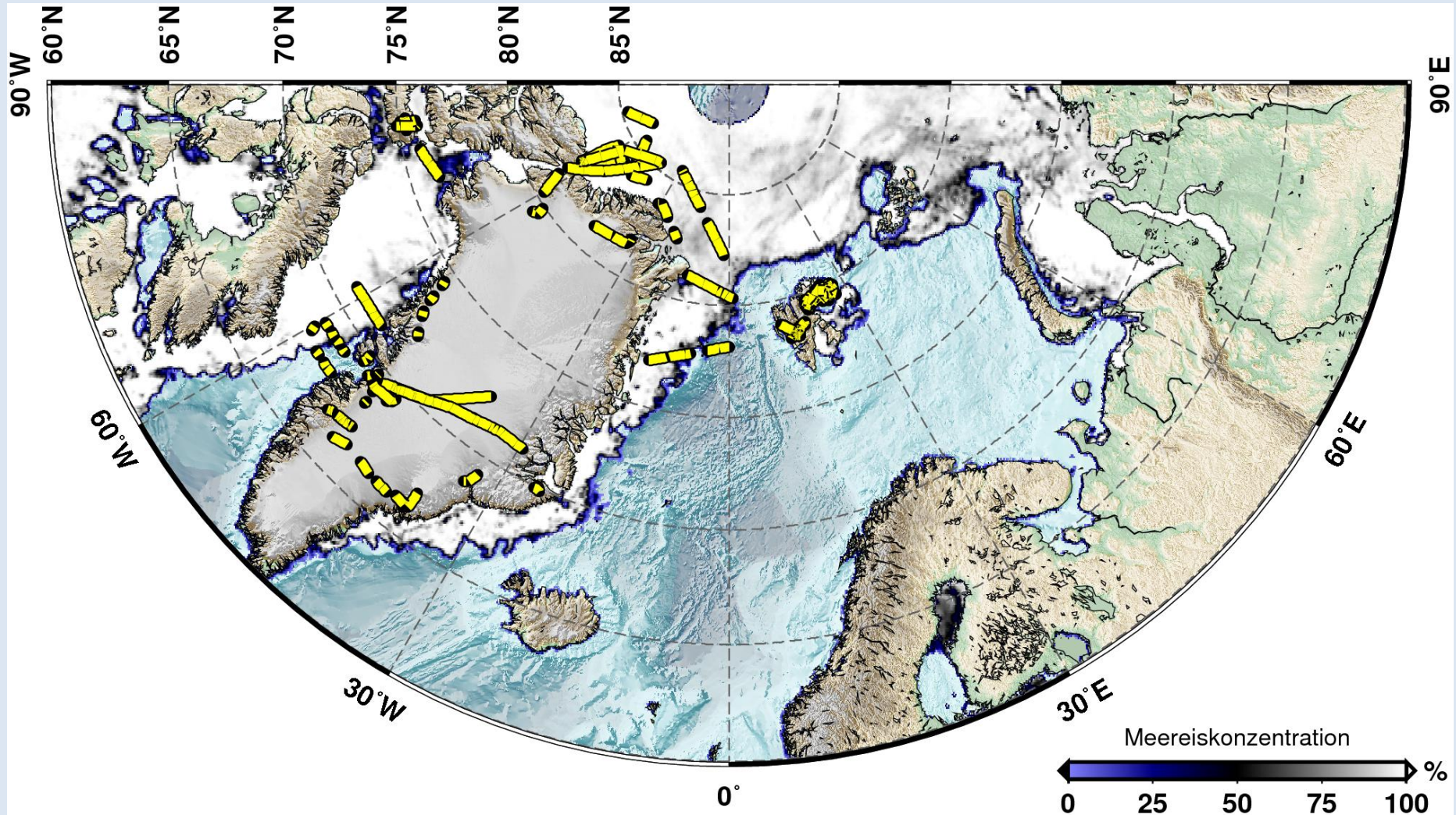
Accuracy of surface elevation derived from ASIRAS and CryoSat

V. Helm¹, S. Hendricks¹

¹ Alfred-Wegener Institute, Bremerhaven

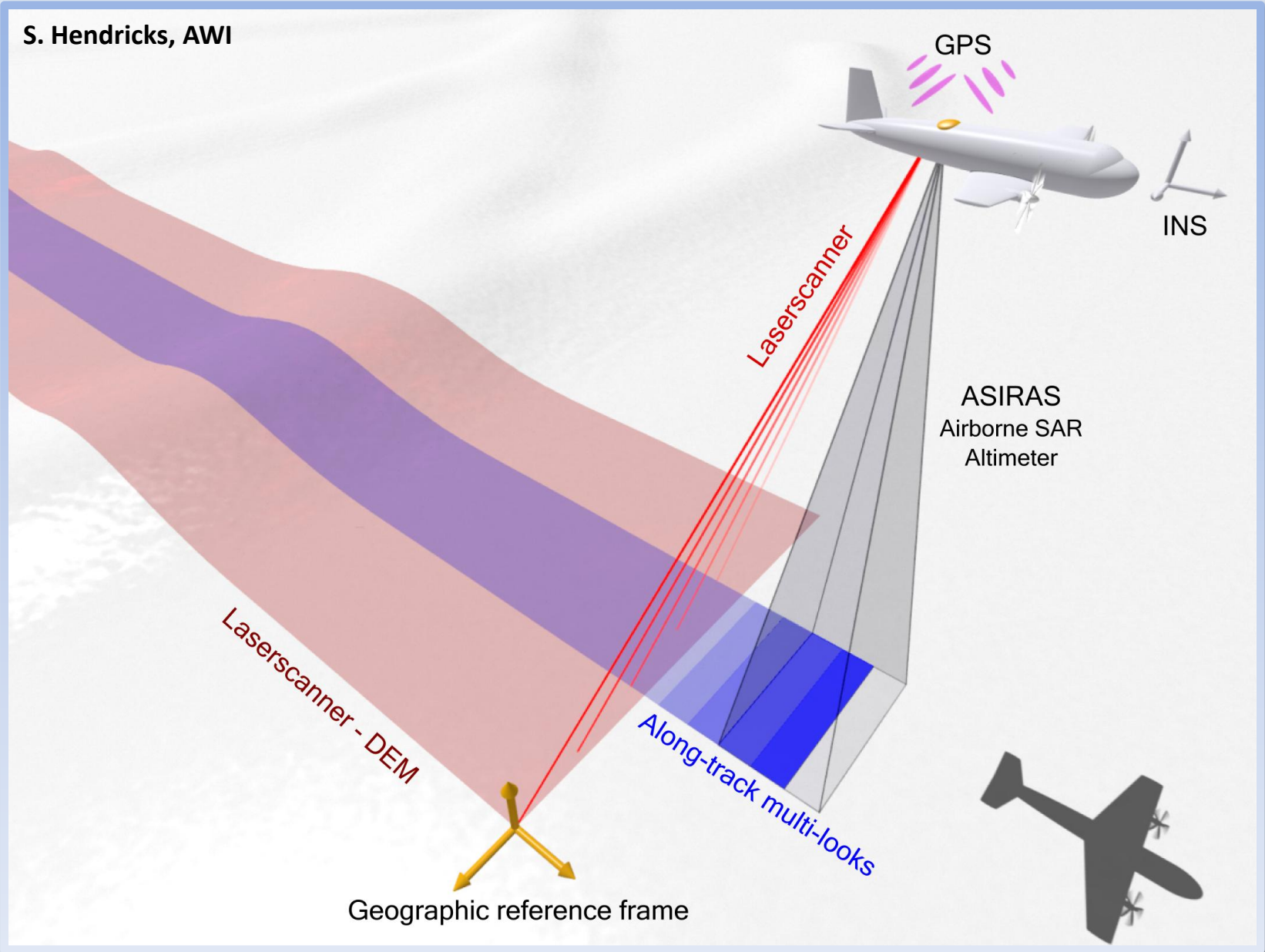


Airborne campaigns from 2004 to 2009



Aircraft Instrumentation

S. Hendricks, AWI



Error sources and estimates

**Laser DEM
accuracy**

- **0.05 m to 0.1 m**

**DGPS processing,
INS drift bias**

- **0.15**

**Accuracy of
ASIRAS Cal**

- **< 0.1m**

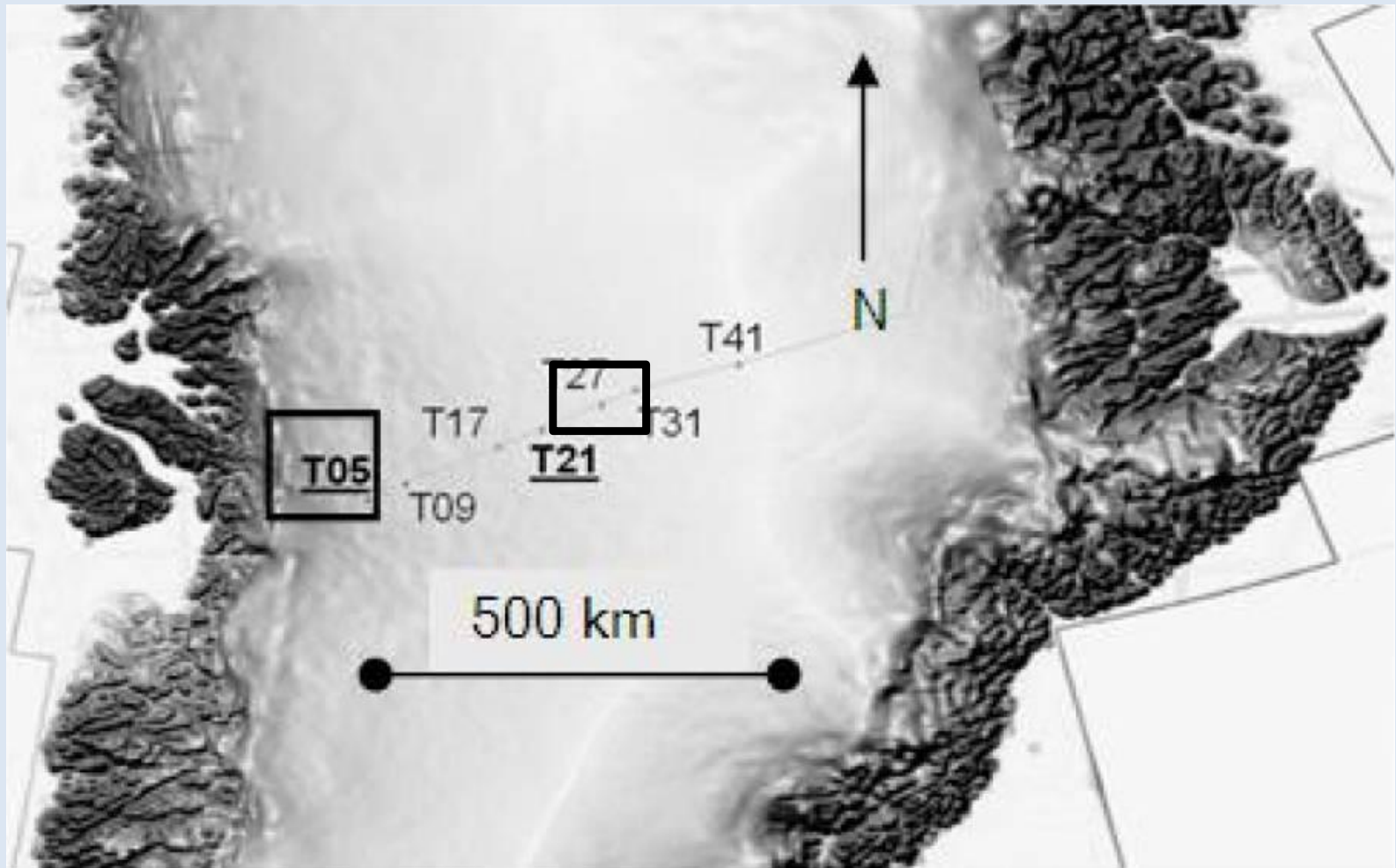
**ASIRAS DEM
accuracy**

- **???**

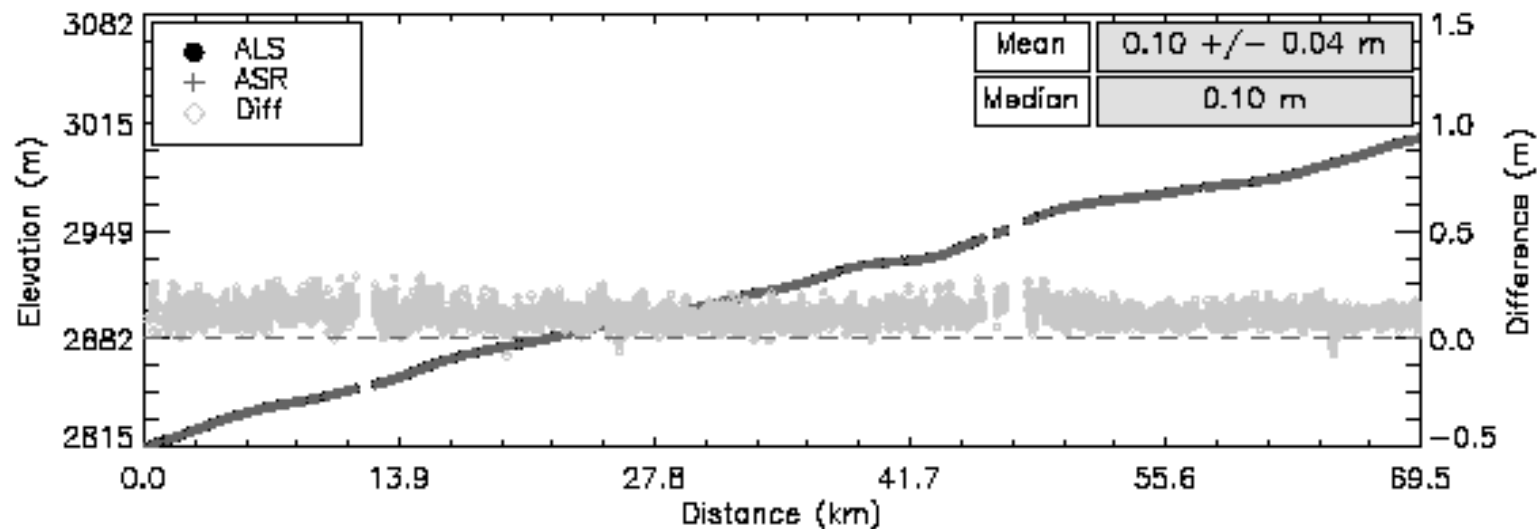
ASIRAS accuracy in various snow regimes

ASIRAS DEM Accuracy

- Dry snow zone (EGIG line)
- Percolation zone (EGIG line)
- Austfonna Ice cap



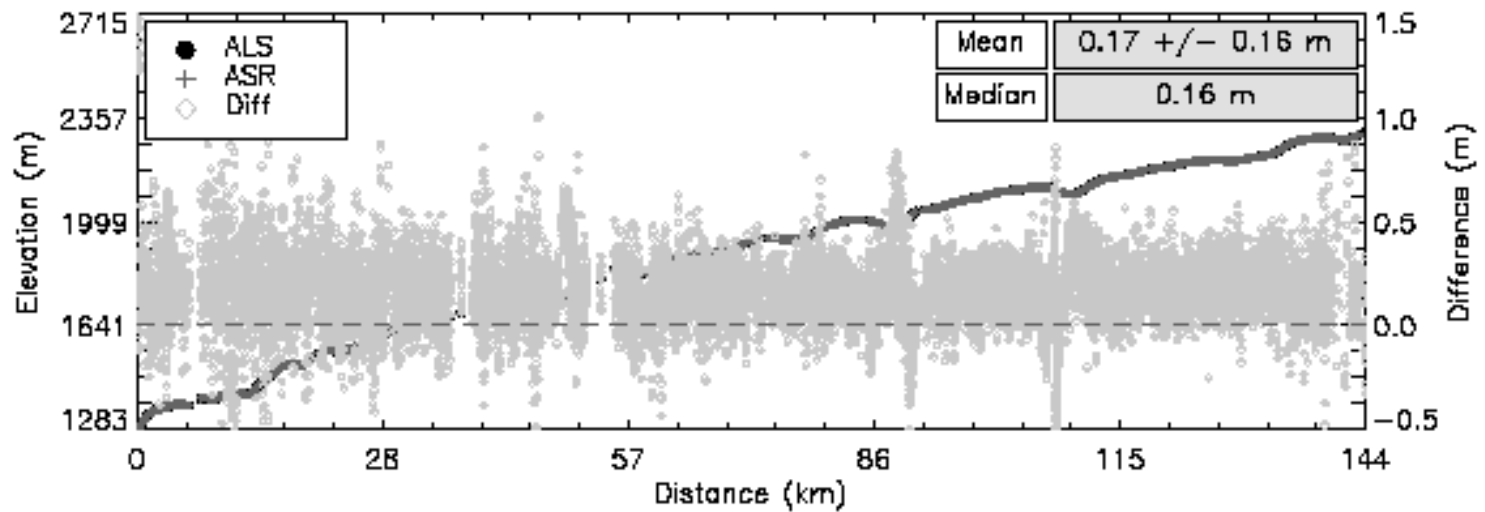
Comparison of ASIRAS with laser DEM in Dry snow zone



Difference of ASIRAS to ALS DEM in the dry snow zone (EGIG line) (m)

| Median | Stddev | Footprint Roughness | Year |
|--------|--------|---------------------|-------------|
| 0.10 | 0.04 | 0.04 | 2004 Spring |
| 0.18 | 0.05 | 0.05 | 2004 Autumn |
| -0.01 | 0.03 | 0.05 | 2006 Spring |
| 0.12 | 0.09 | 0.05 | 2008 Spring |

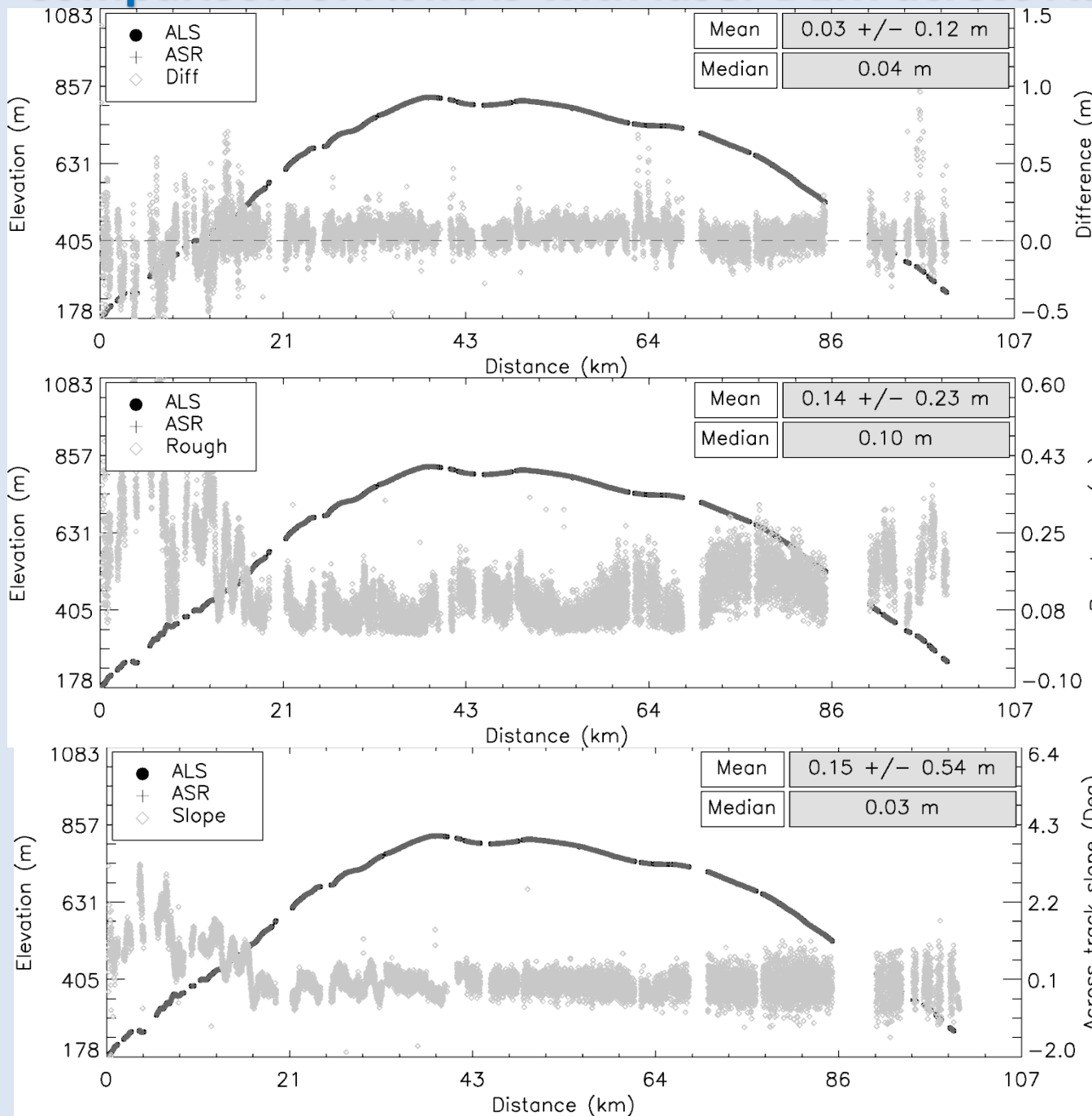
Comparison of ASIRAS with laser DEM in percolation zone



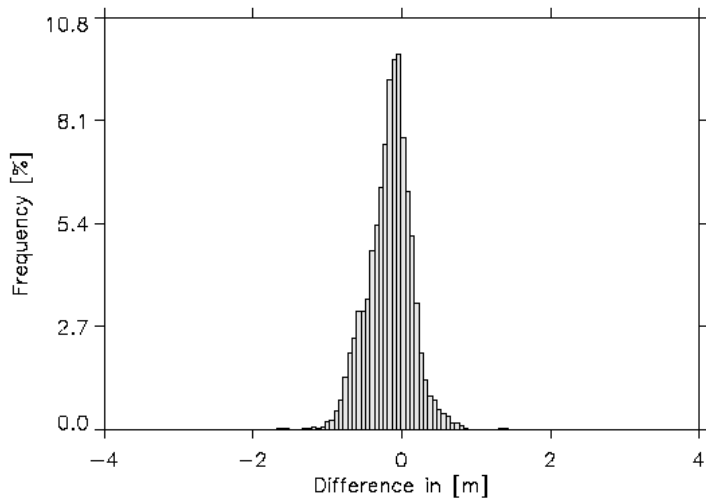
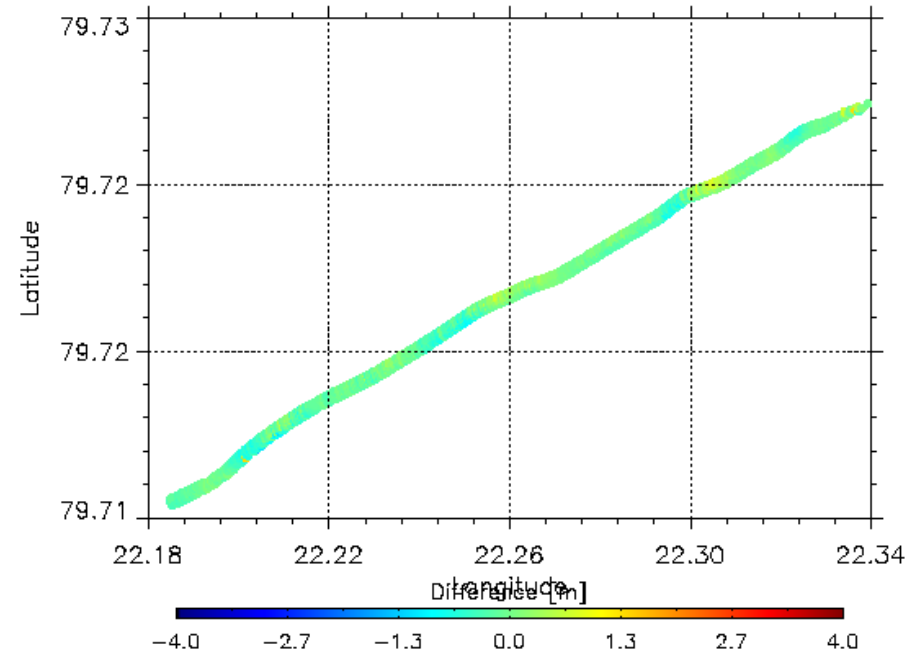
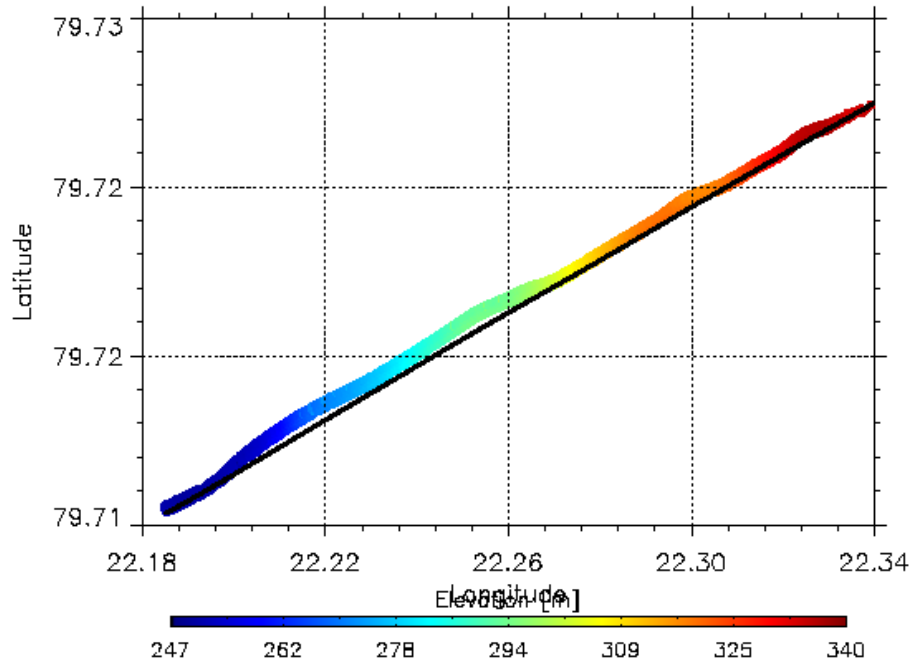
Difference of ASIRAS to ALS DEM in the percolation snow zone (EGIG line) (m)

| Median | Stddev | Footprint Roughness | Year |
|--------|--------|---------------------|-------------|
| 0.06 | 0.16 | 0.08 | 2004 Spring |
| 0.03 | 0.09 | 0.06 | 2004 Autumn |
| 0.11 | 0.13 | 0.06 | 2006 Spring |
| 0.16 | 0.16 | 0.07 | 2008 Spring |

Comparison of ASIRAS with laser DEM across Austfonna



Interferometric processing



Cross Point error of SARIn processed ASIRAS compared to Laser DEM

Median

-0.10

Mean

-0.13

Stddev

0.29

- Accuracy of Laser scanner DEM is < 0.10 m
 - Static offsets of up to 0.15 m due to DGPS processing and/or INS drift bias
 - This is important for absolute Elevation comparisons (Year to Year or with CryoSat-2)
- ASIRAS calibration:
 - Accuracy: < 0.1 m
 - static offset dependent on Retracker and different from campaign to campaign (Retracker differ up to 0.3 m, static offset range 0.0 to 3.30 m)
- Accuracy of ASIRAS along a profil is approx. 0.1 m (for TSRA retracker)
 - to 2.0 m in the percolation and Ablation zone (for OCOG retracker)
- **Penetration of ASIRAS varies from 0.0 m to 0.2 m**
- **Penetration might be a combined effect of footprint roughness and snow properties (surface density, grain size)**
- Interferometric processing of ASIRAS gives very good results (Hawley et. al 2008)

ASIRAS can be used for the validation of CryoSat-2

Comparisons of CryoSAT-2 and Laser DEM

Area: NEEM drill site (Grid: 50 km x 50 km) with 1km x 5 km line spacing

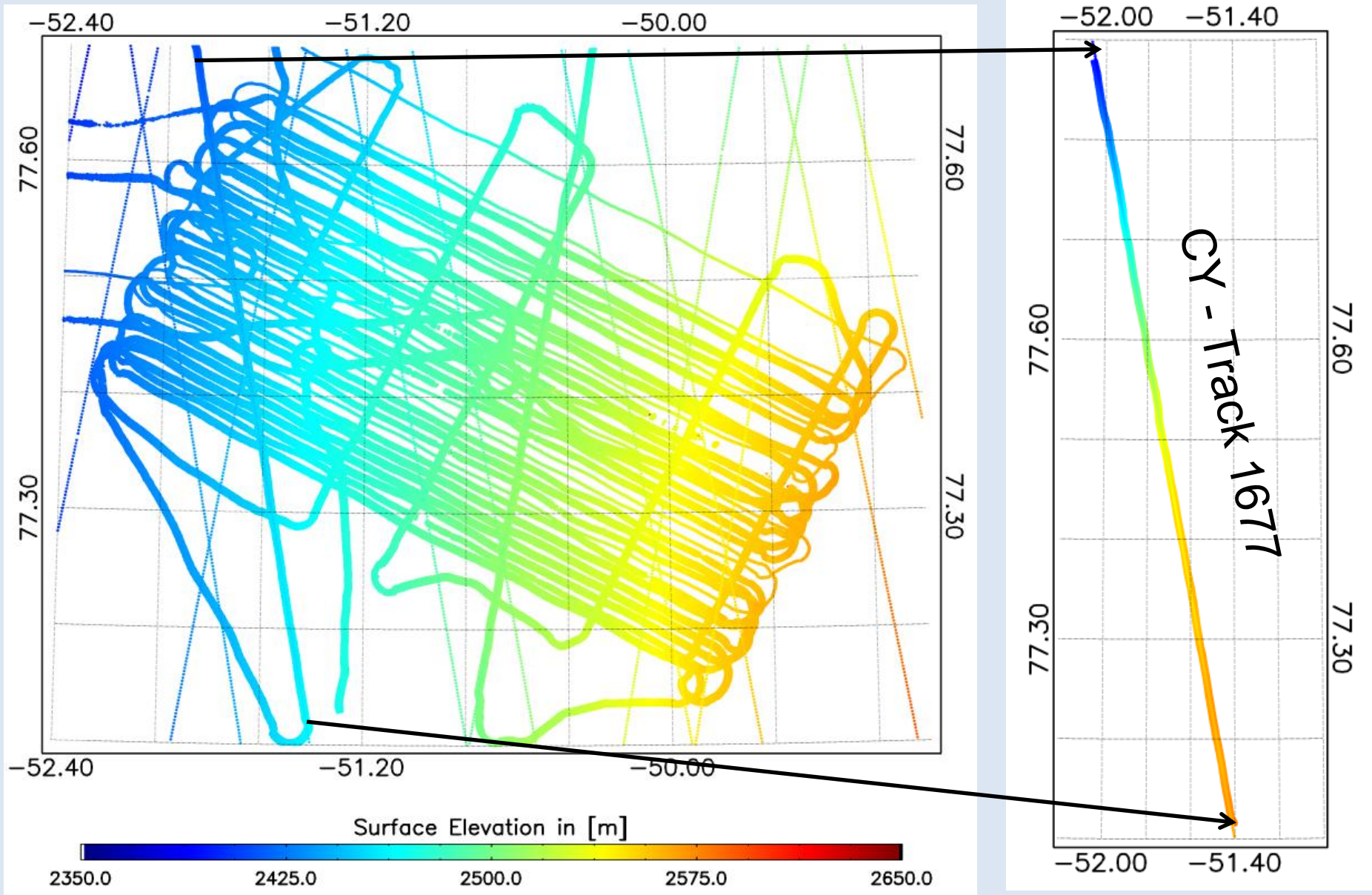
Data acquisition: Laserscanner and ASIRAS

Period: 28th July to 5th August 2010

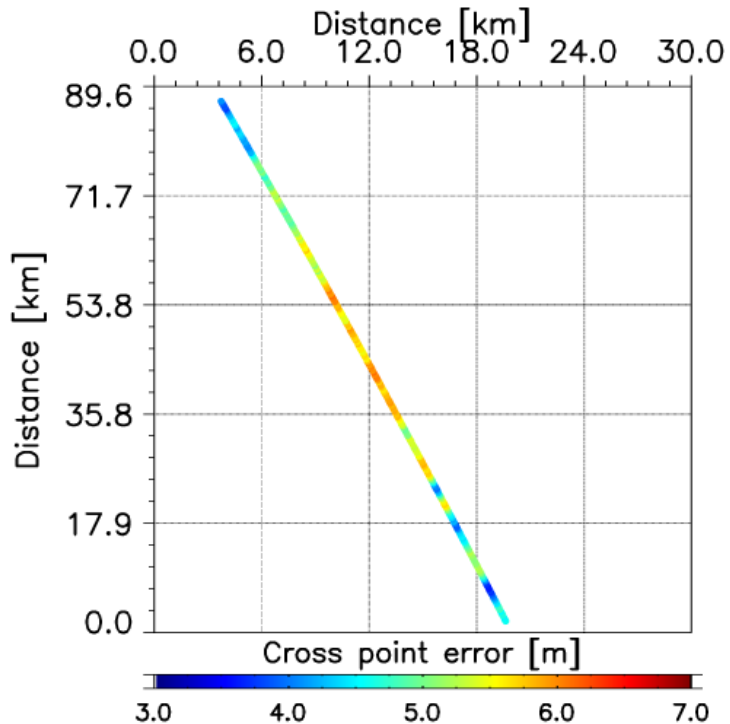
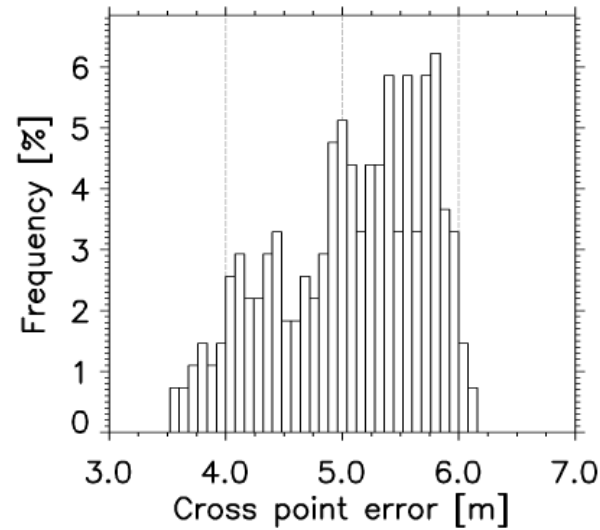
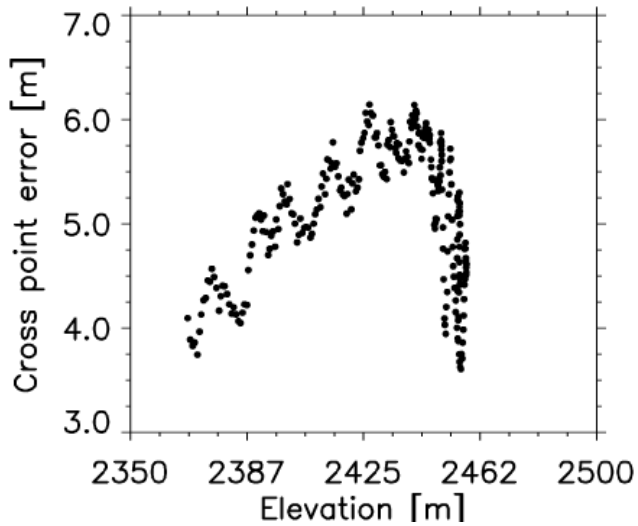
CryoSat-2: L1B LRM data along track 1677 (2nd of August 2010).

CryoSat elevations were determined by retracking the CryoSat-L1B LRM waveforms with an Threshold spline retracker.

ALS – DEM including CryoSat-2 tracks from July and August 2010



Cross point analysis of ALS and SIRAL L1B along CY-track 1677

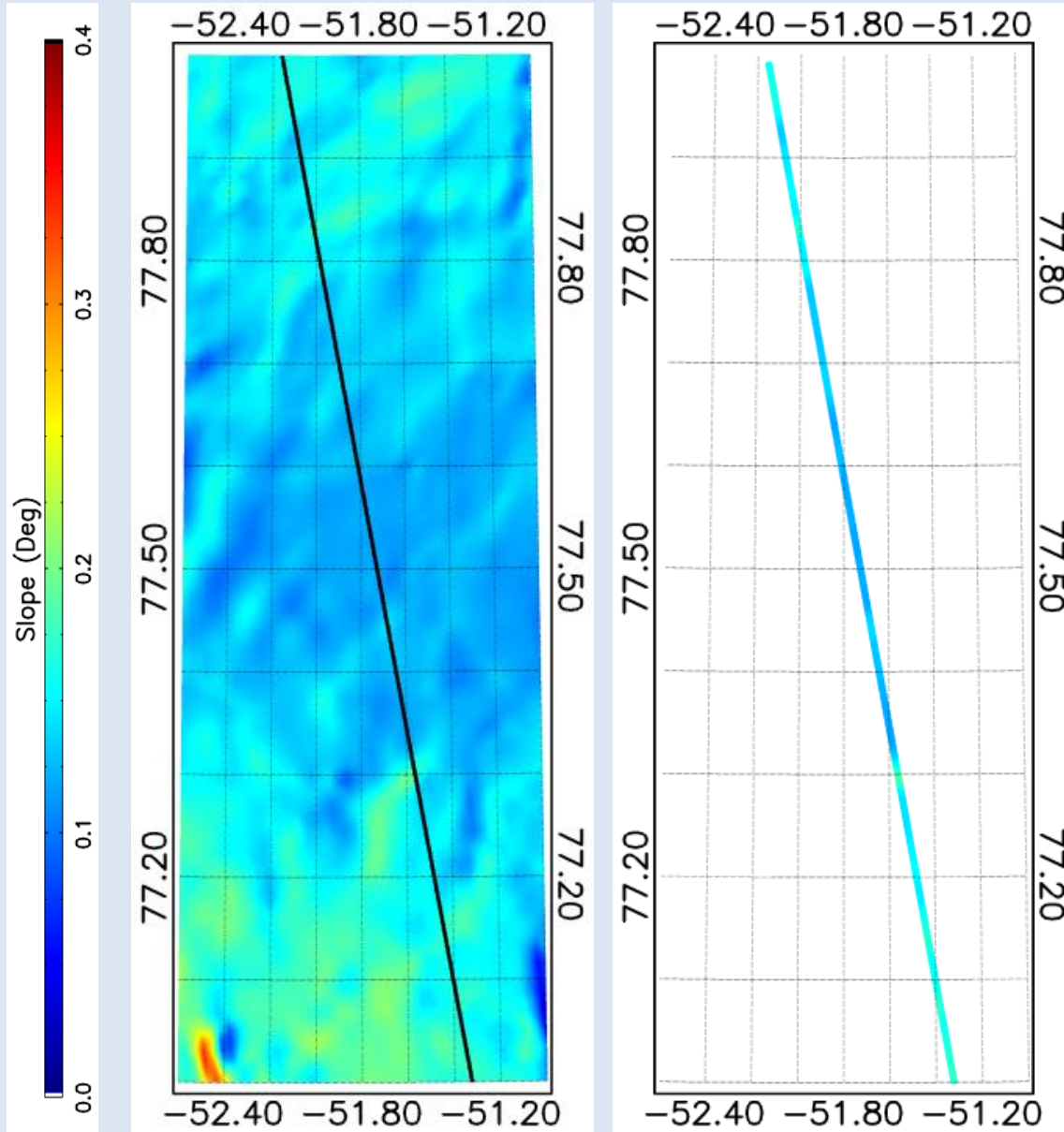


Median: 5.21 m

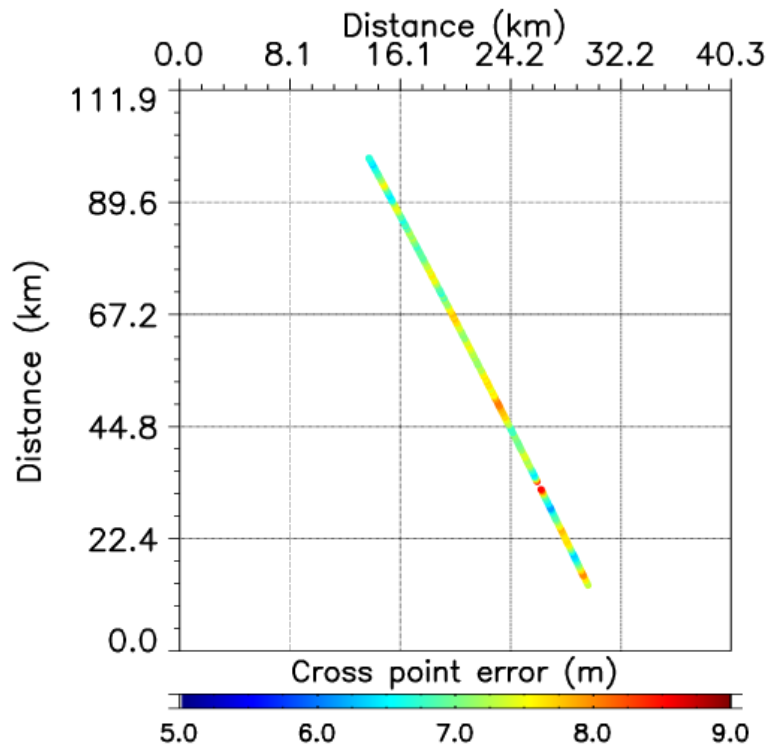
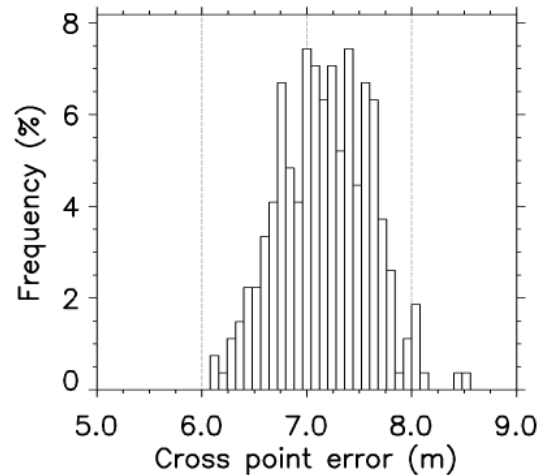
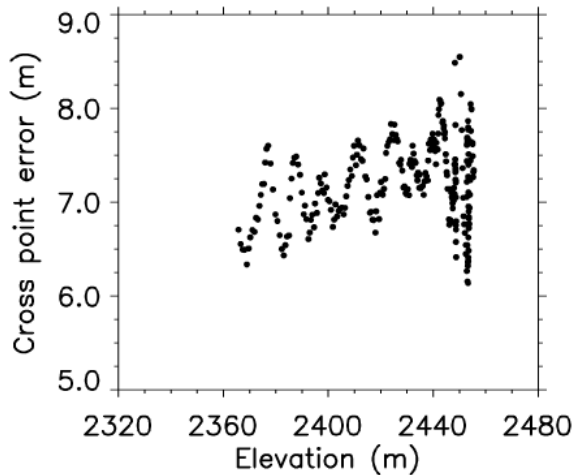
Stddev: 0.64 m

Number of CP points: 273

Slope detection along CY-track 1677



Comparison of ALS and slope corrected SIRAL L1B

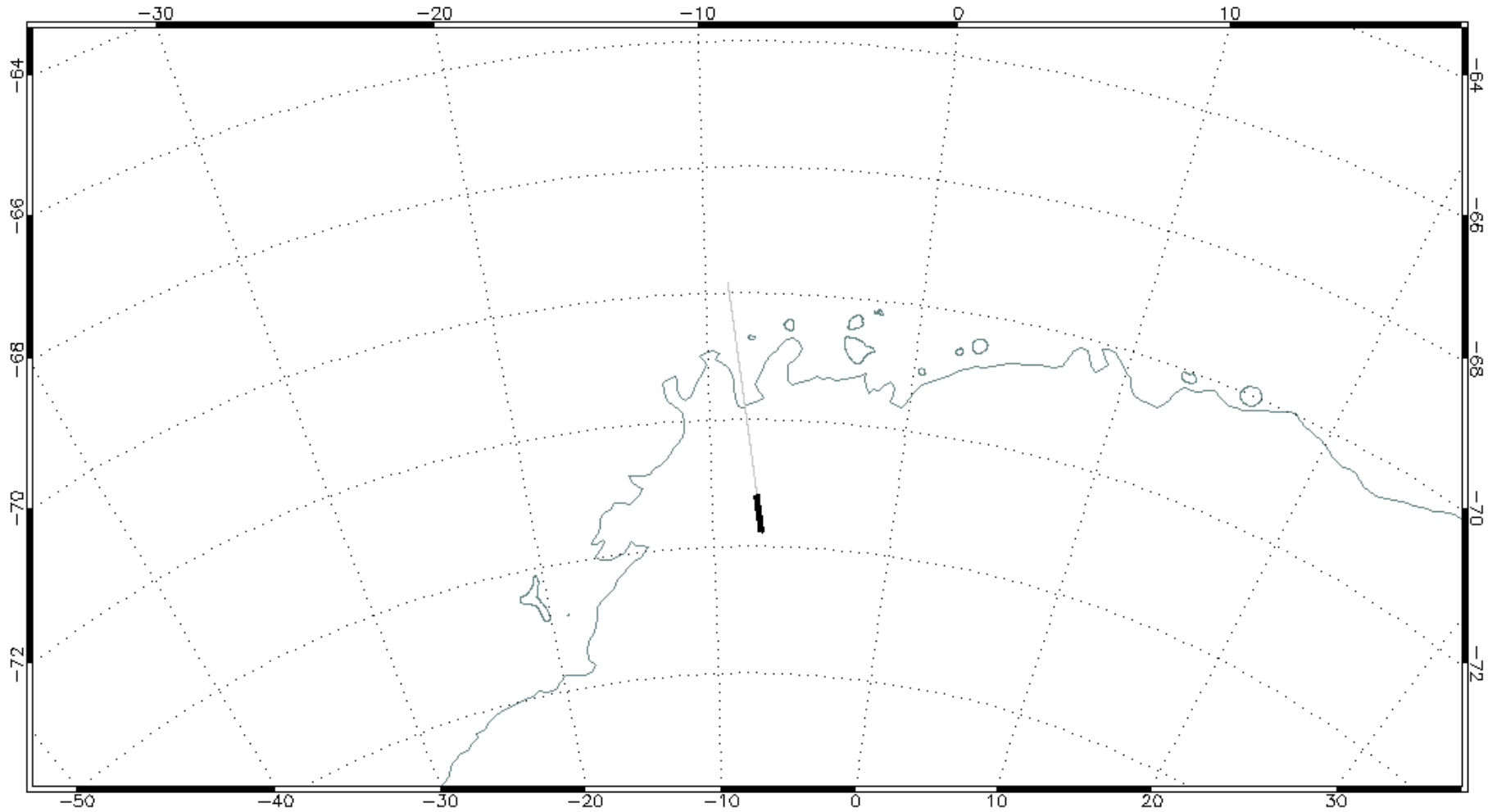


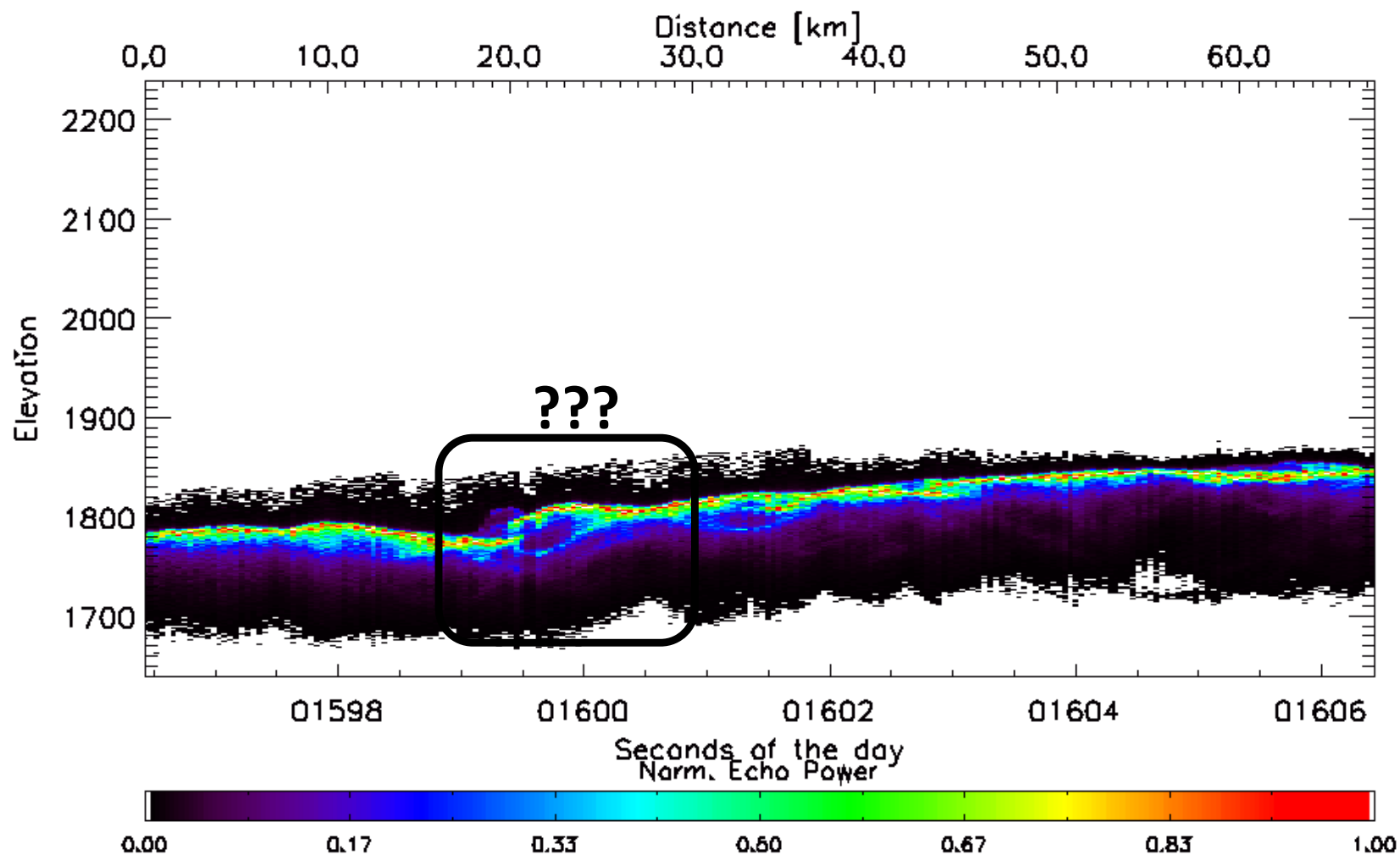
Median: 7.41 m

Stddev: 0.44 m

Number of CP points: 273

CY SARIN data





- **Is the offset of 7 m related to penetration or instrumental path delays?
(ESA reported 3.8 m static offset)**
- **What causes subsurface features in SARIn data?**