SCOOP WP6000
Coastal Zone Study

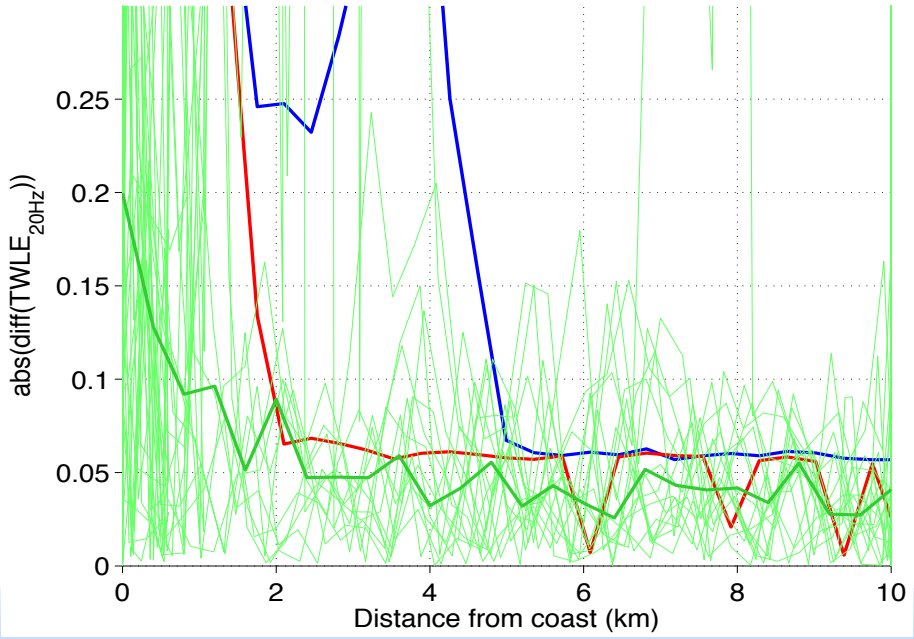
Led by NOC with Noveltis and Univ. Bonn

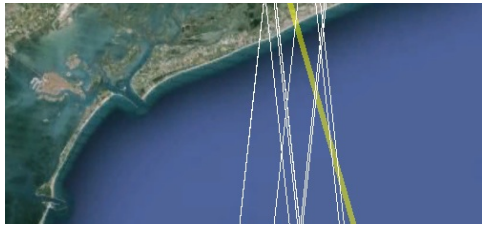
National
Oceanography Centre

NATURAL ENVIRONMENT RESEARCH COUNCIL

Overall WP6000 Objective

- Performance specification and Product Validation Plan (PVP)
- Specific processing investigations
  - Land proximity,
  - ground track orientation
  - SAR stack analysis
- Validate innovative methods and algorithms against fiducial data sources and report the error analysis and cross-comparisons in Product Validation Reports (PVR)
- Produce Output Products and Product Specification Document (PSD)





Envisat p0543 SGDR (median of 76 passes)

Envisat p0543 ALES (median of 76 passes)

CryoSat–2 SAMOSA (single passes)

CryoSat–2 SAMOSA (median of 11 passes)

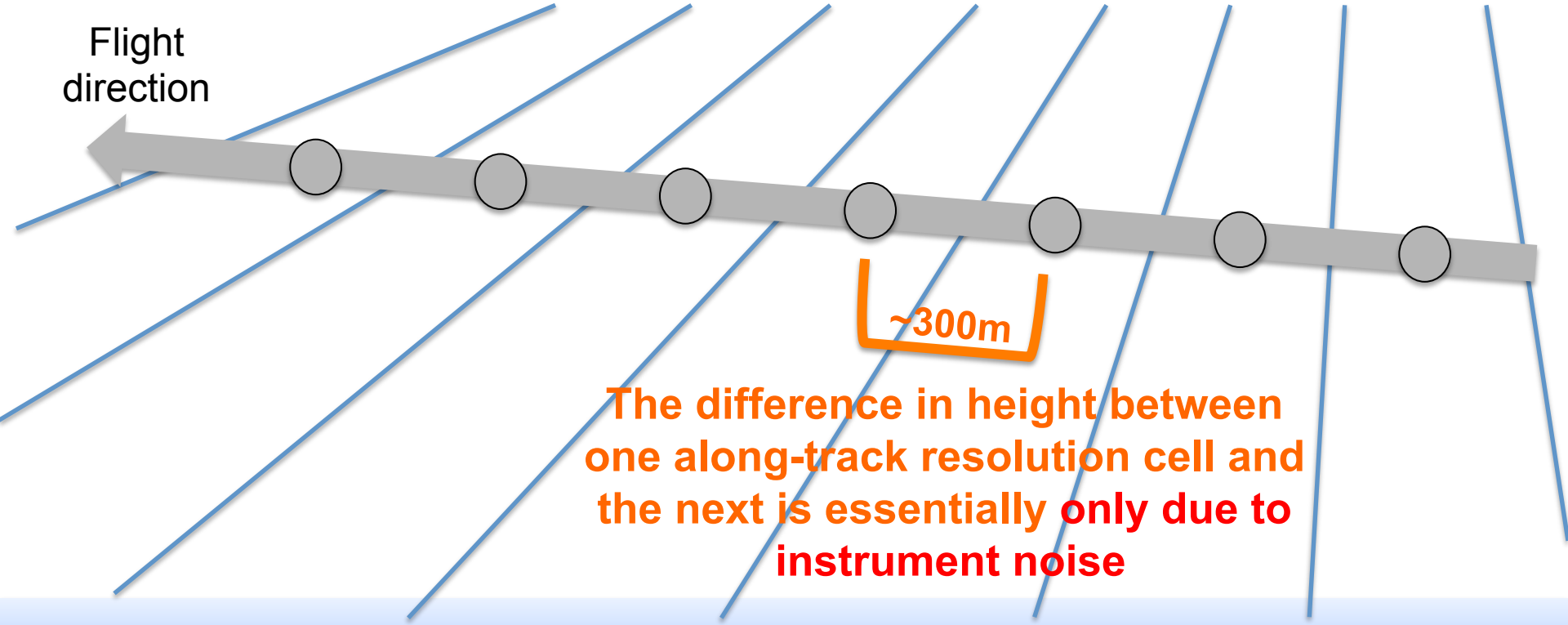
Inputs

- L2 and auxiliary data (WP3000 & WP4000)
- IODD (WP3000 & WP4000)
- PSD (WP3000 & WP4000)
- ATBDs (WP3000 & WP4000)

WP6000's many tasks – 1

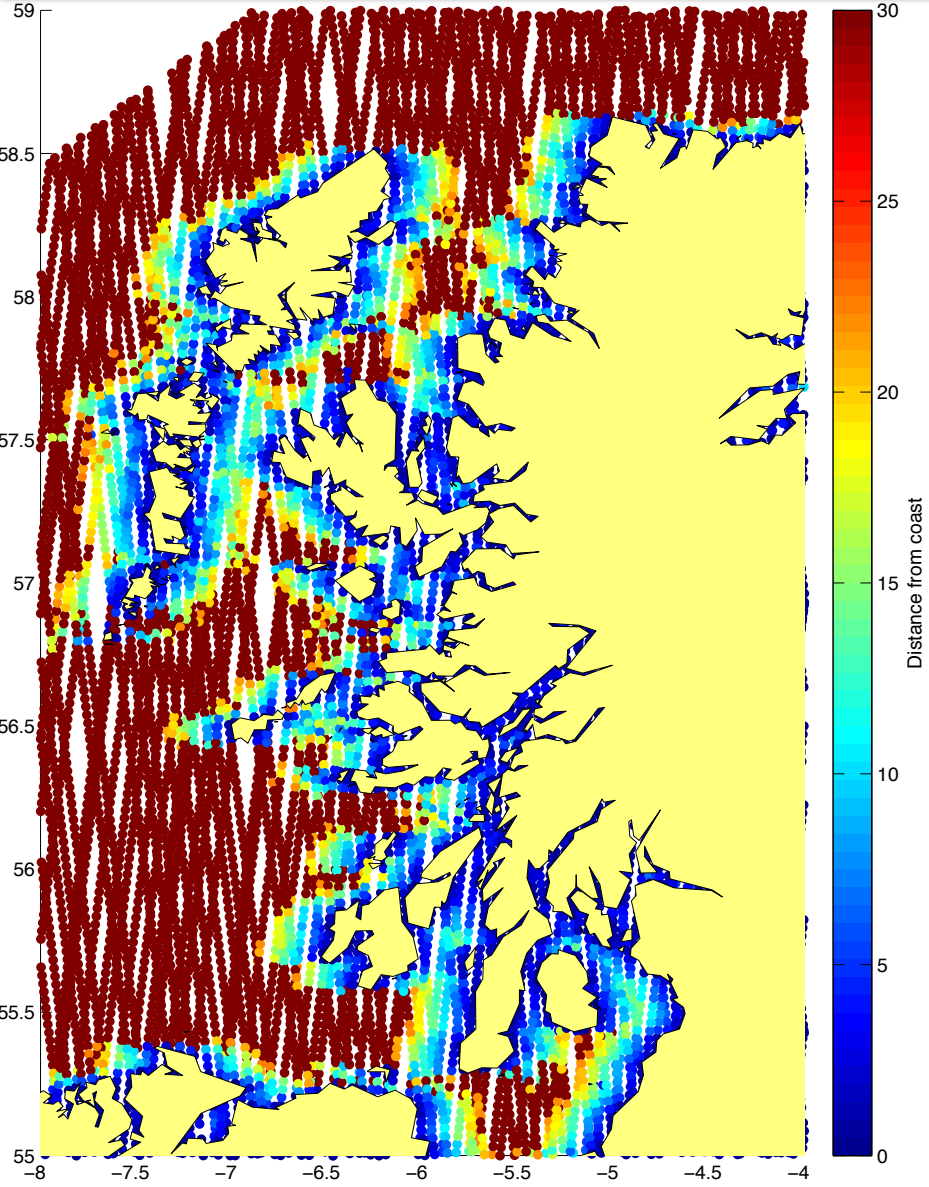
- WP6100 Generation of a **Product Validation Plan (PVP)** for the coastal ocean that describes the validation strategy, with performance metrics (NOC, Noveltis, TUDa)
- WP6200 Performance analysis (verification of Sentinel-3 reference performance) (NOC)

Assessing SAR mode performance in the coastal zone

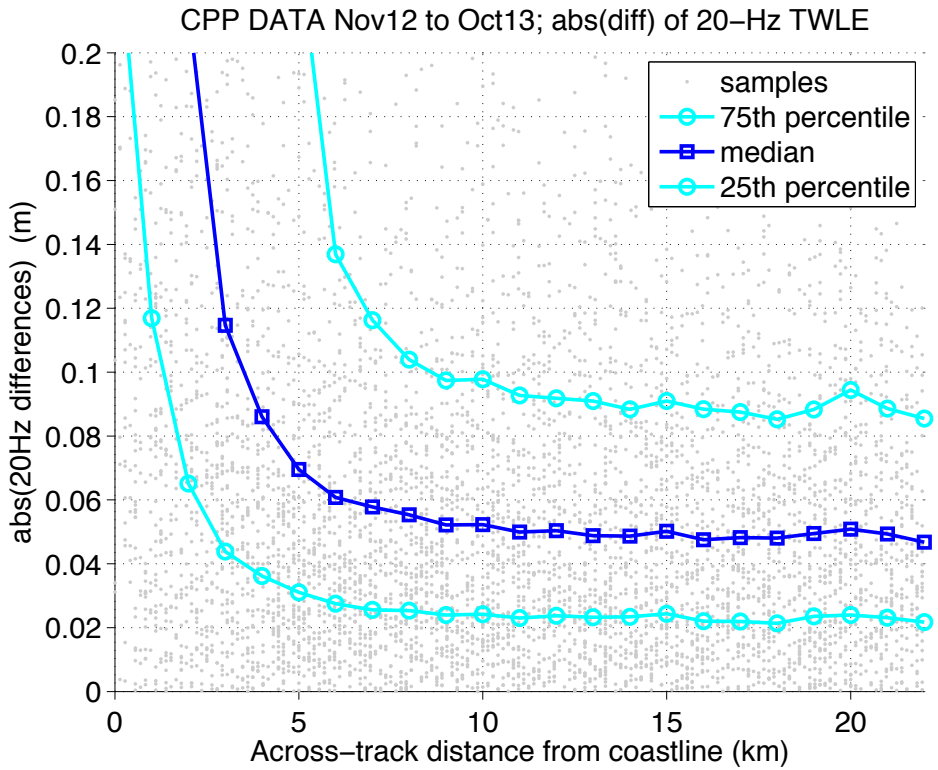


The difference in height between one along-track resolution cell and the next is essentially only due to instrument noise

Example of performance analysis



C2 data from CPP processor (1 full year around UK) provided by F. Boy, CNES



WP6000's many tasks – 2

- WP6300 Swell Impact on SAR altimeter retrieved height (Noveltis)

WP6000's many tasks – 3

- WP6400 Characterisation of SAR mode performance in the German Bight region (TUDa)
  - Validation work and the swell analysis will be performed with both CryoSat-2 and Sentinel-3 data, depending on suitable reading software being available and time of Availability of S-3.

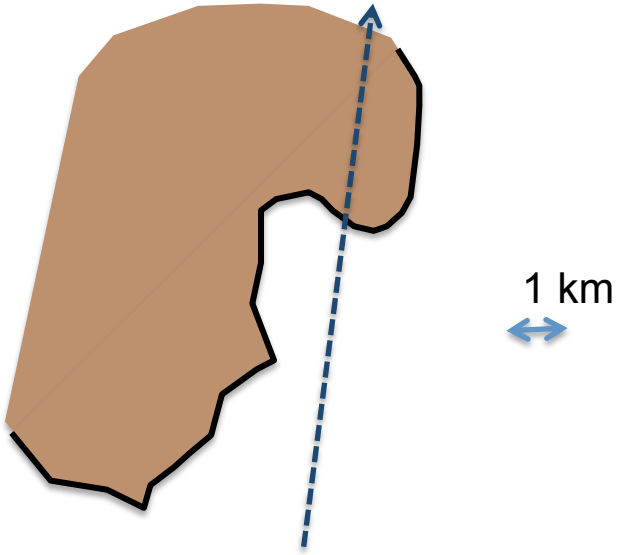
WP6000's many tasks – 4

- WP6500 SAR stack optimal weighting in the coastal zone, and developing schemes to better exploit stack beam parameters (NOC, Starlab)
  - Links to WP3300 (potential improvements o the processing configurations), WP4600 (improvements to coastal zone processing including subwaveform retracking)
- WP6600 Investigation into impact of Land Proximity and Ground Track orientation (NOC)

Proximity and orientation issues

- Across-track distance is not much ambiguous (narrow SAR footprint well approximated by a line)
- AoA is much more ambiguous
- For instance:

Which one is the AoA here?



  - NOC have proposed an objective definition based on the gradient of the coastal proximity parameter which will also be used in SCOOP

Example of expected Results – Verification

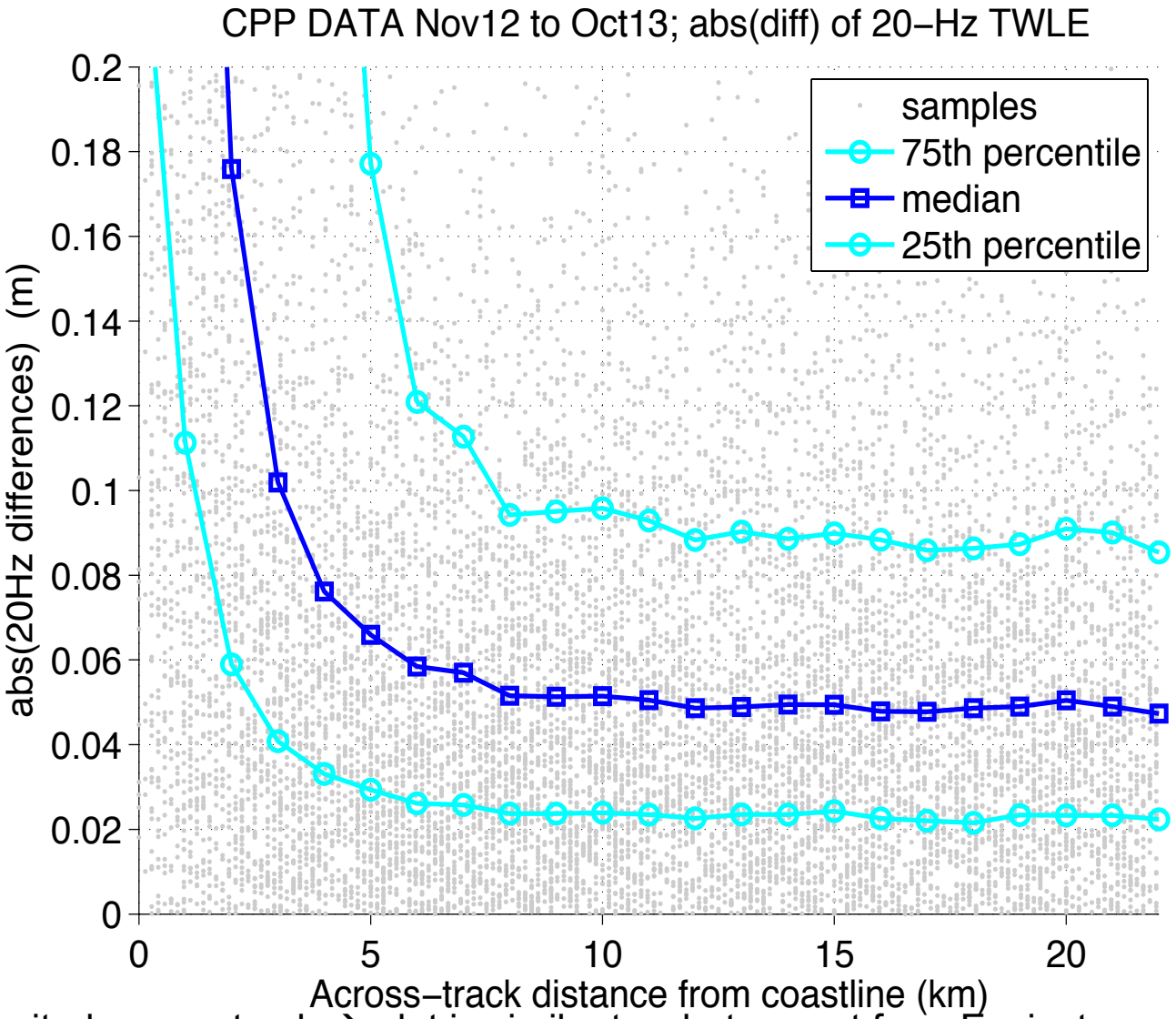
(assessment of precision instrumental noise)

SAR processors configuration in CP40

SAR L1b Processing Options	CPP	GPOD
Hamming Weighting Function	Not Applied	Applied only in Coastal Zone
Beam Steering	Approximated	Approximated
Radar Window Size	Normal (128 bins)	Extended (256 bins)
Range pre-FFT Zero Padding	Not Applied	Applied

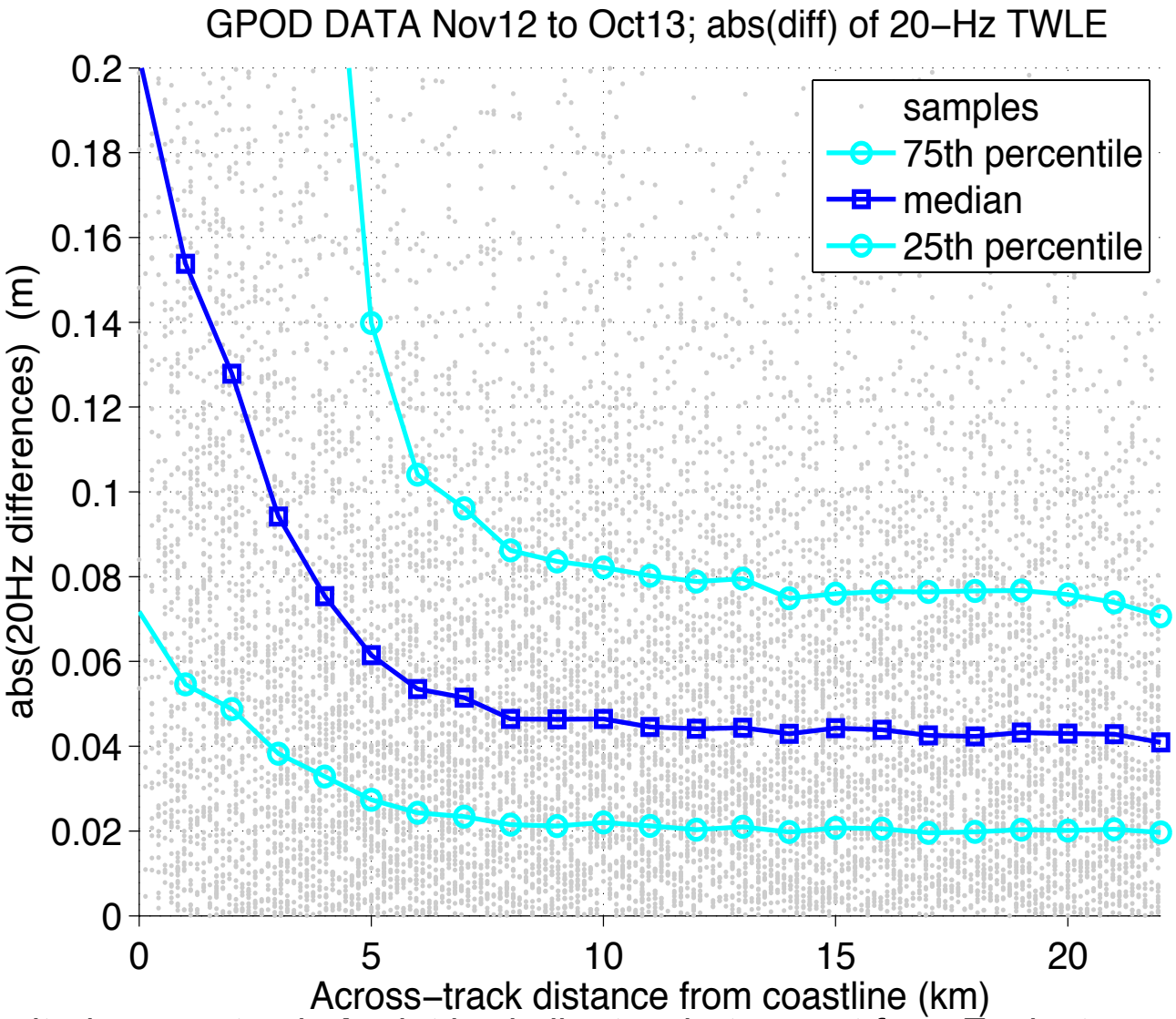
SAR L2 Processing Options	CPP	GPOD
SAR Return Waveform Model	Numerical Solution with real antenna pattern & real PTR	SAMOSA 2 with LUT for alpha_p (PTR width)
Delay Doppler Map (DDM) Masking	Applied	Applied

CPP – vs across-track distance



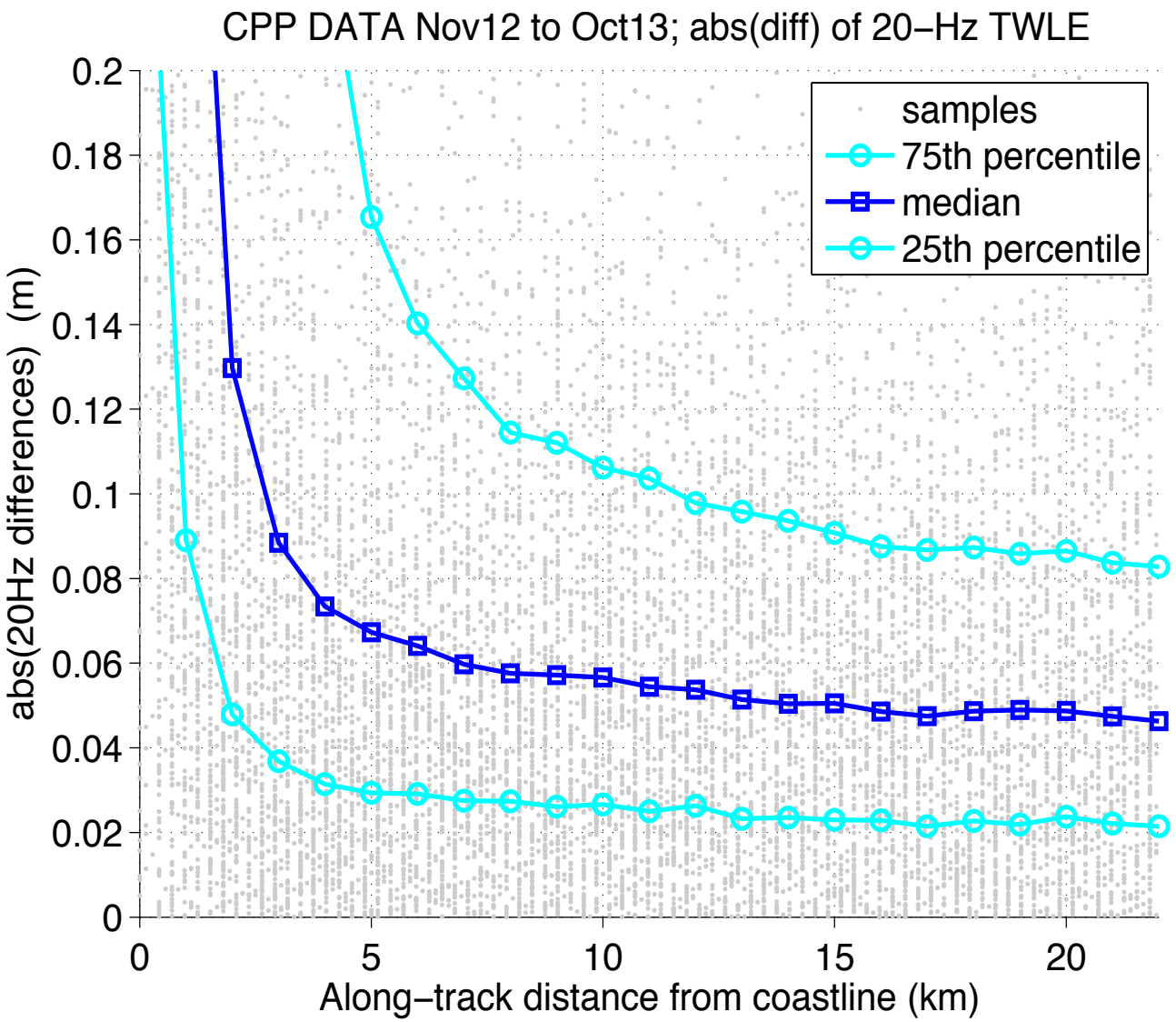
Pulse-limited across-track → plot is similar to what we get from Envisat

GPOD – vs across-track distance

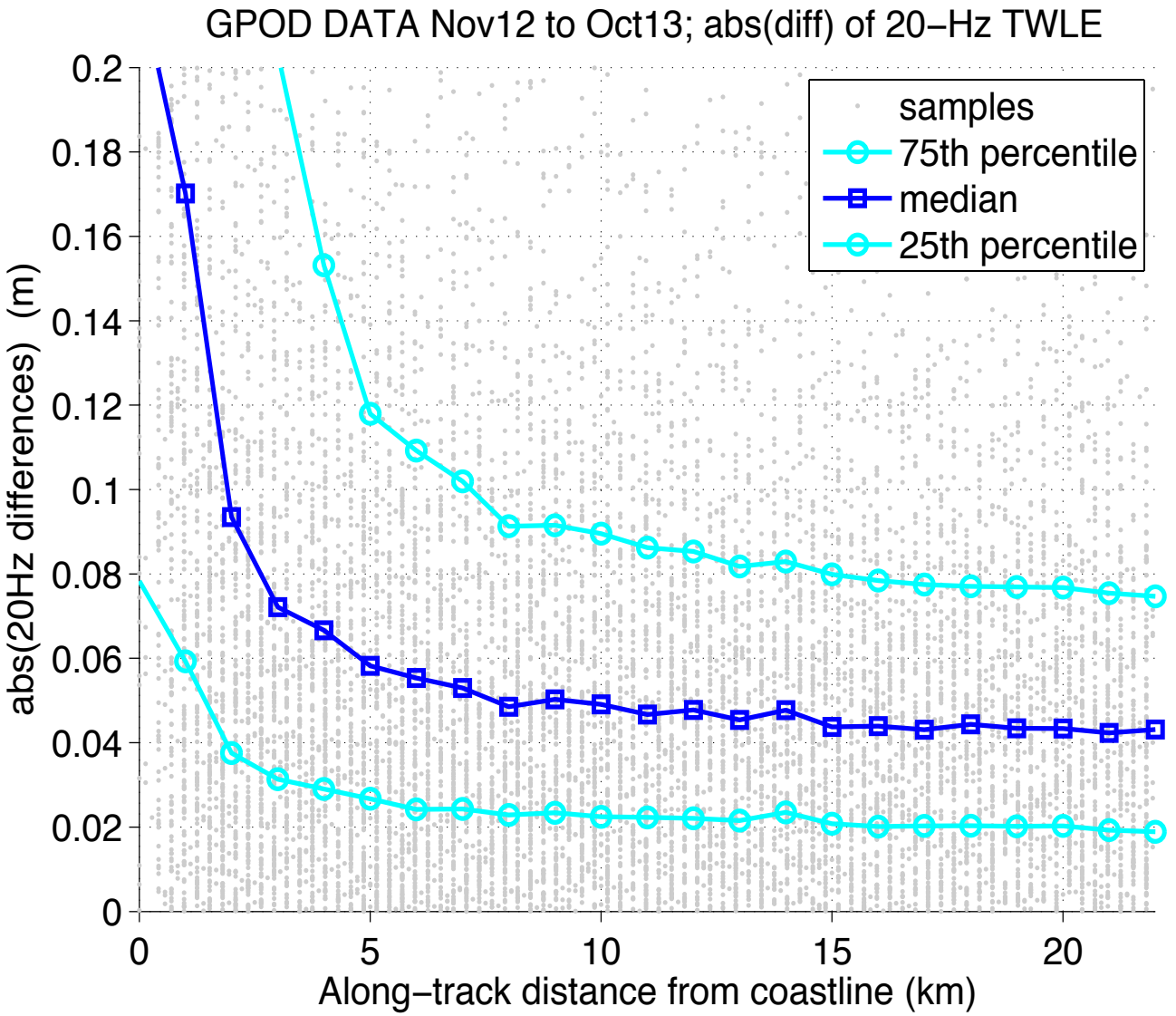


Pulse-limited across-track → plot is similar to what we get from Envisat

CPP – vs along-track distance

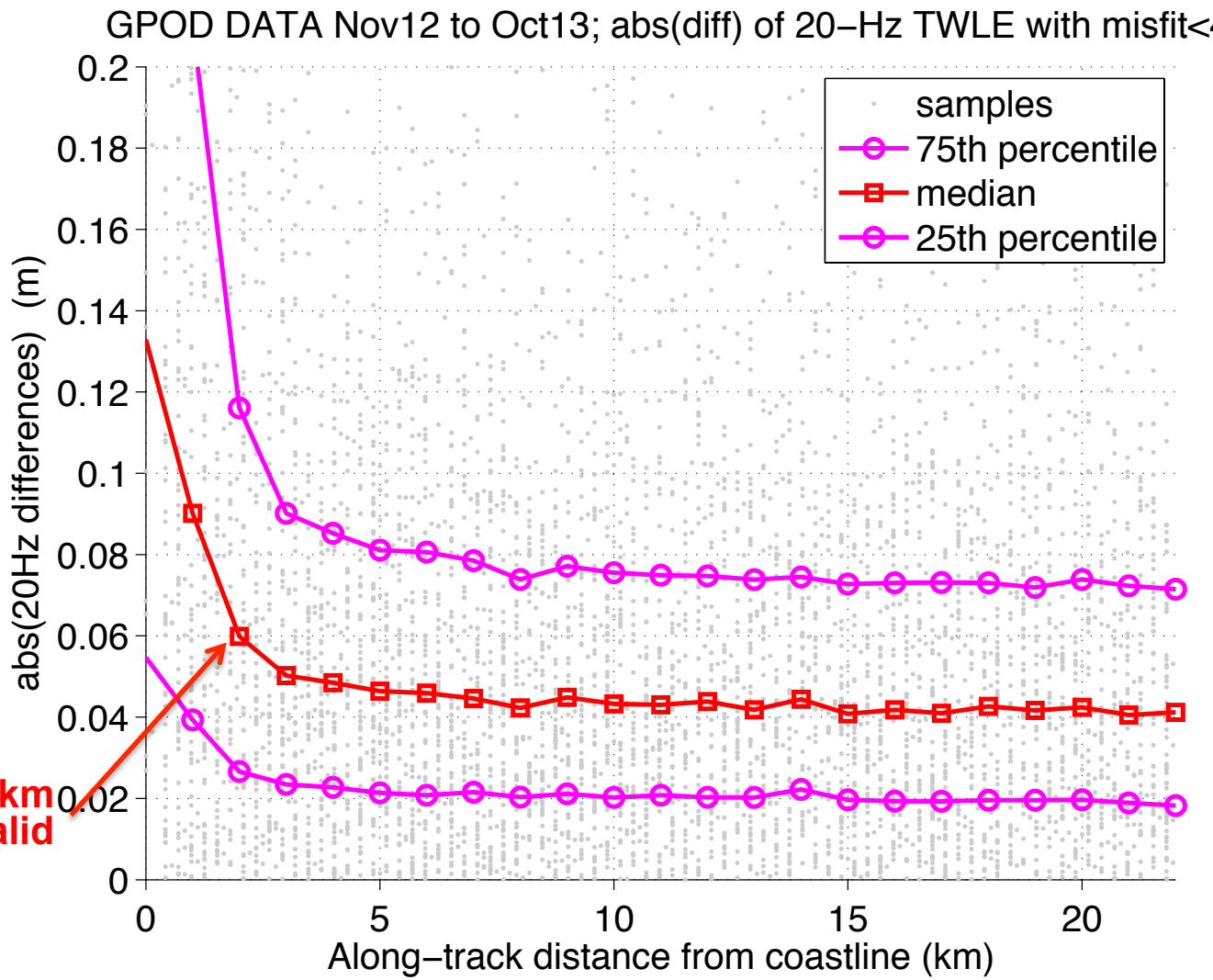


GPOD – vs along-track distance



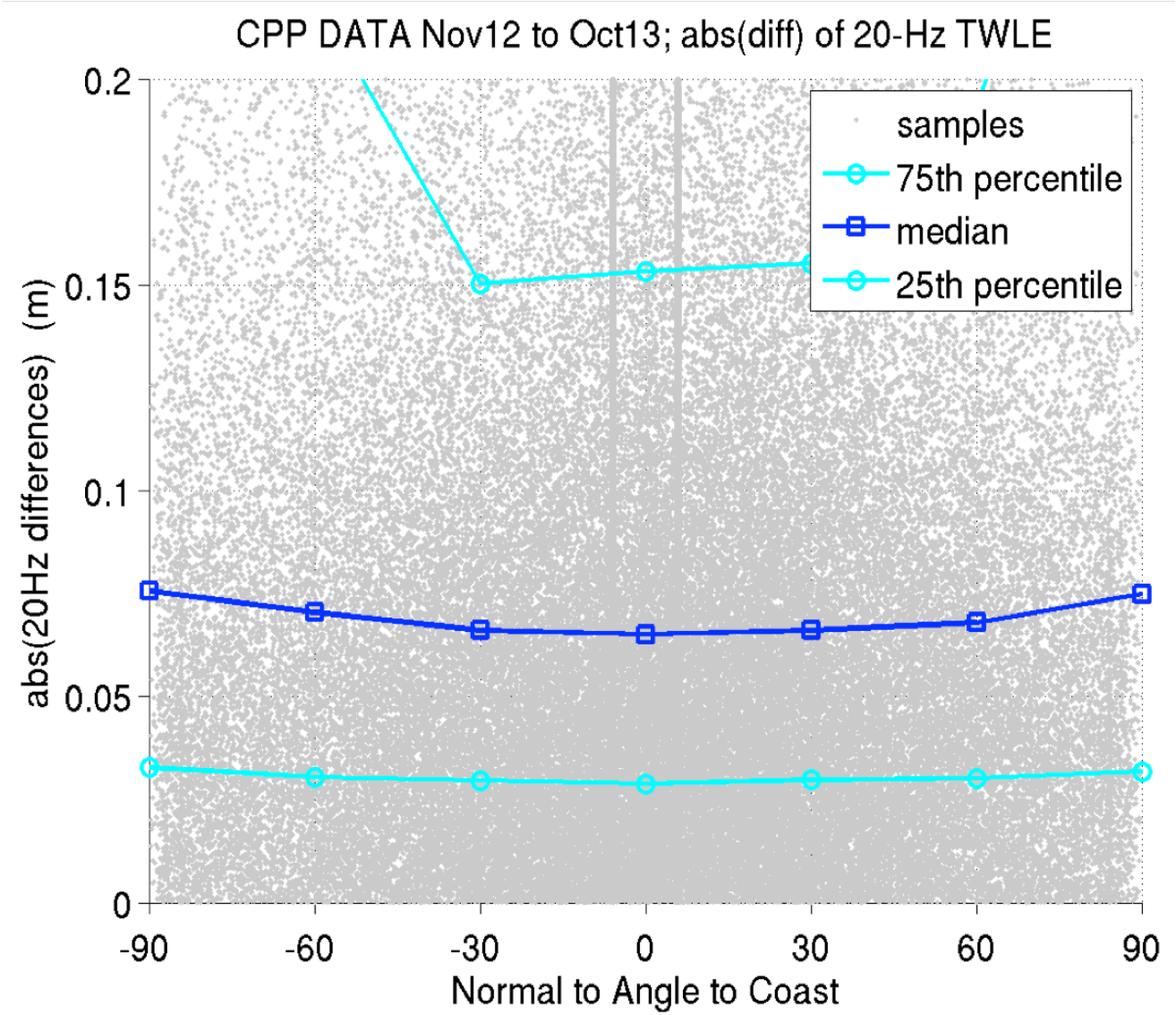
GPOD – vs along-track distance

With additional screening based on retracking misfit

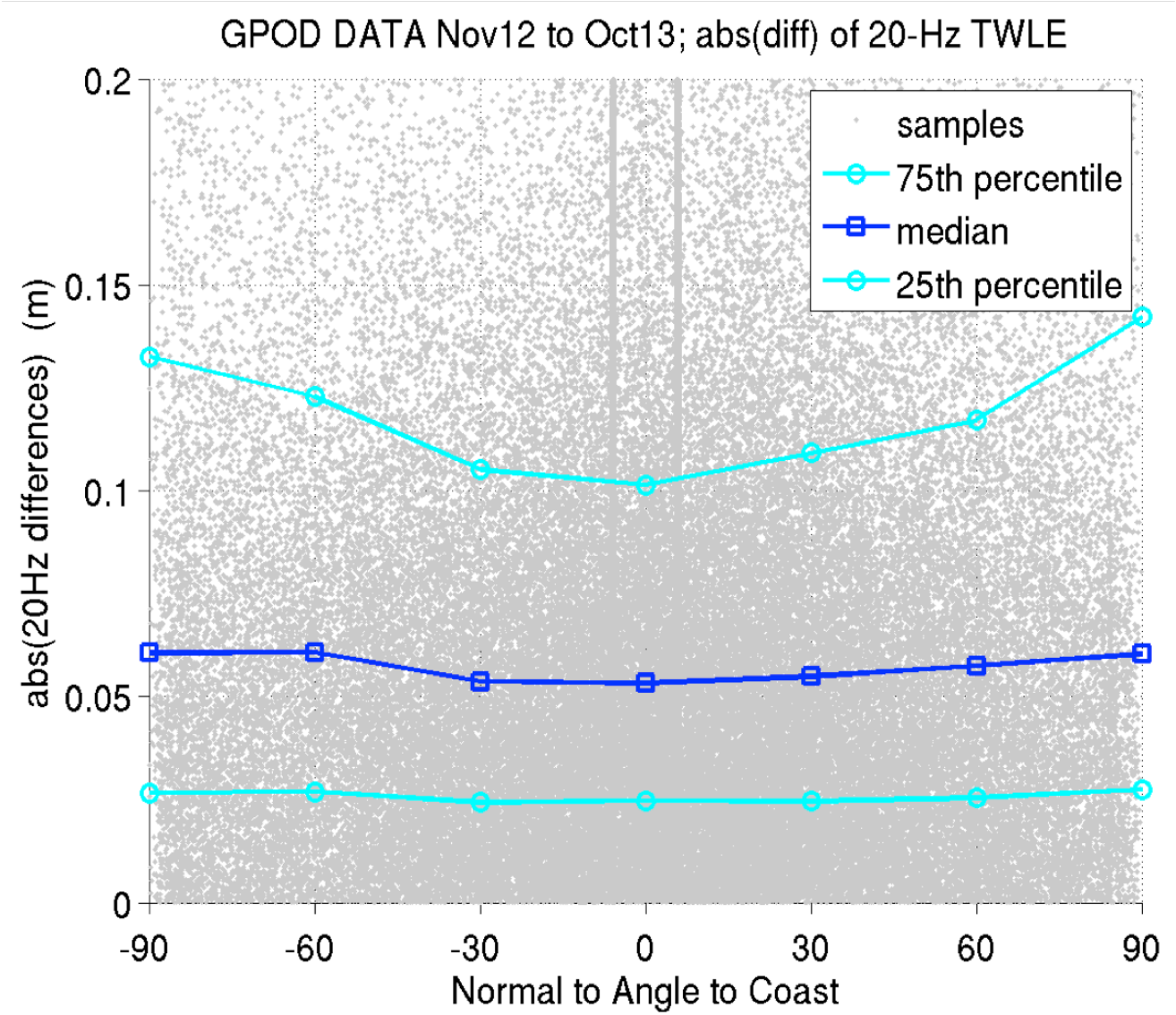


6cm @ 2km with ~50% valid

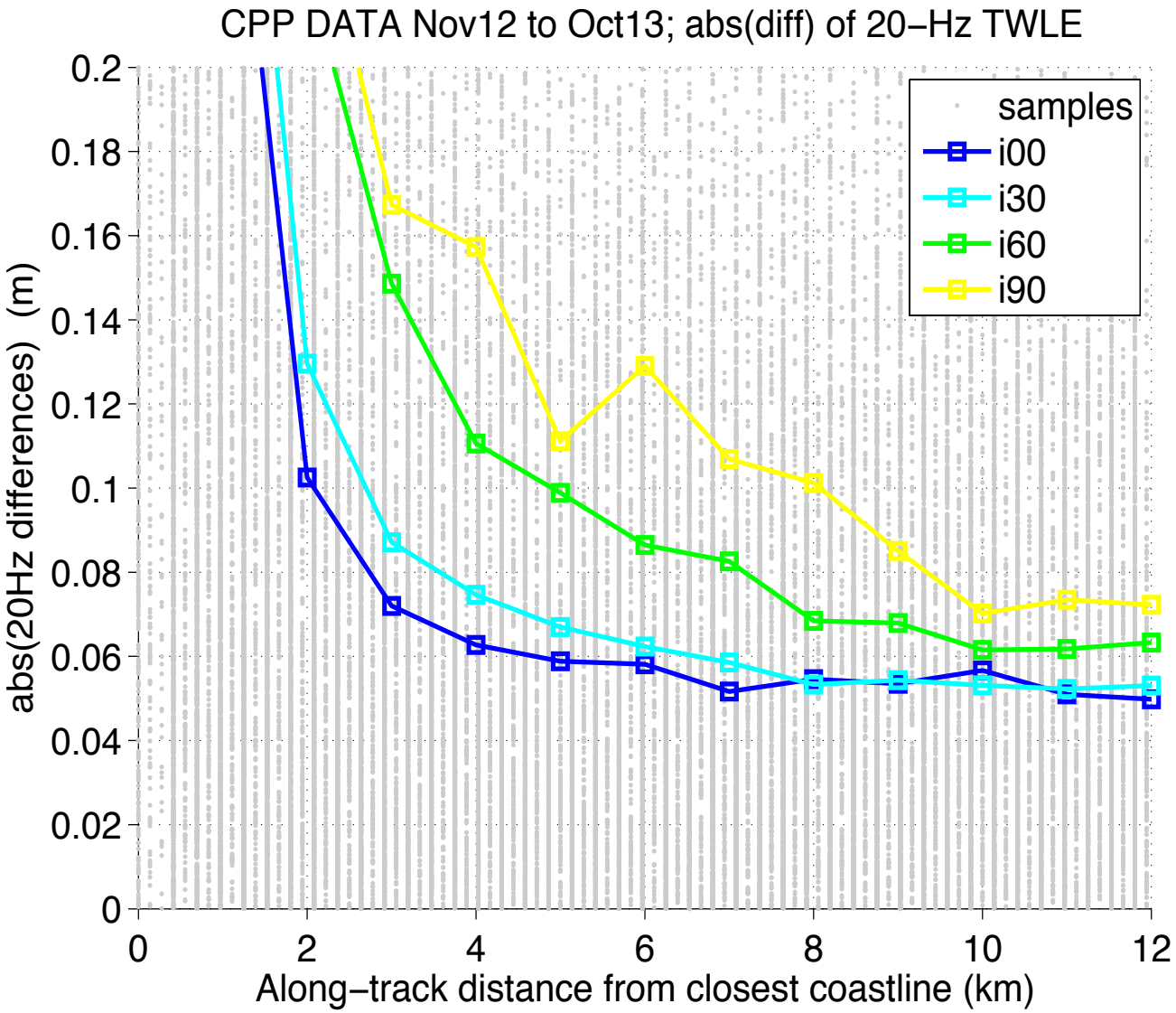
CPP – vs angle to coast



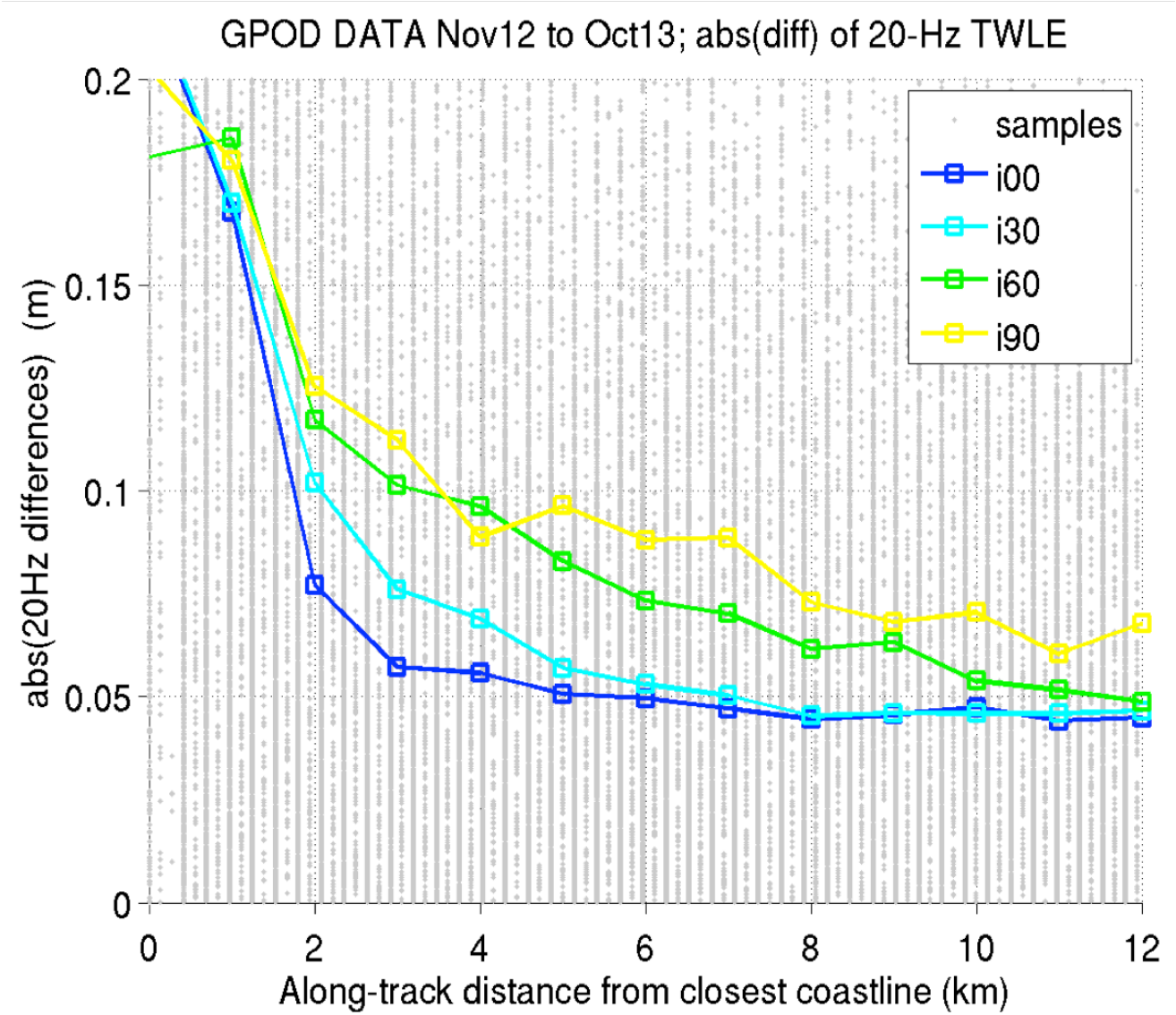
GPOD – vs angle to coast



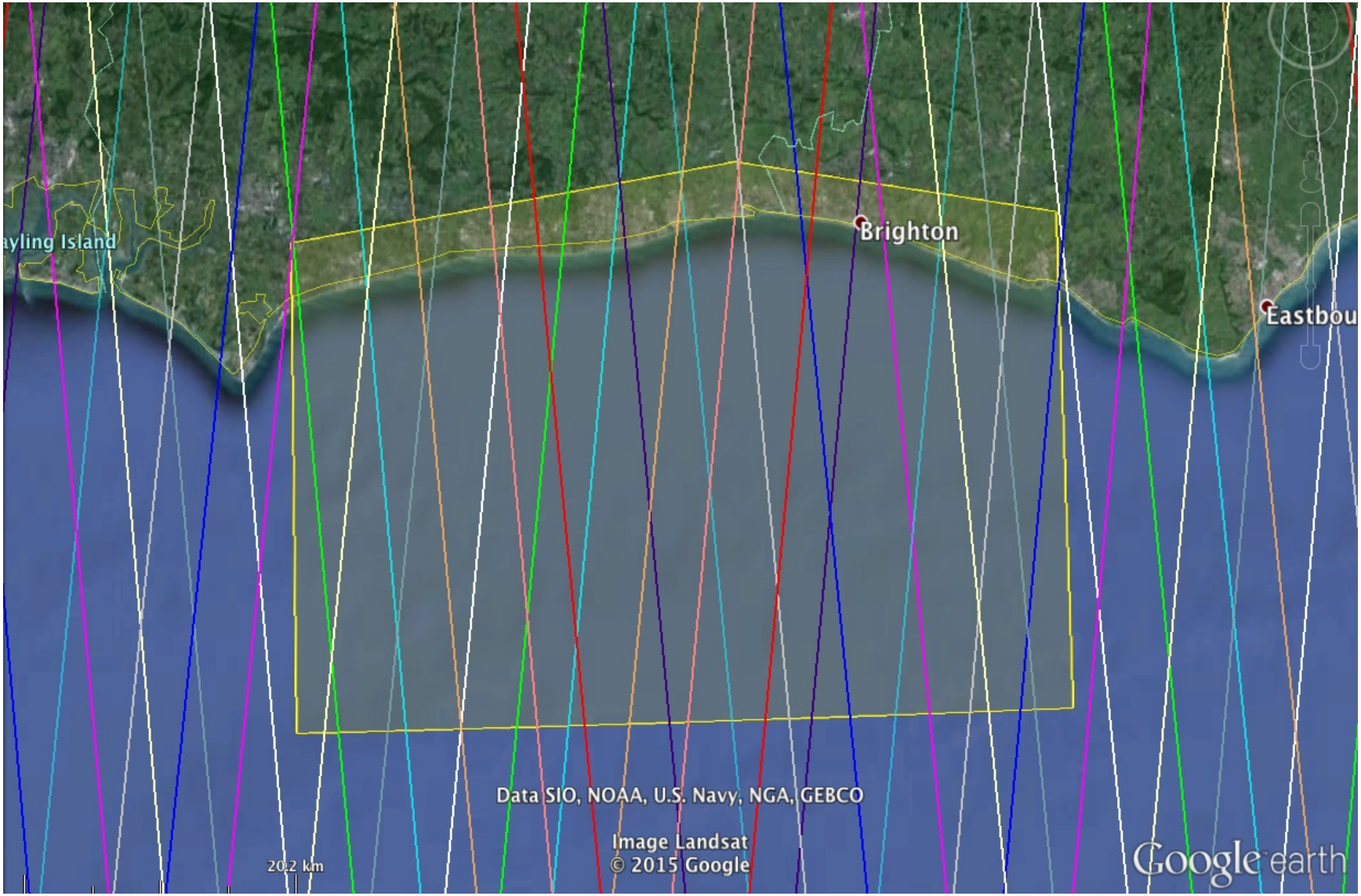
CPP in angle ranges



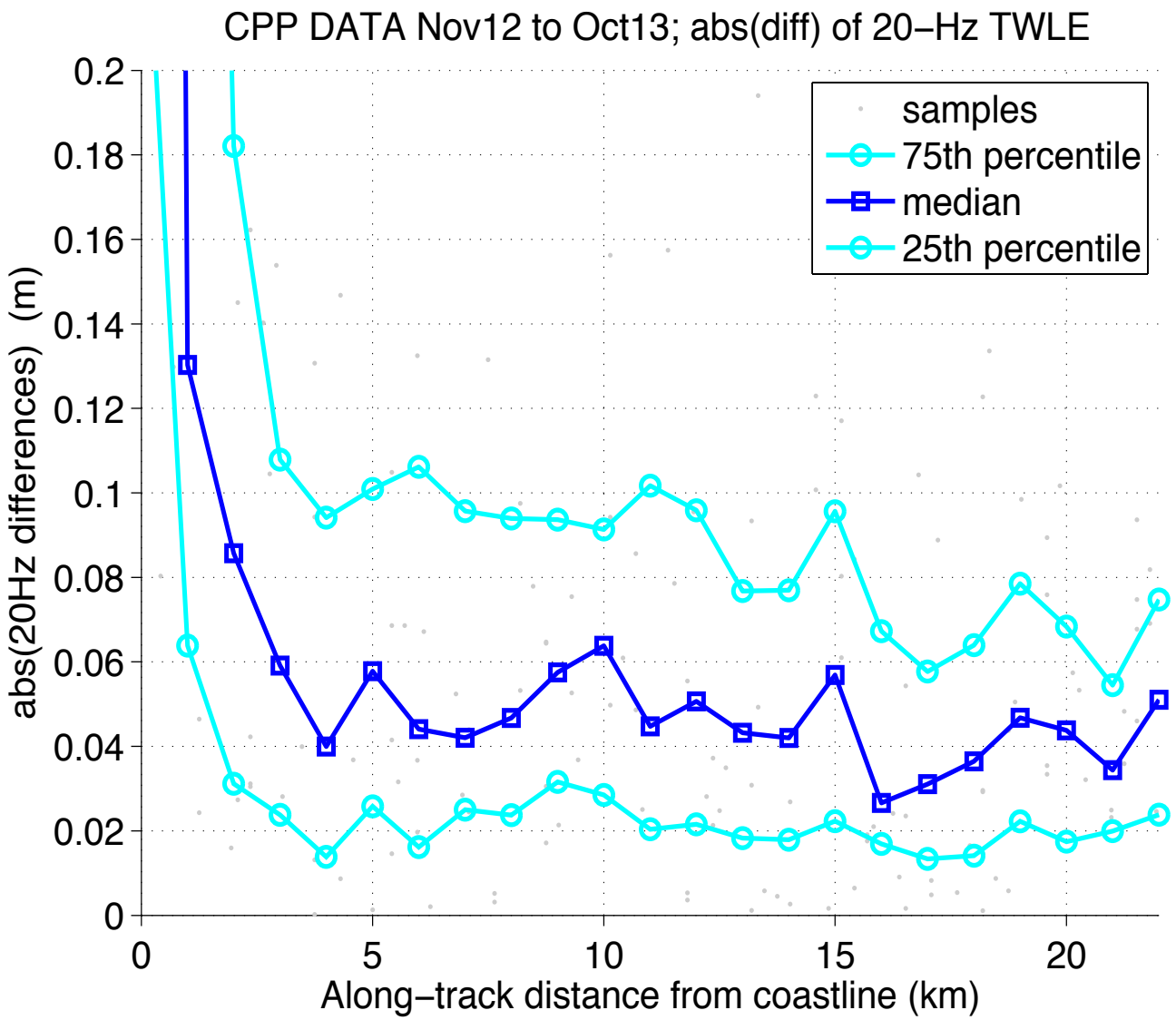
GPOD in angle ranges



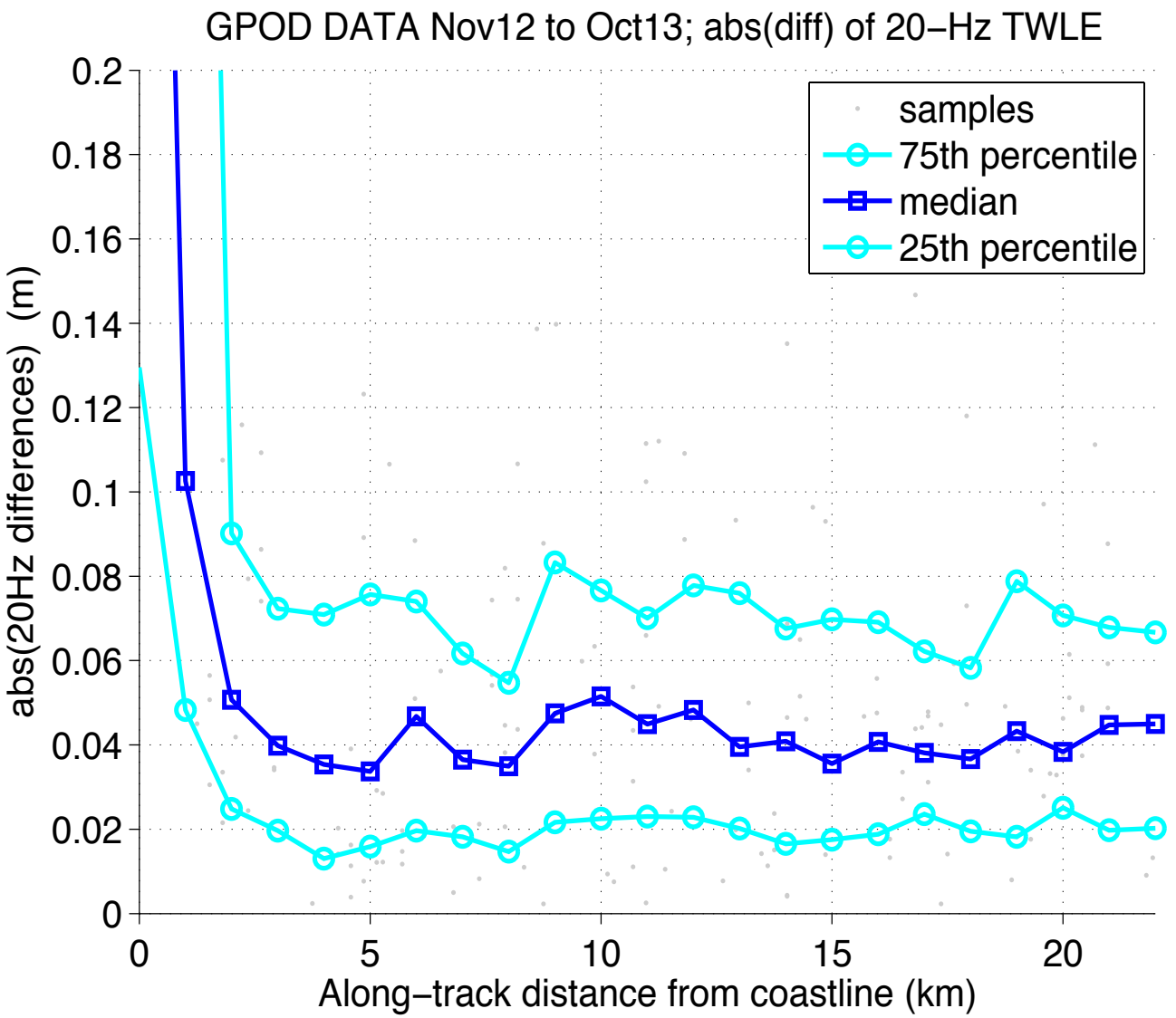
A good case study: Brighton Box



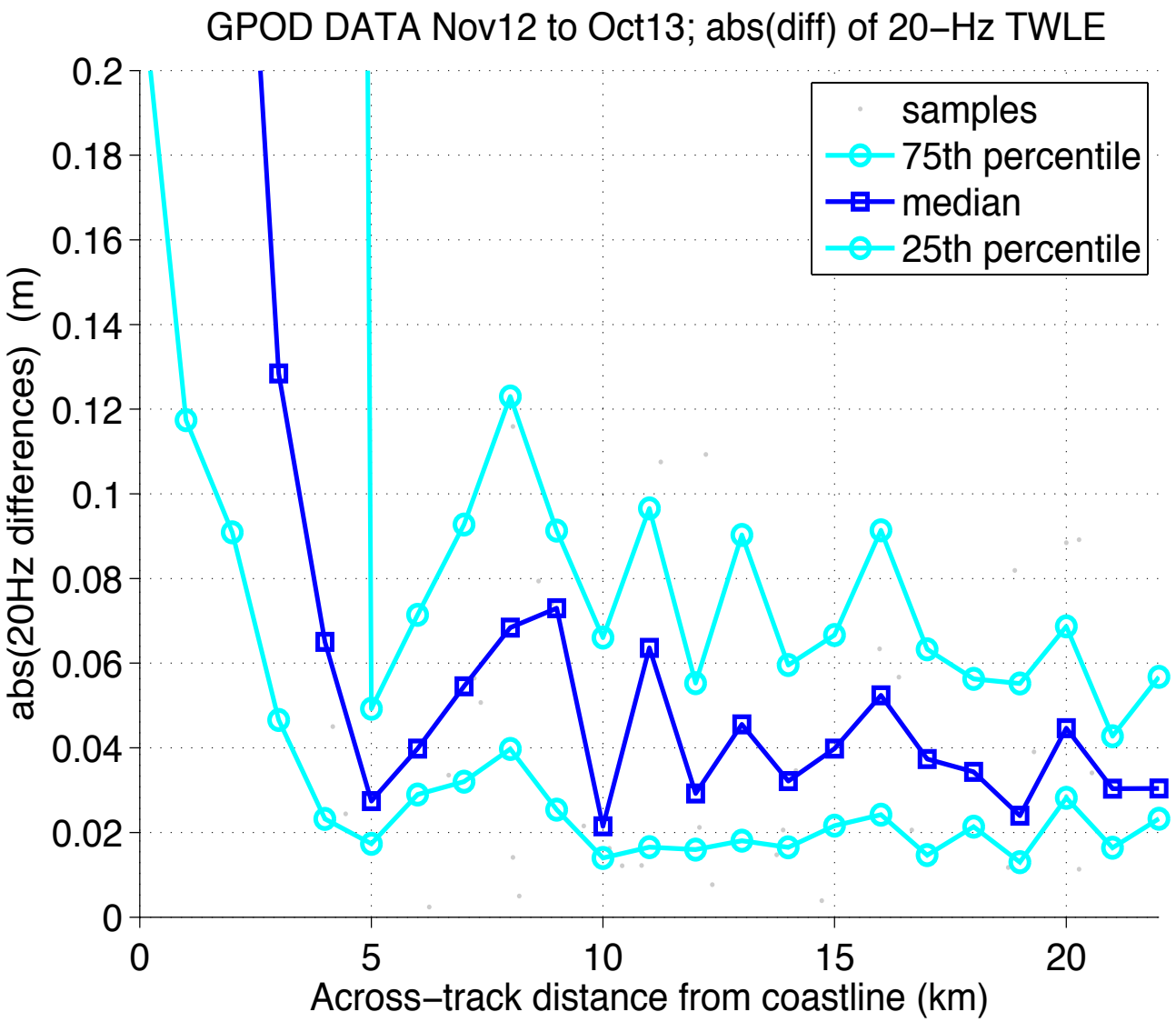
CPP on Brighton Box vs along-track d



GPOD on Brighton Box vs along-track d



GPOD on Brighton Box vs across-track d



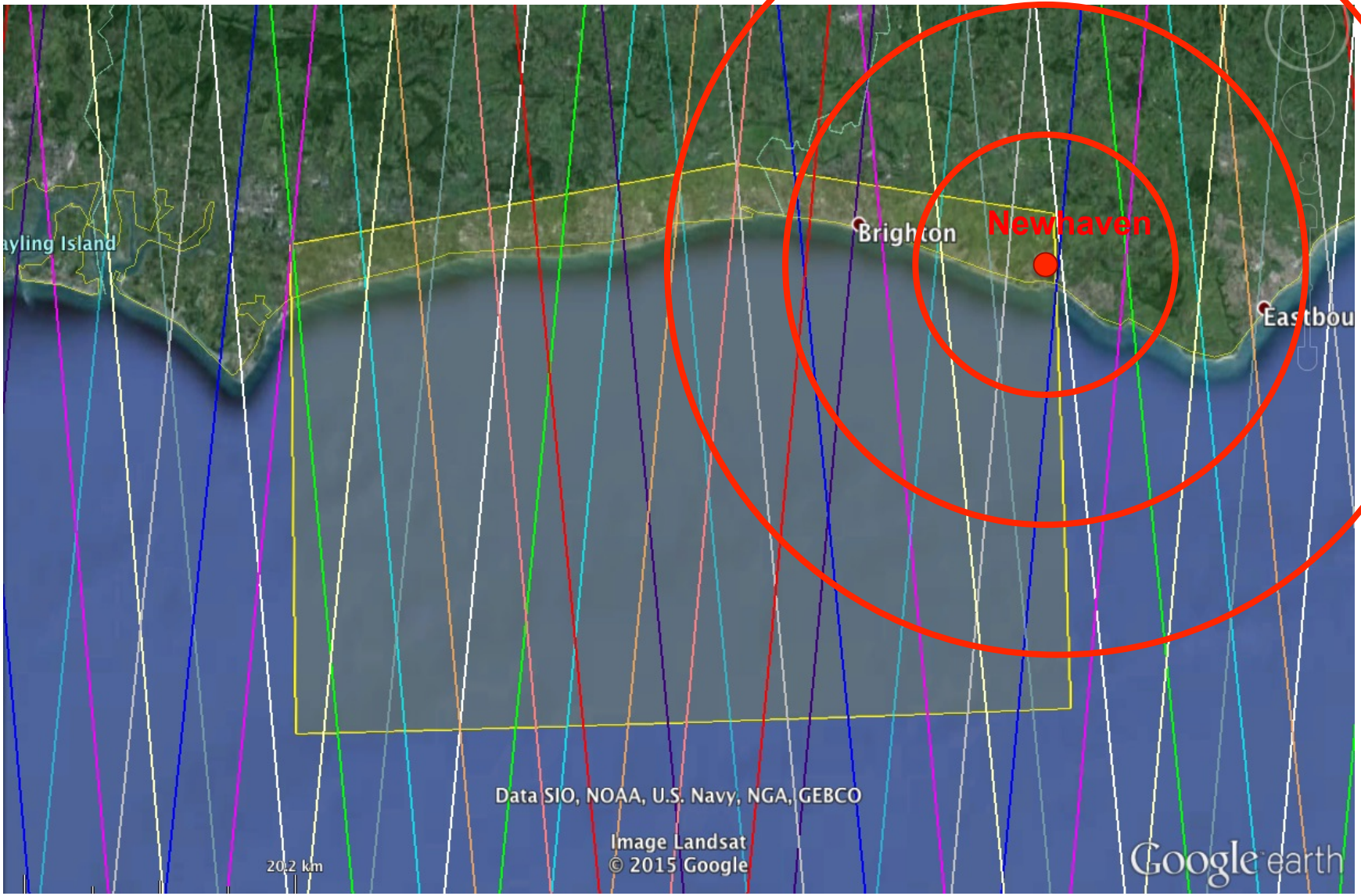
Example of expected Results – Validation

(accuracy w.r.t. tide gauges)

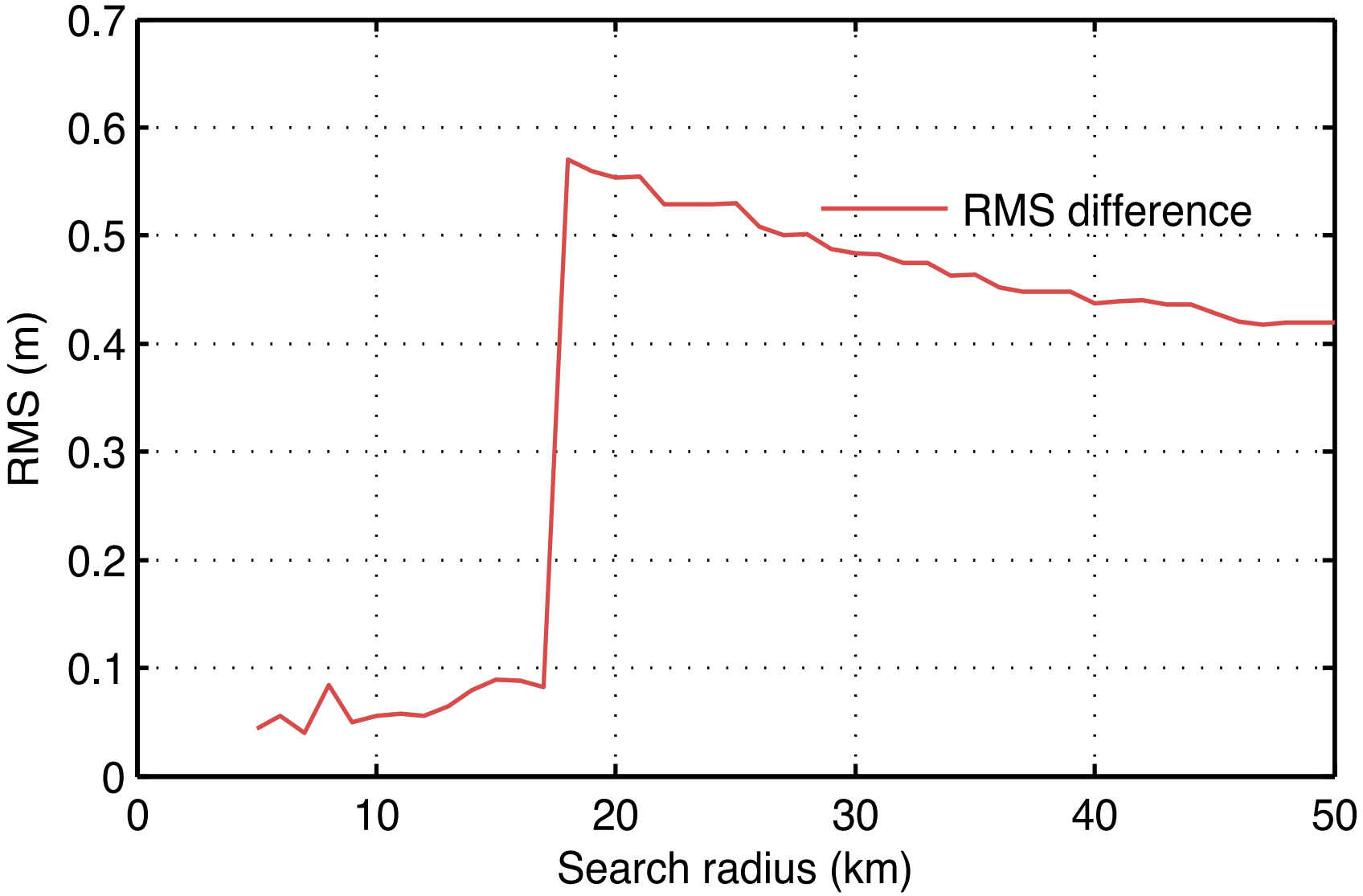
Validation against TG

- We compare Total Water Levels (i.e. we leave tides and atmospheric signals in)
- Validation of non-repeat altimetry against Tide Gauges presents an interesting problem:
  - **how far away from the tide gauge should we go in selecting the altimeter data?**
- We consider a ‘search radius’ around the TG and see how the rms difference varies when this radius is changed

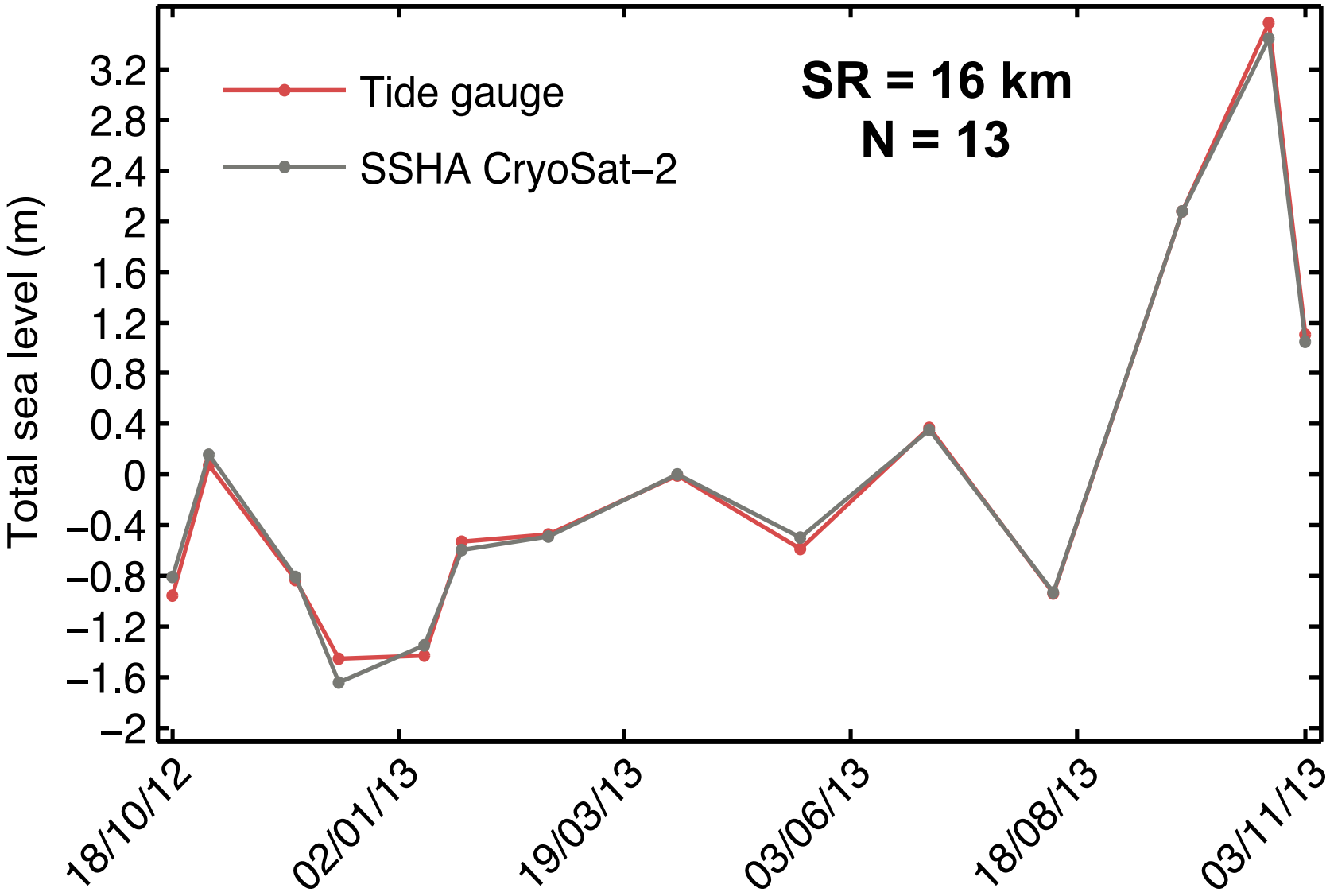
Newhaven TG


Newhaven
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat
© 2015 Google
Google earth

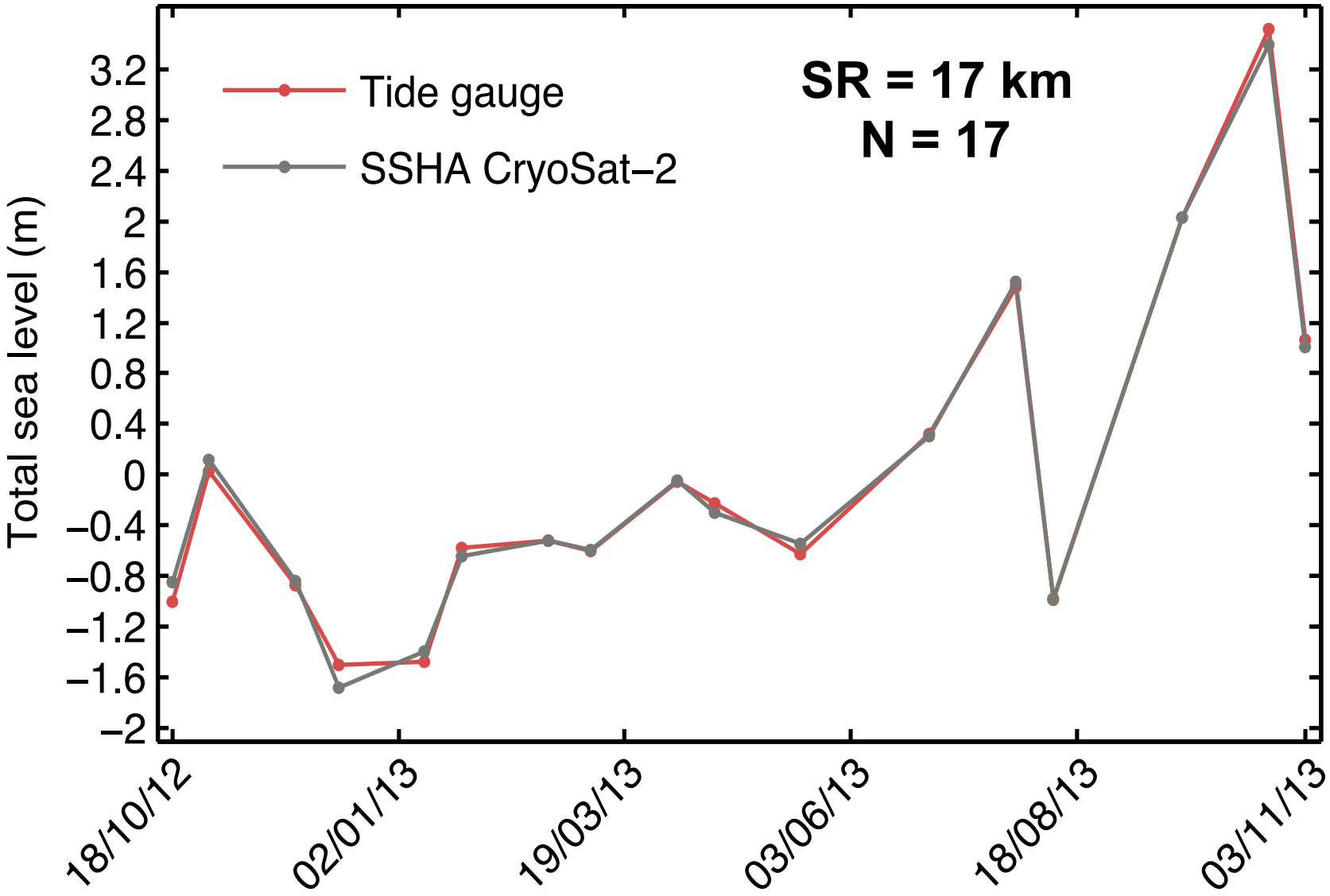
Newhaven


0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RMS (m)
RMS difference
0
10
20
30
40
50
Search radius (km)

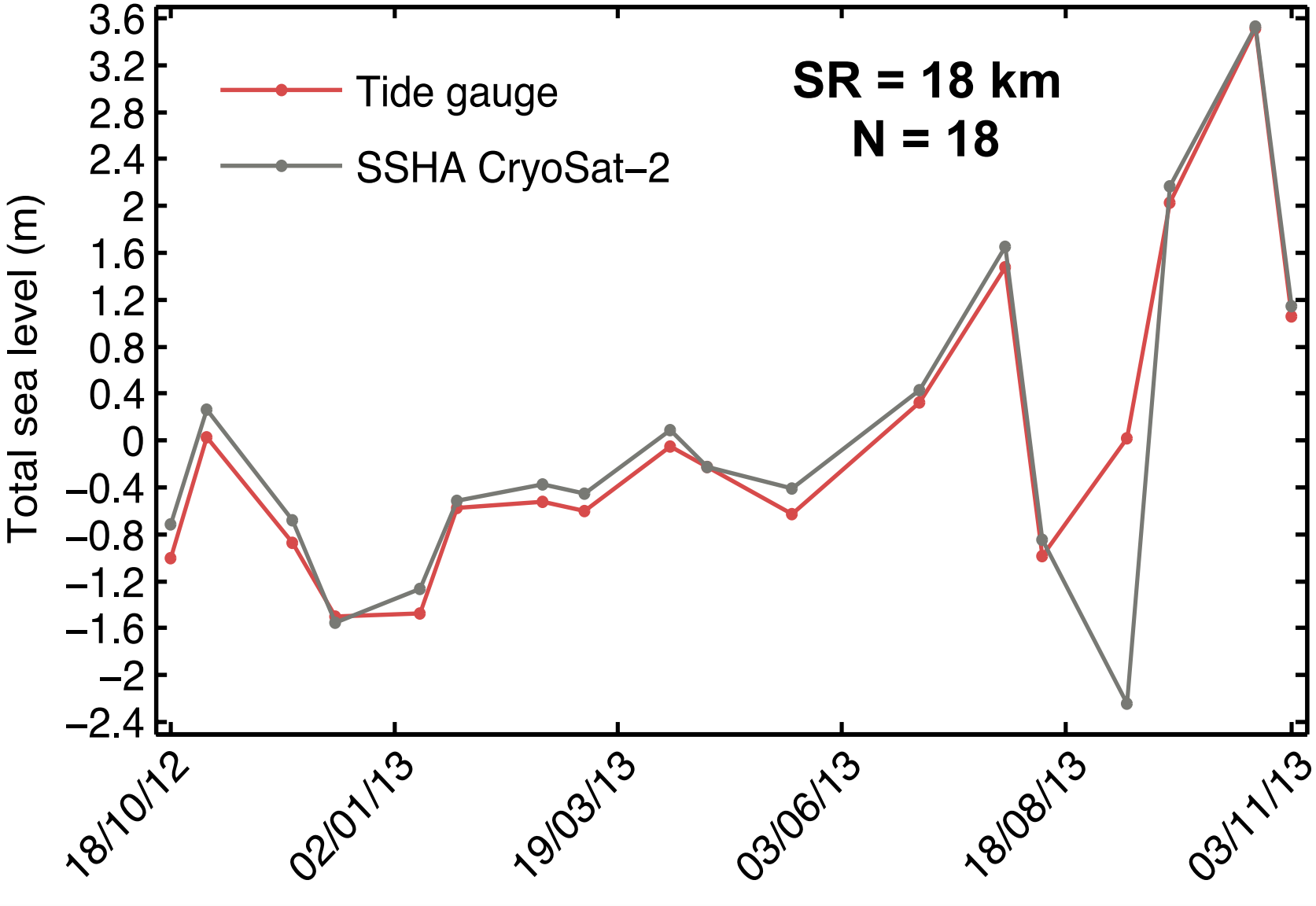
Newhaven


Tide gauge
SSHA CryoSat–2
SR = 16 km
N = 13
Total sea level (m)
3.2
2.8
2.4
2
1.6
1.2
0.8
0.4
0
−0.4
−0.8
−1.2
−1.6
−2
18/10/12
02/01/13
19/03/13
03/06/13
18/08/13
03/11/13

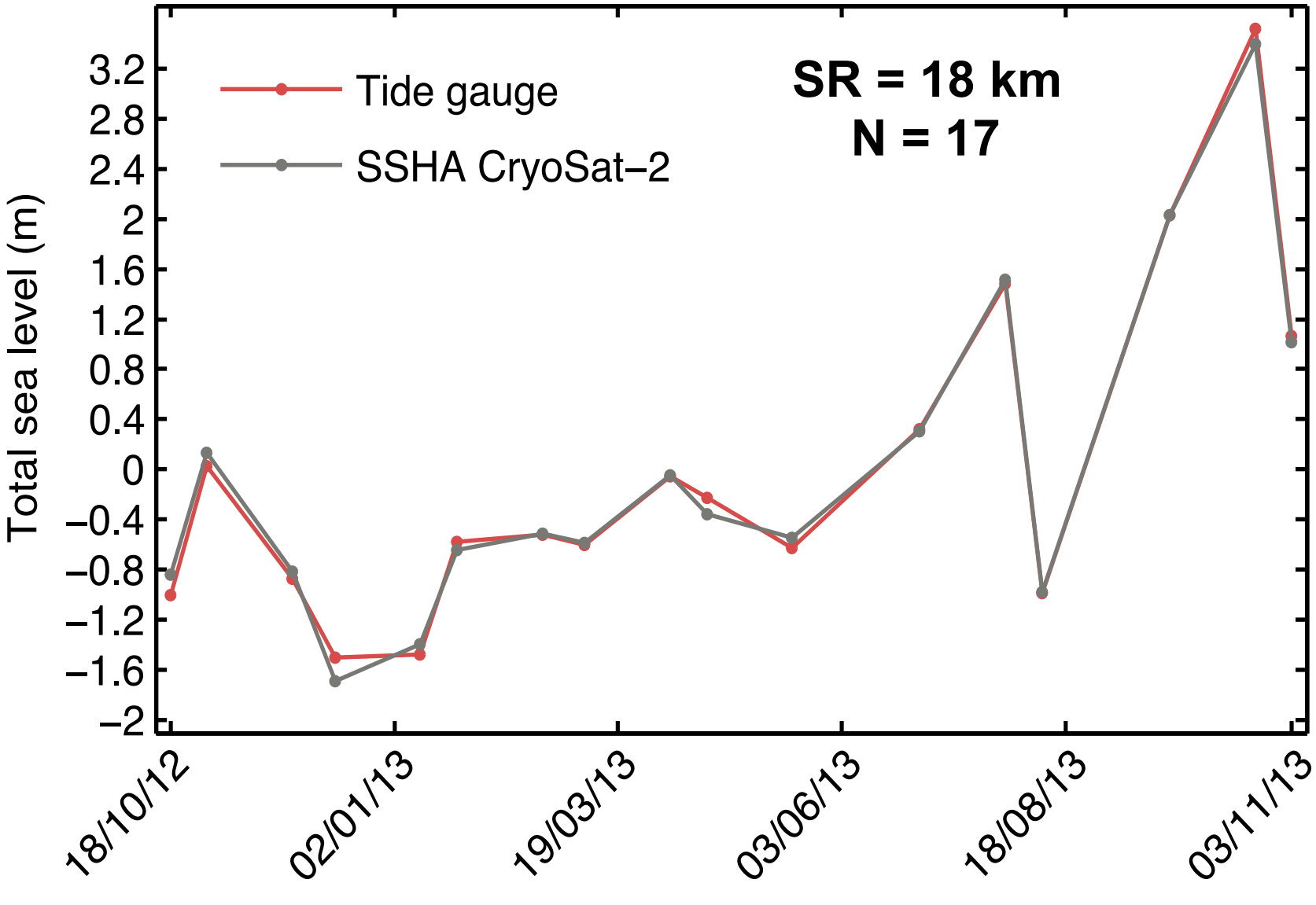
Newhaven


Tide gauge
SSHA CryoSat–2
SR = 17 km
N = 17
Total sea level (m)
3.2
2.8
2.4
2
1.6
1.2
0.8
0.4
0
−0.4
−0.8
−1.2
−1.6
−2
18/10/12
02/01/13
19/03/13
03/06/13
18/08/13
03/11/13

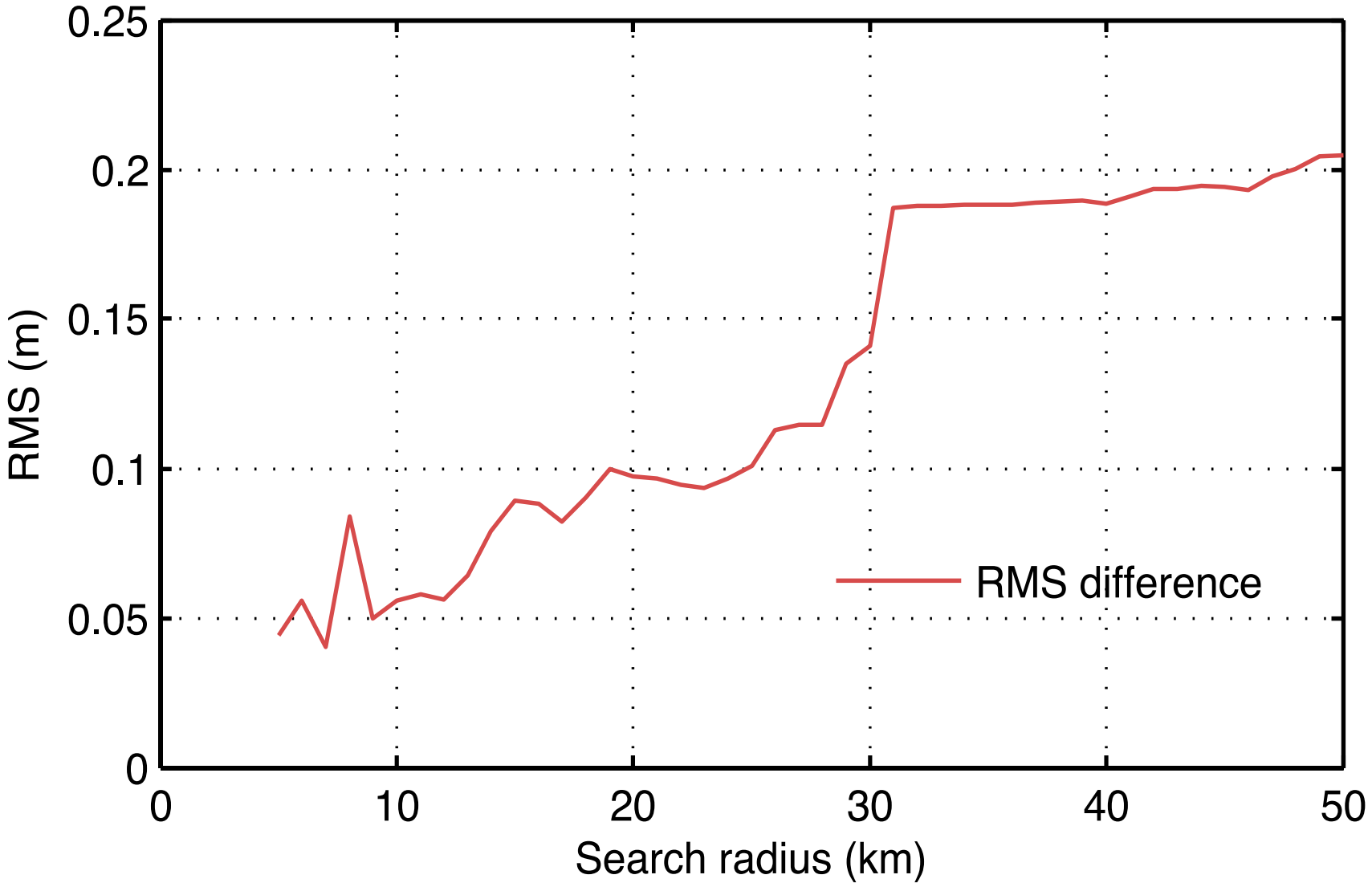
Newhaven


Tide gauge
SSHA CryoSat–2
SR = 18 km
N = 18
Total sea level (m)
3.6
3.2
2.8
2.4
2
1.6
1.2
0.8
0.4
0
–0.4
–0.8
–1.2
–1.6
–2
–2.4
18/10/12
02/01/13
19/03/13
03/06/13
18/08/13
03/11/13

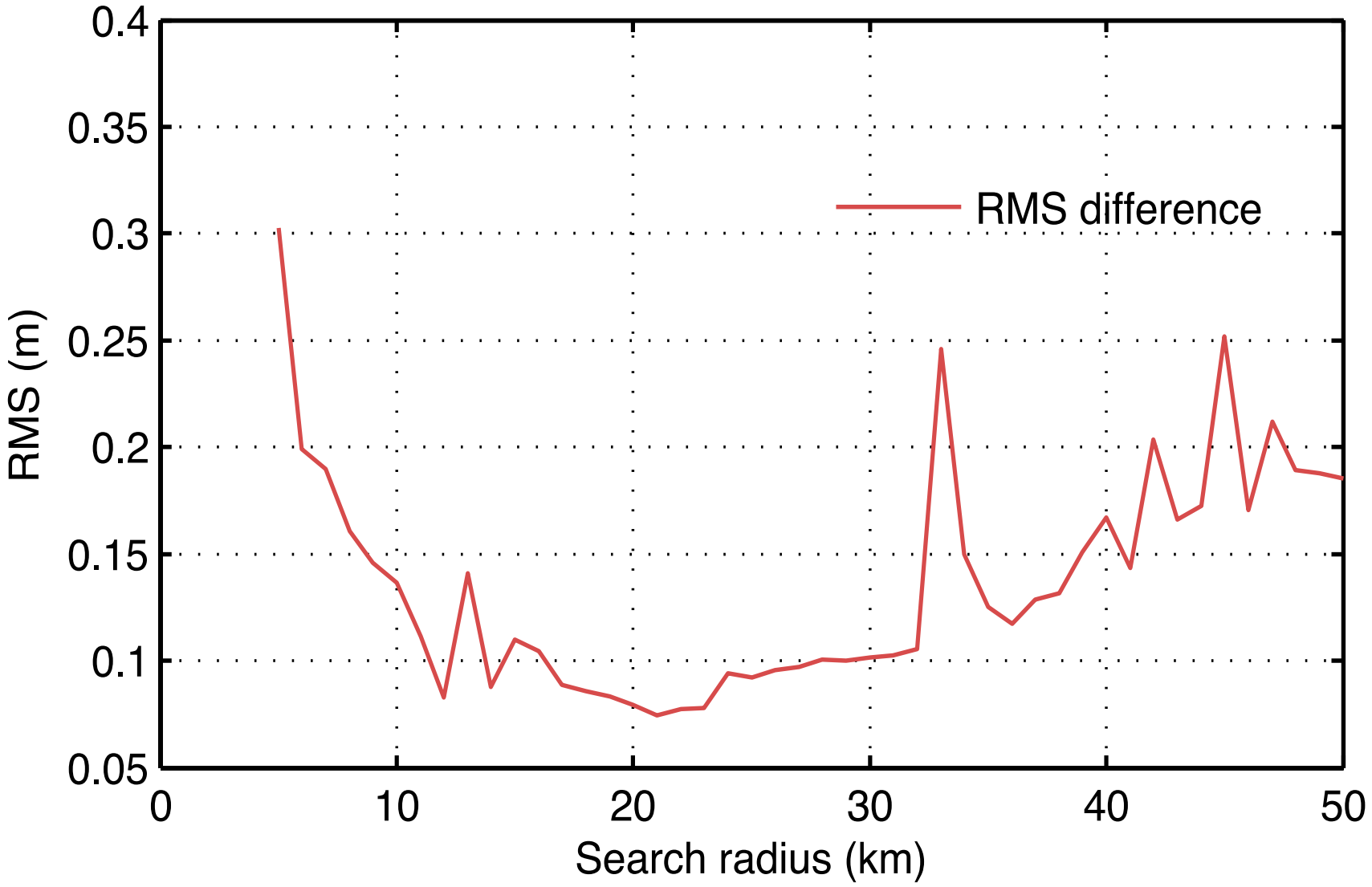
Newhaven, 1 outlier removed



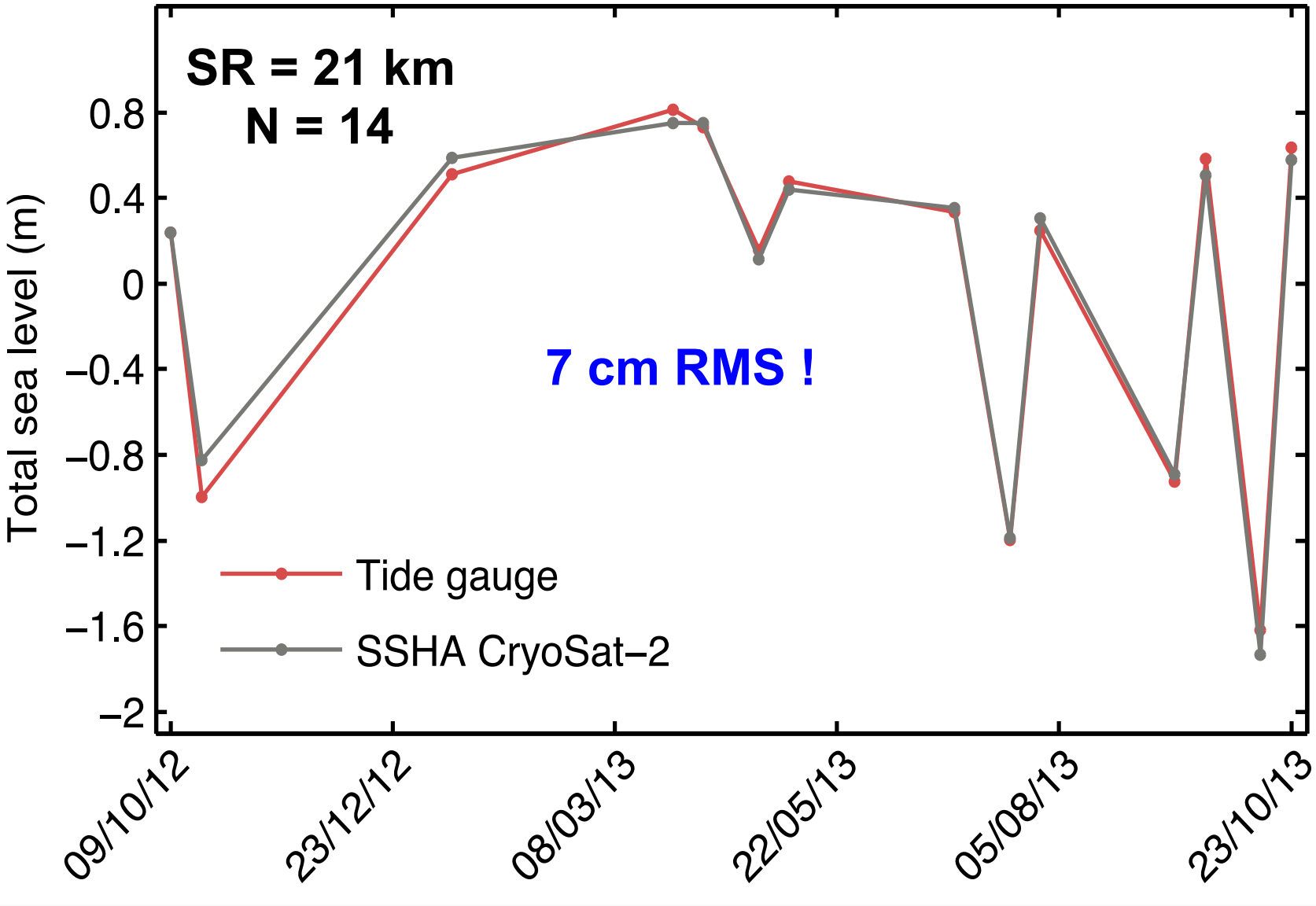
Newhaven, 1 outlier removed



Aberdeen


0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
RMS (m)
0
10
20
30
40
50
Search radius (km)
RMS difference

Aberdeen


SR = 21 km
N = 14
7 cm RMS !
Total sea level (m)
0.8
0.4
0
−0.4
−0.8
−1.2
−1.6
−2
Tide gauge
SSHA CryoSat−2
09/10/12
23/12/12
08/03/13
22/05/13
05/08/13
23/10/13

WP6000's many tasks – 5

- WP6700 Validate and cross-calibrate innovative methods and algorithms through a set of diagnoses and compile findings into Product Validation Reports (PVR) (NOC, Noveltis, TUDa)
- WP6800 Generate test datasets of innovative output products in the coastal zone in a portable format for public domain dissemination and documentation (NOC)

WP6000 – Deliverables

- Product Validation Plan D2.4
- Product Validation Report (one per data L2 product, or one single document), D2.5
- Output Products (test datasets in the coastal zone) D2.9