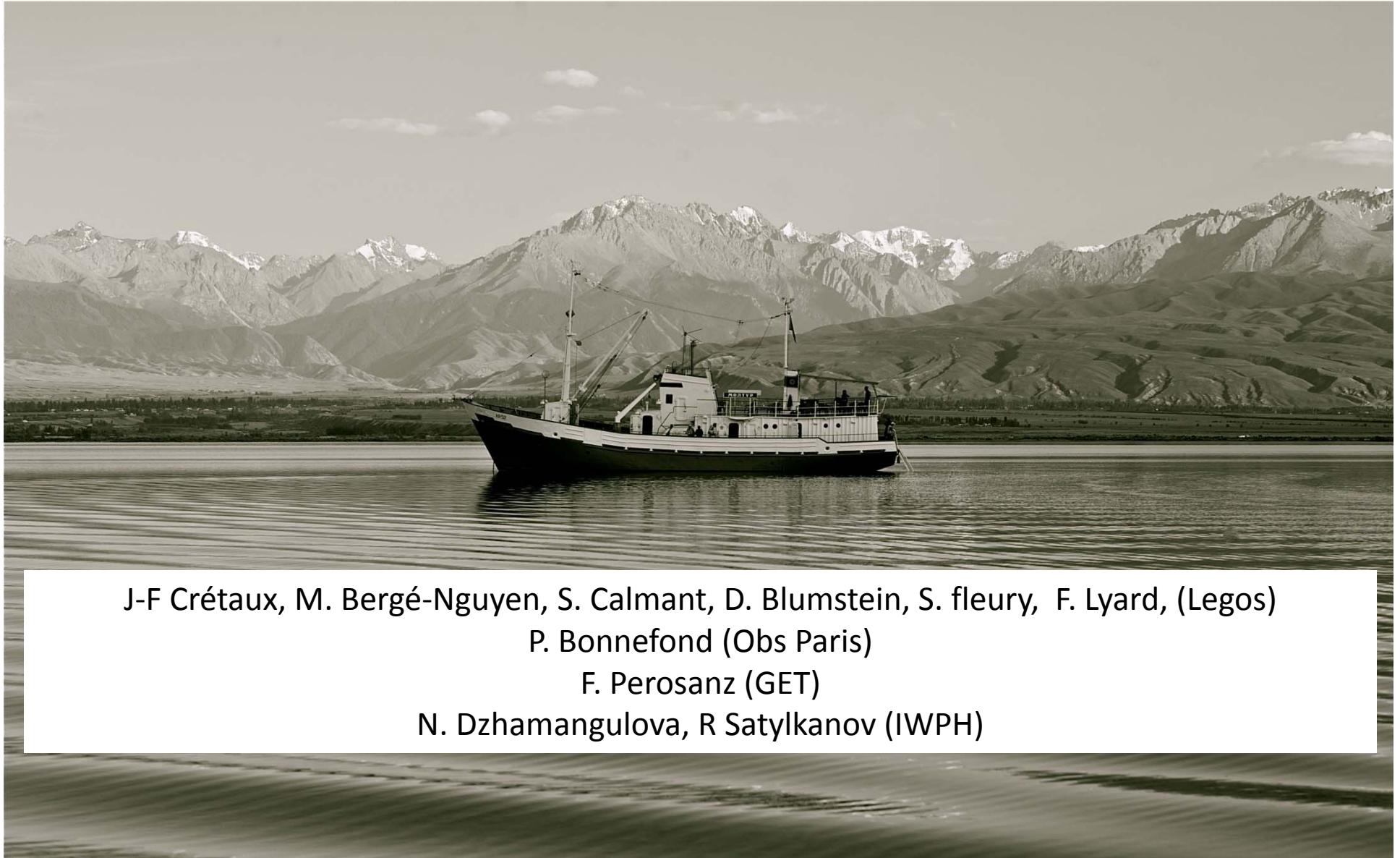


# Cal/Val of Jason-3 & Sentinel-3A over the Lake Issykkul

First determination of error budget and absolute bias



J-F Crétaux, M. Bergé-Nguyen, S. Calmant, D. Blumstein, S. fleury, F. Lyard, (Legos)  
P. Bonnefond (Obs Paris)  
F. Perosanz (GET)  
N. Dzhamangulova, R Satylkanov (IWPH)

## Lake Issykkul cal/Val site for satellite altimetry

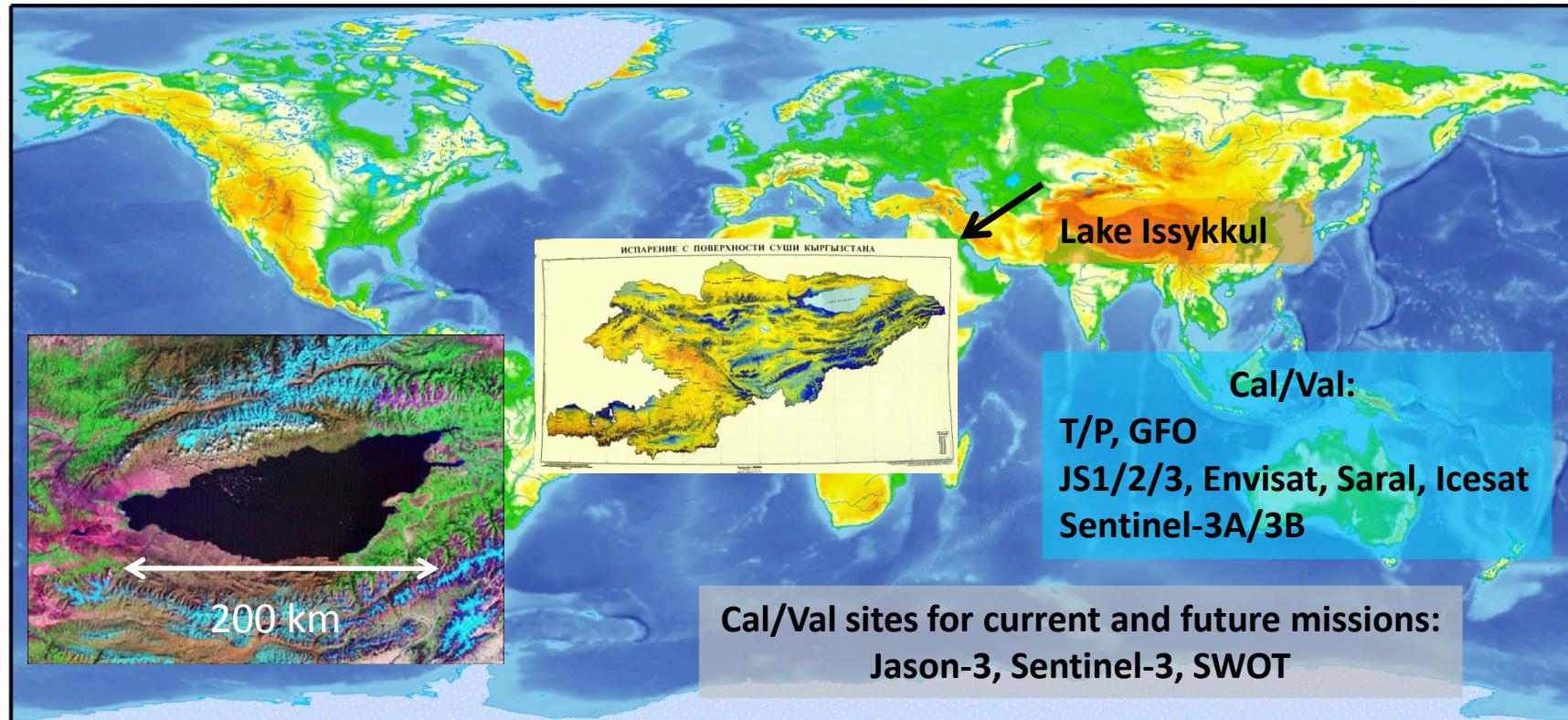
### Framework project:

Initiated in 2004 by a NATO project between France and Kyrgyzstan

Continued in 2008 by a CNES/TOSCA project for contribution of France to C/V of altimeters:

FOAM Headed by P. Bonnefond including ocean, lakes and rivers sites

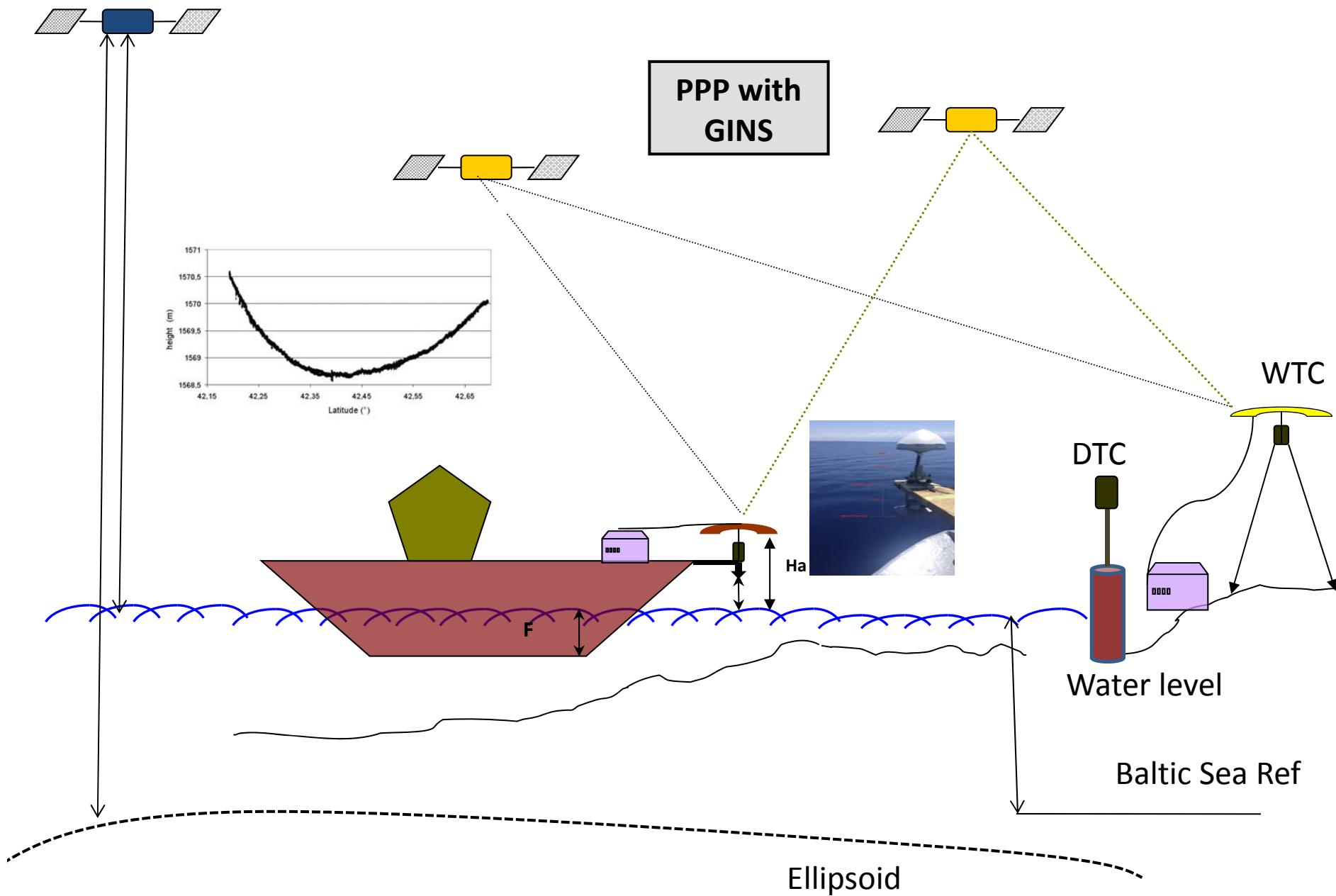
15 field campaigns since 2004, the last in July 2017 dedicated to Jason-3 and Sentinel-3A



Crétaux et al., 2009, 2011, 2013, 2017 (in preparation)

S3A

## Absolute calibration on lakes: experimental design



## Lake Issykkul cal/Val of Jason-3 & Sentinel-3A

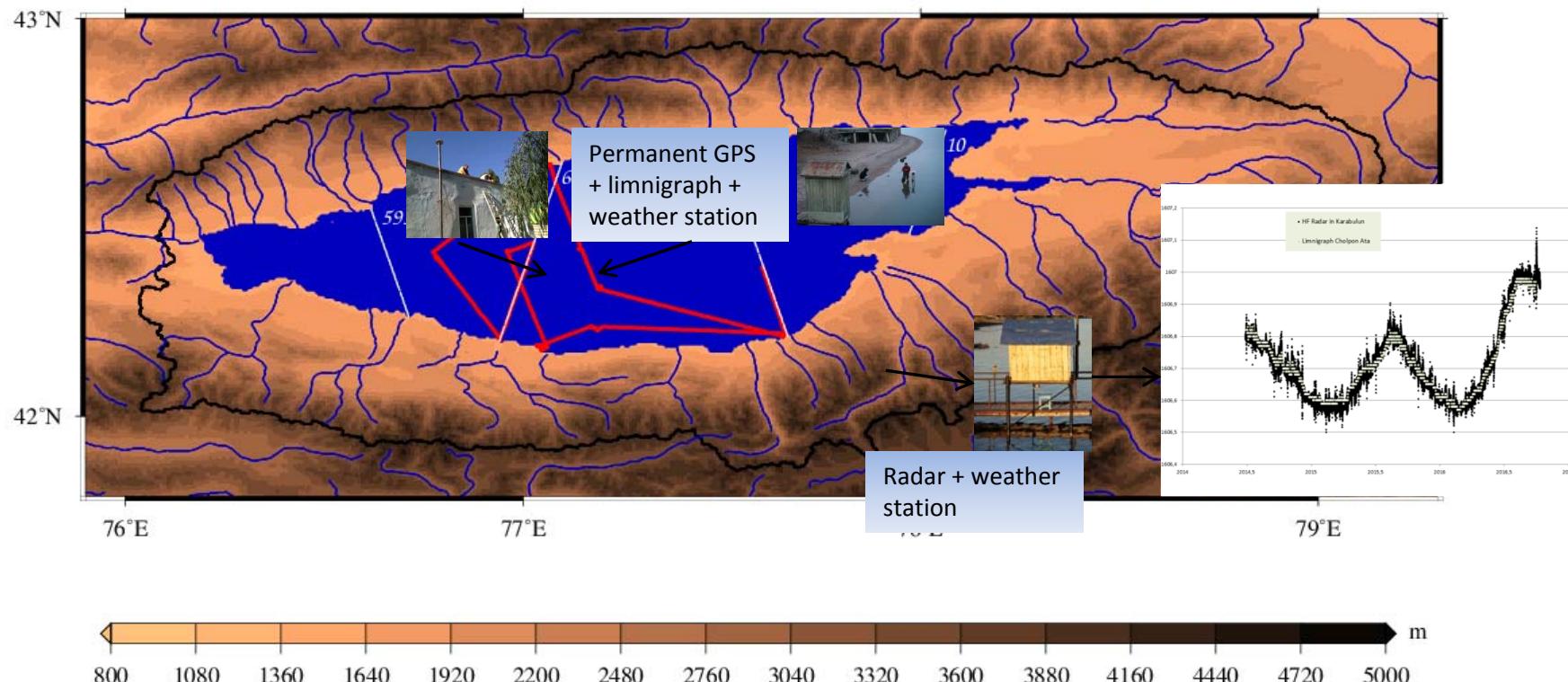
### -Two field work done in 2016:

April with pass of the Jason-3

October with two passes of Sentinel-3 over the tracks 666 and 707

### -One field work in July 2017:

one pass over the track 666 of Sentinel-3 and the track 131 of Jason-3

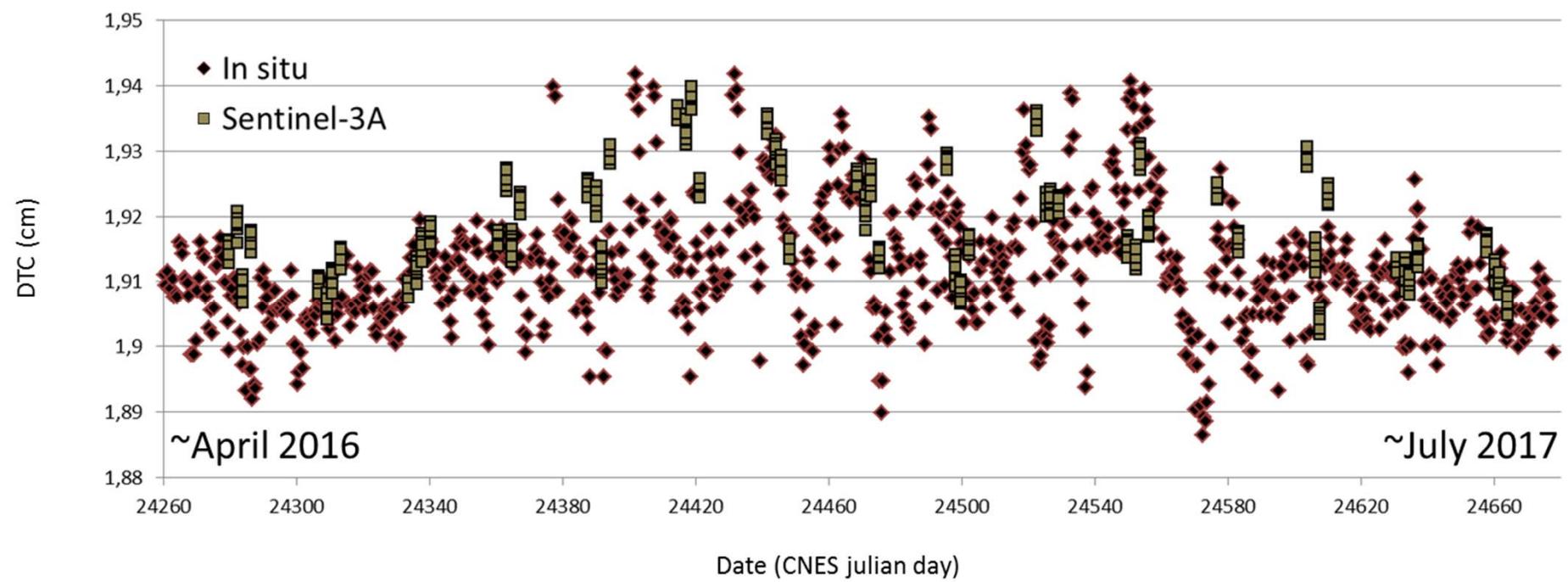
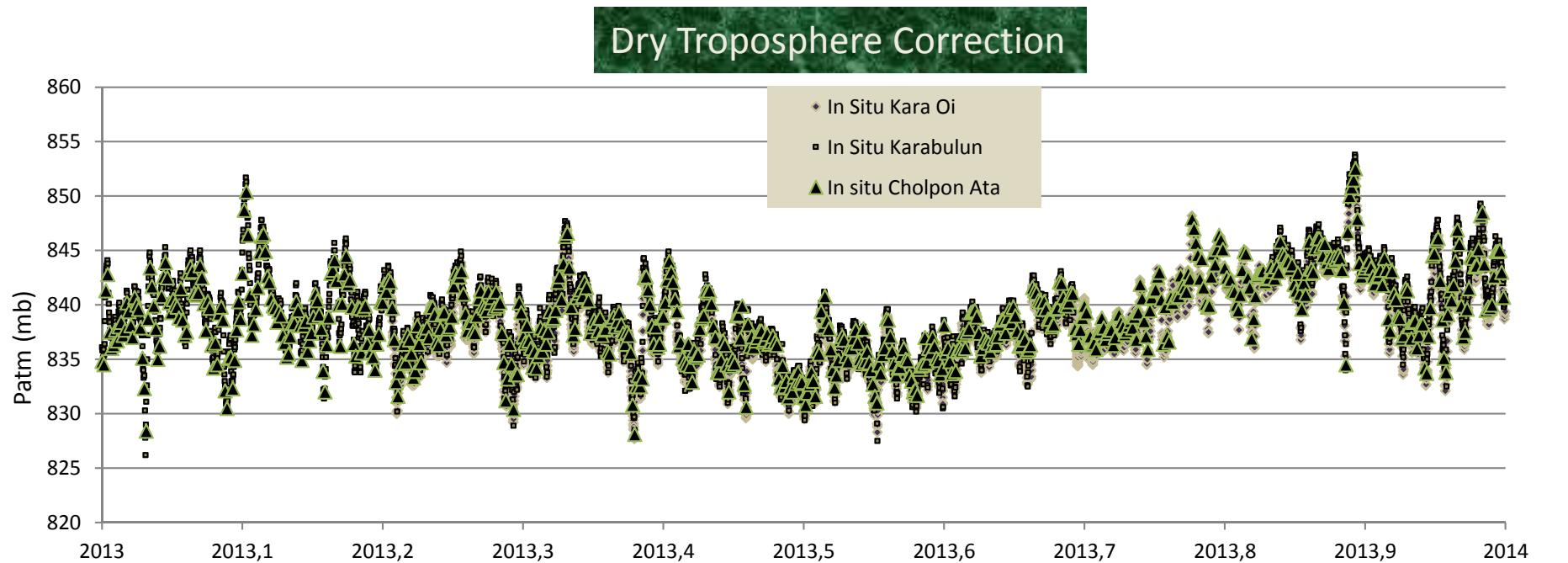


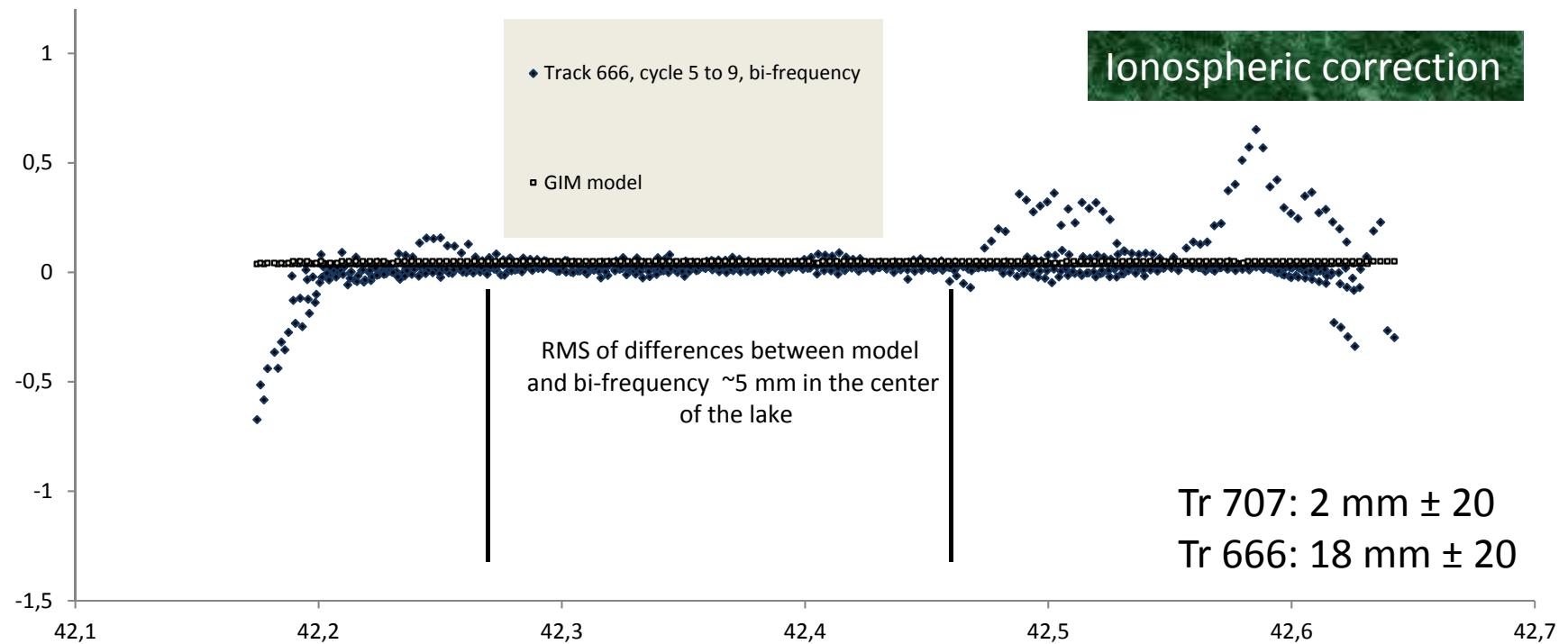
-In situ data and network of ground instrumentation

-No SSB, no inverse barometer, no tide, seiche effect avoid

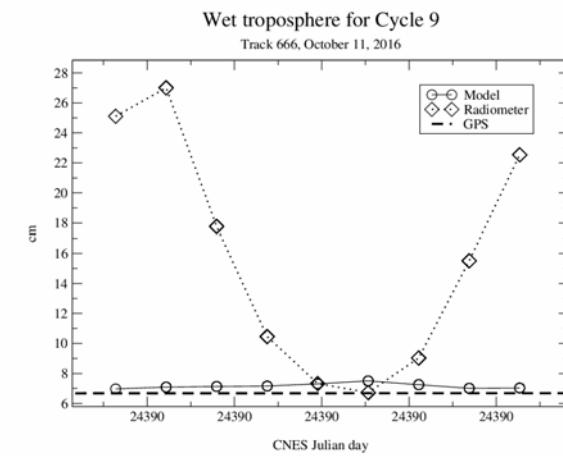
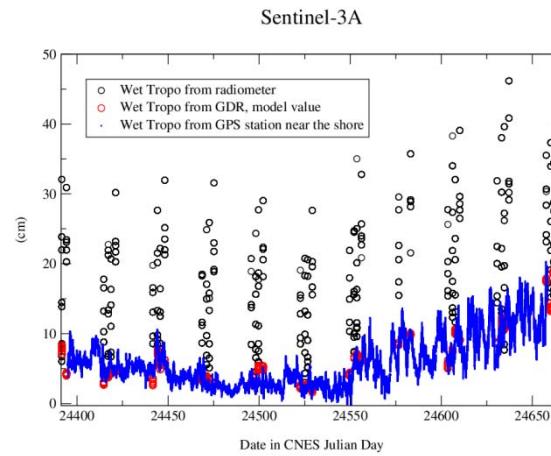
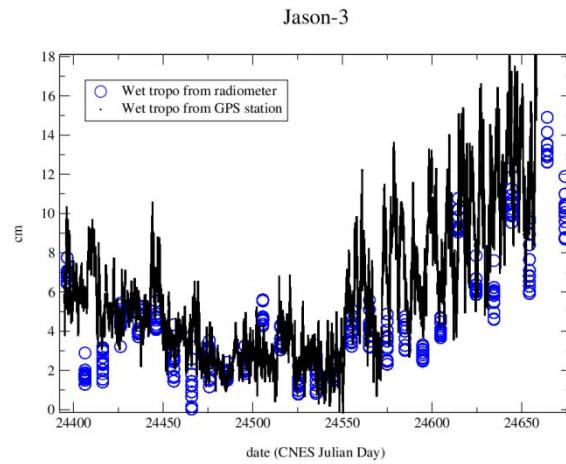
-Assessment of performance of retracking algorithms and of geophysical corrections

-calculation of absolute bias

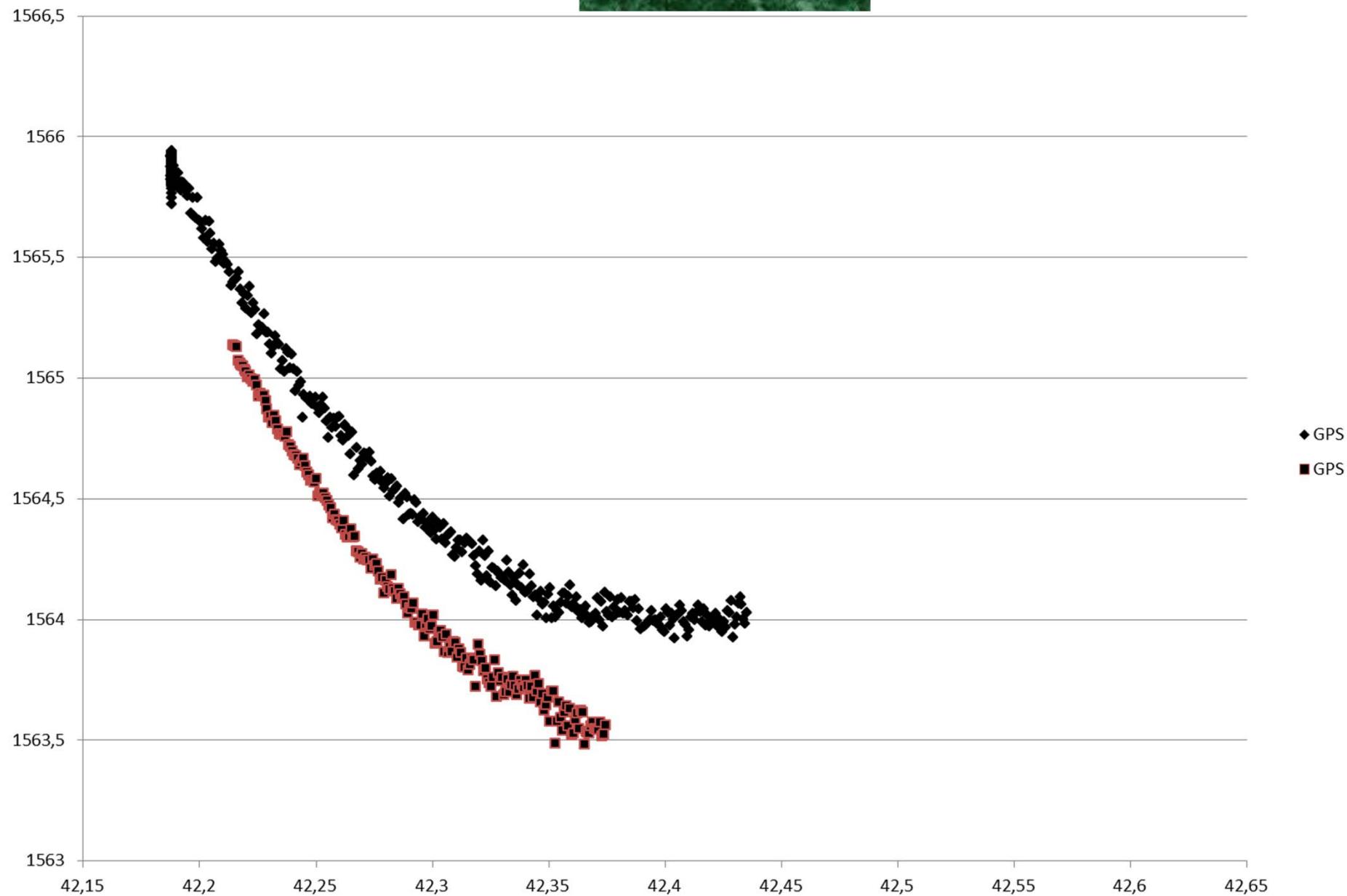




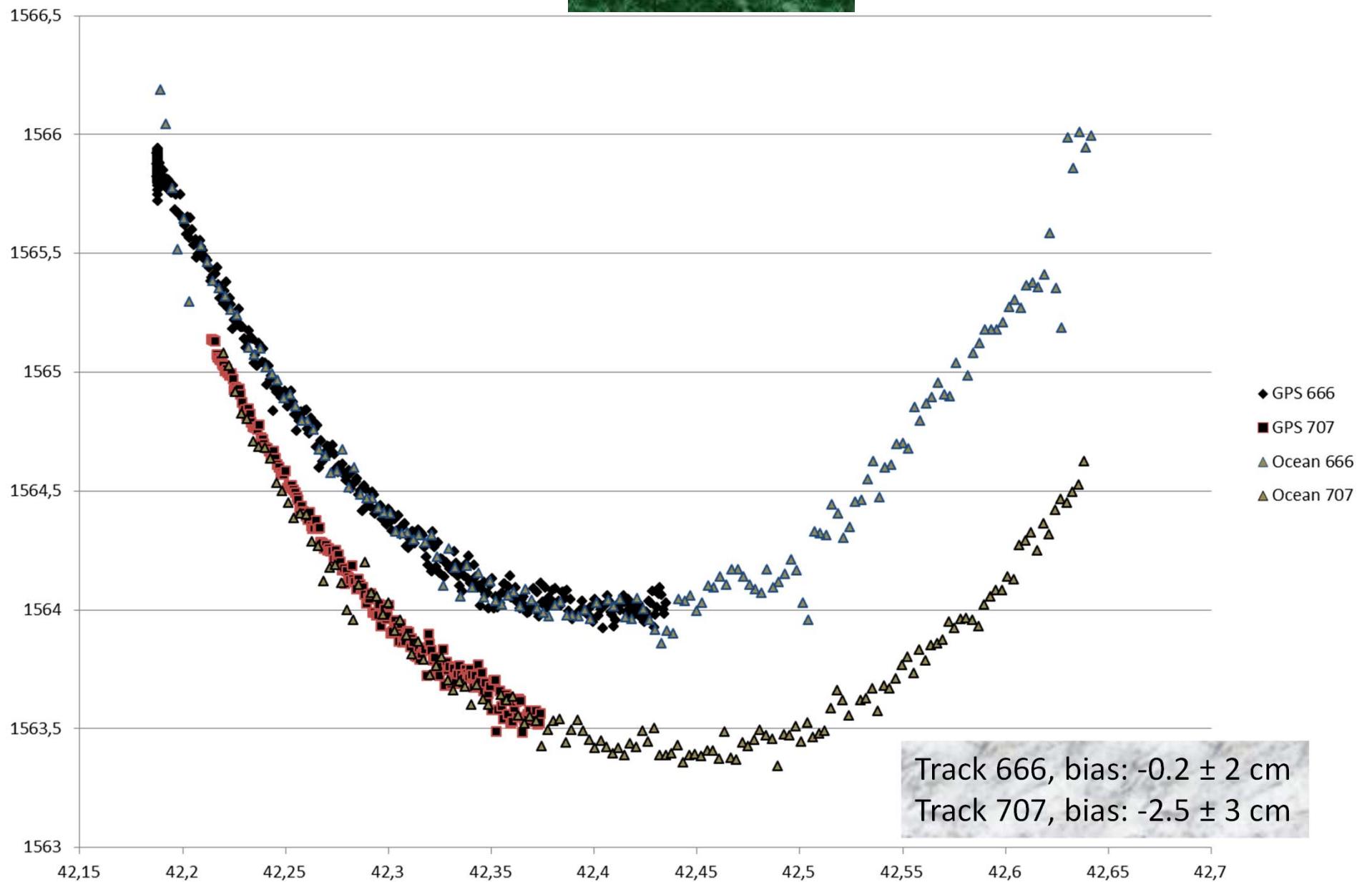
### Wet Tropospheric correction



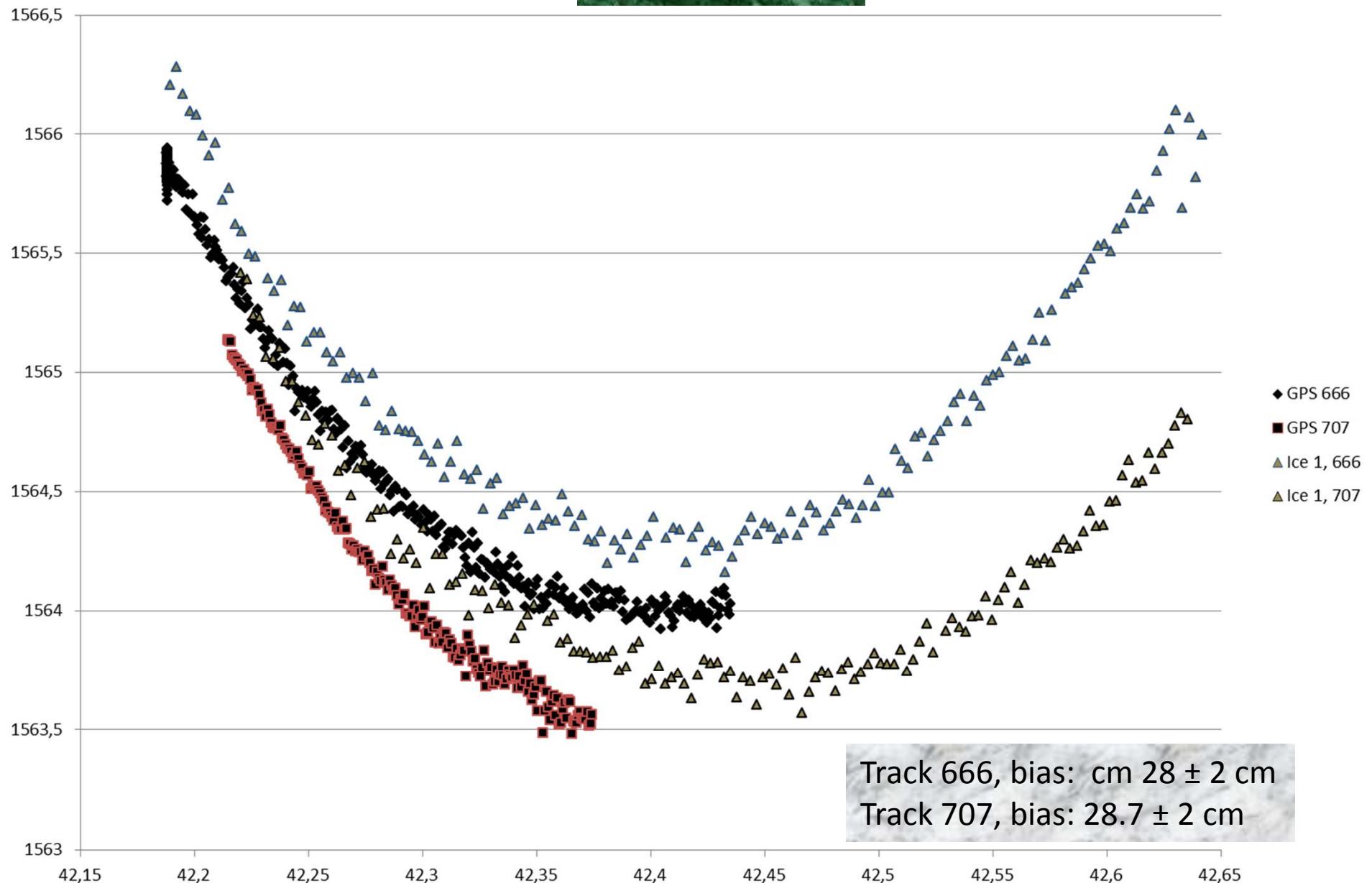
### S3A Absolute biais



## S3A Absolute bias

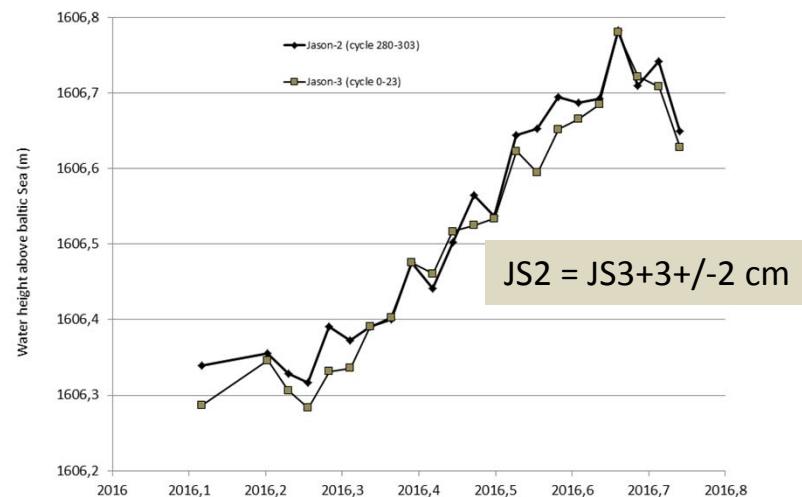


## S3A Absolute bias

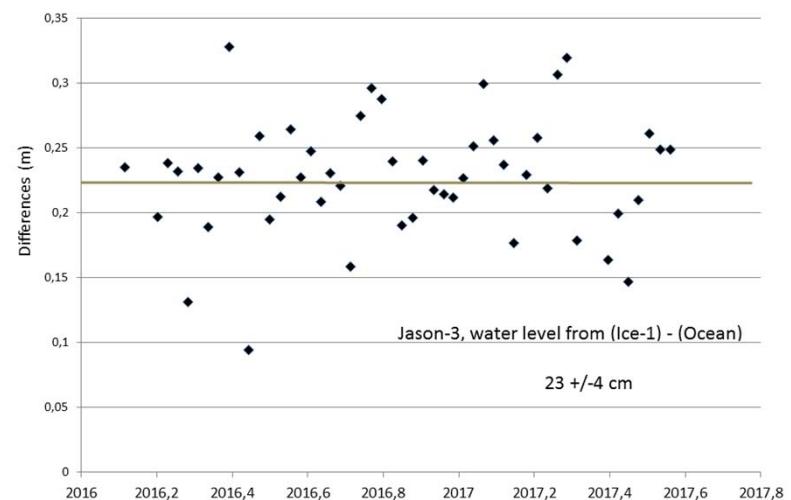


## Jason-3 Absolute and relative biais

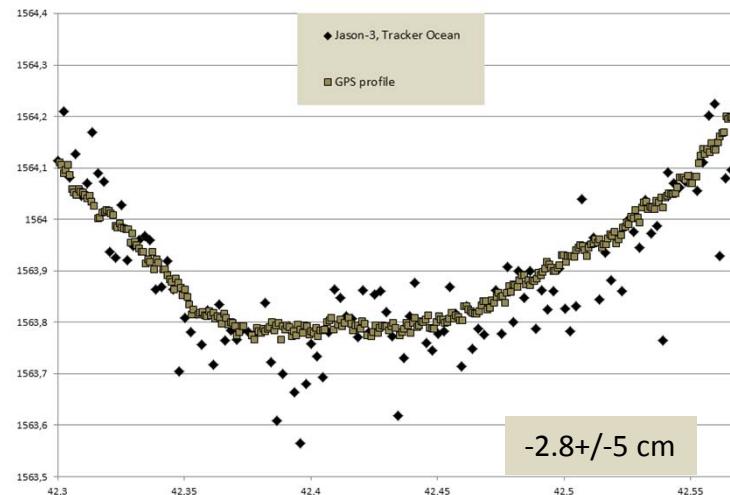
Relative bias Jason-2 / Jason-3 (ocean)



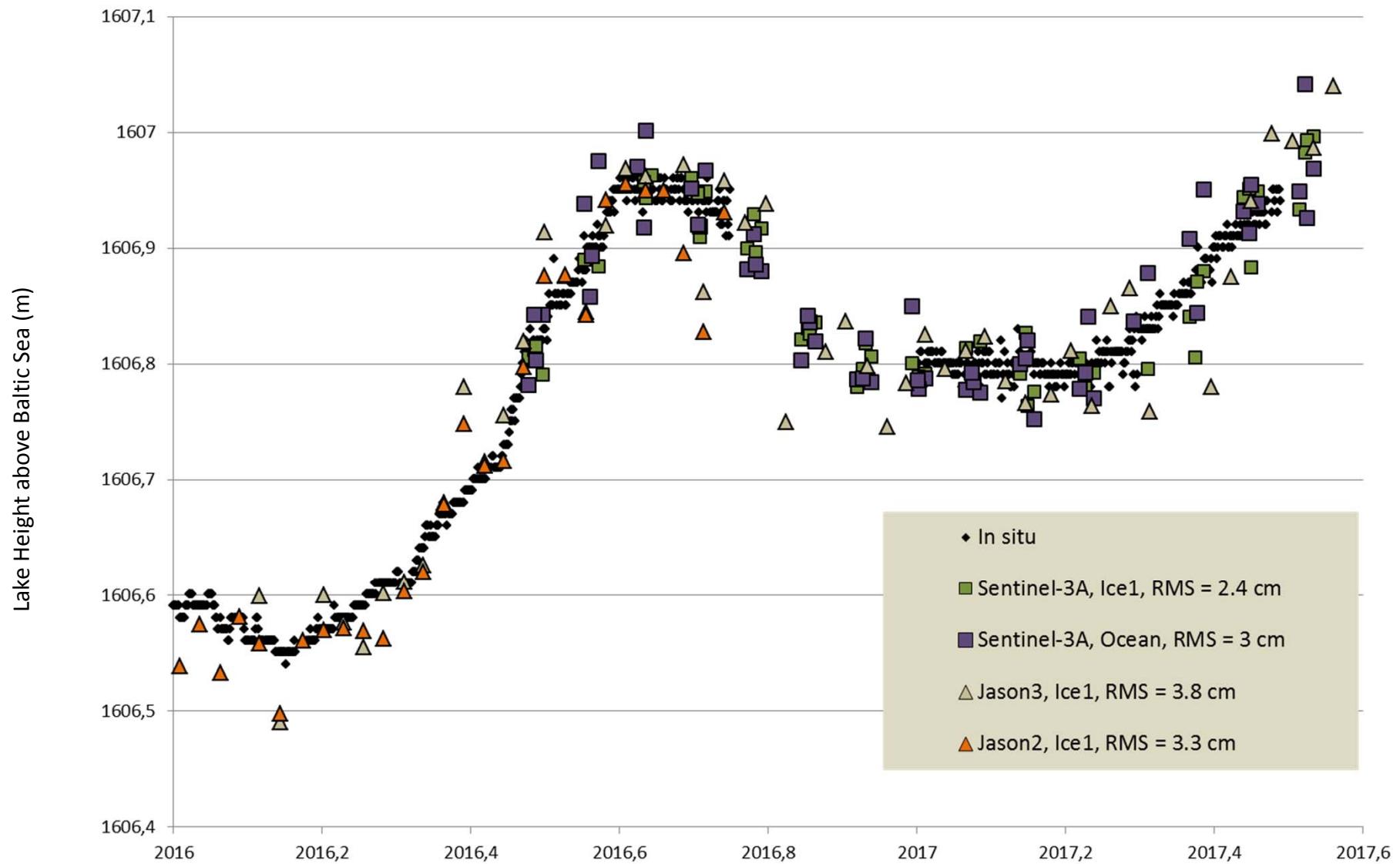
Relative Bias Jason-3 Ocean / ice1



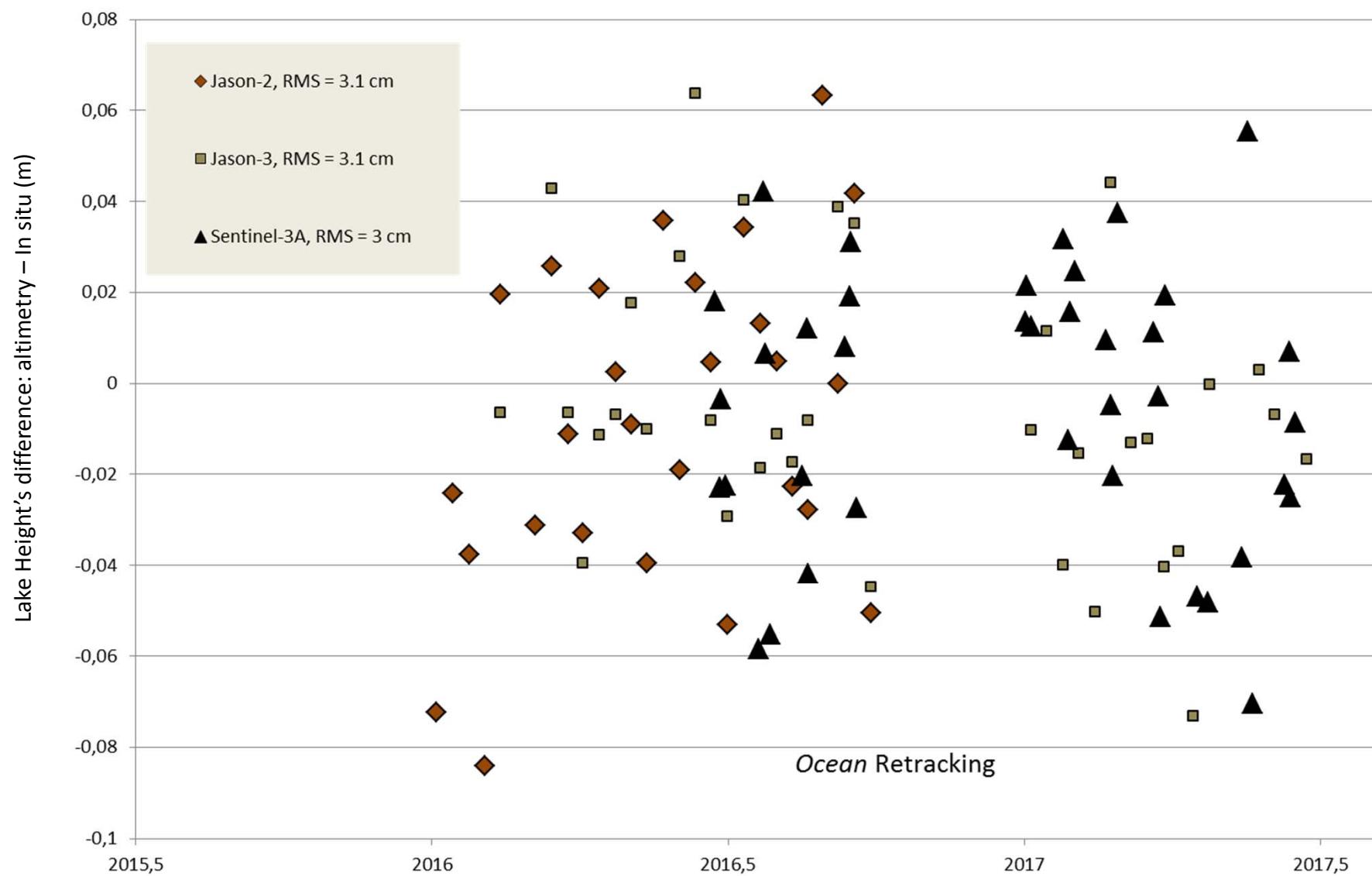
Absolute bias, Jason -3 ocean / GPS

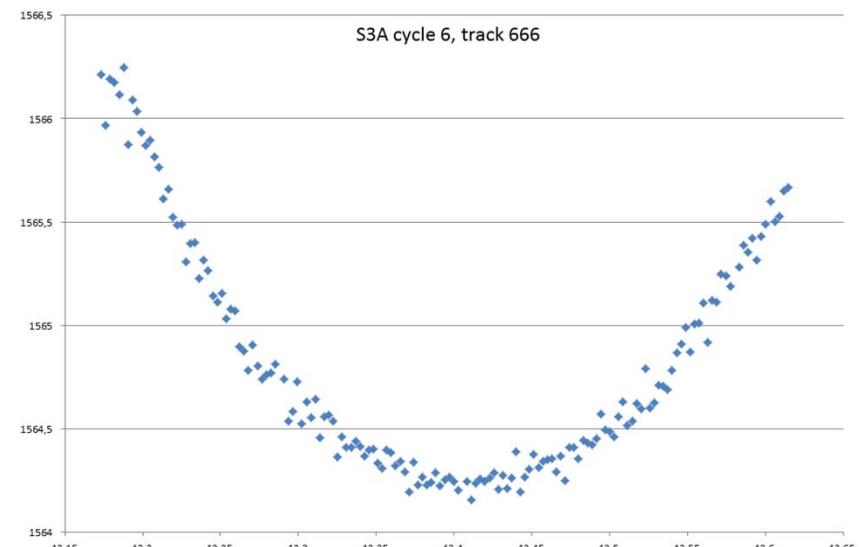
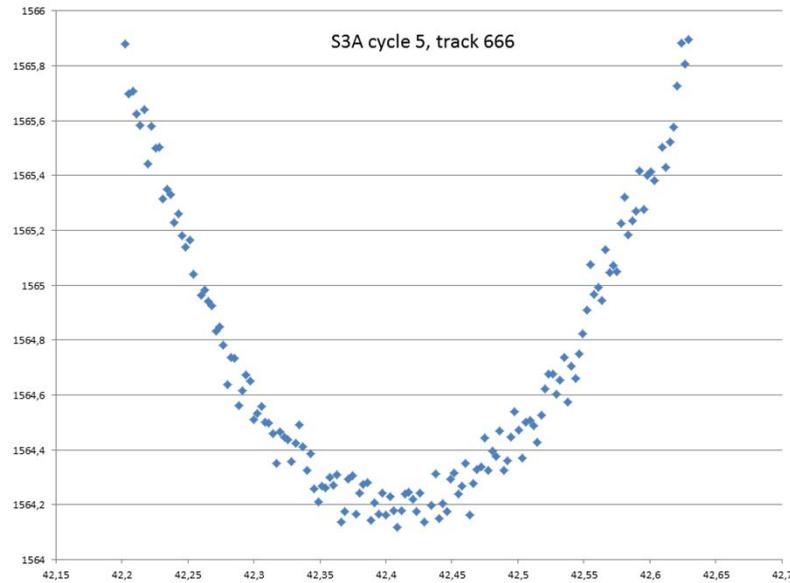


## Accuracy of Jason2, Jason-3 & Sentinel-3A for lake Issykkul (1/2)

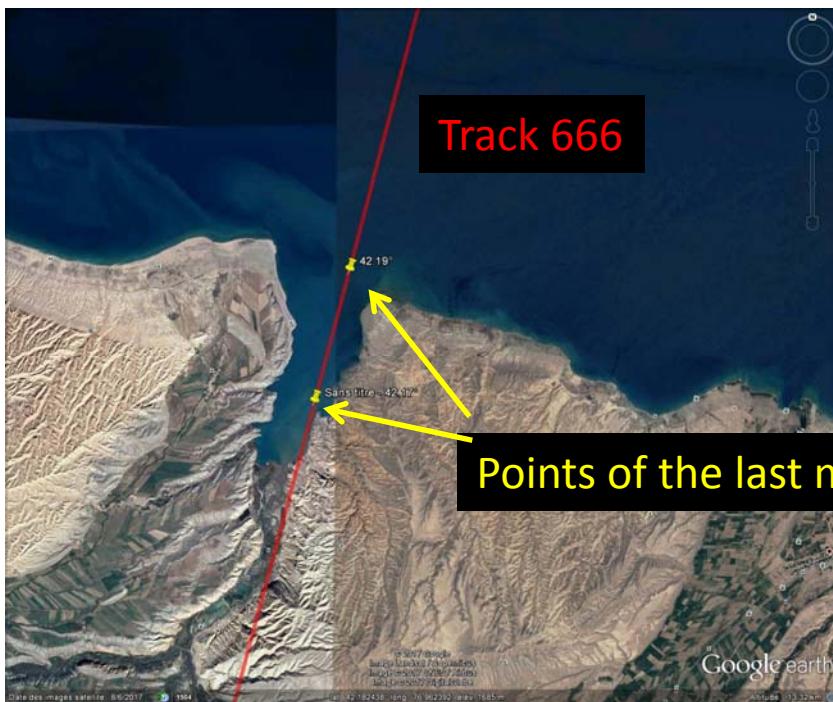


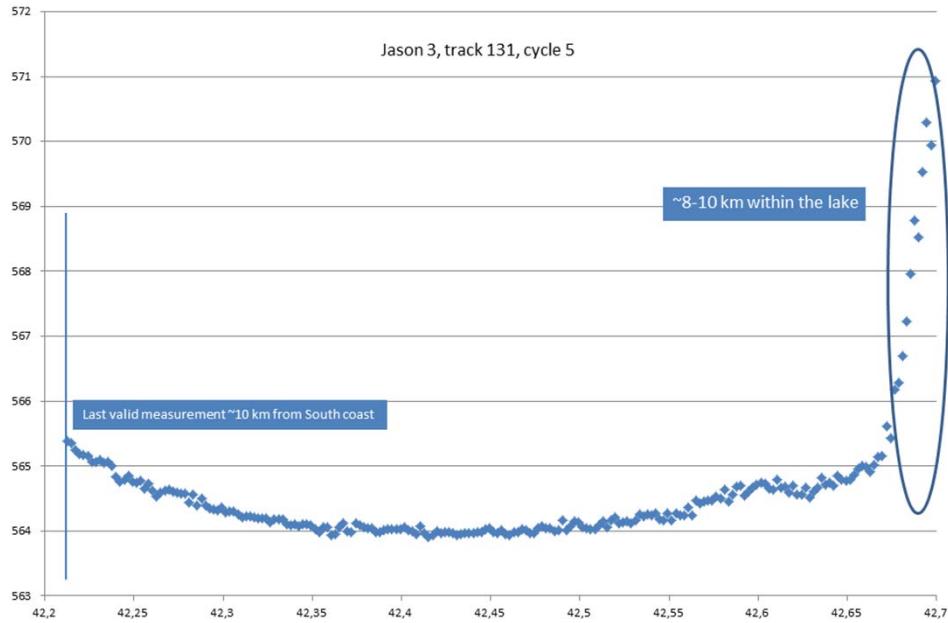
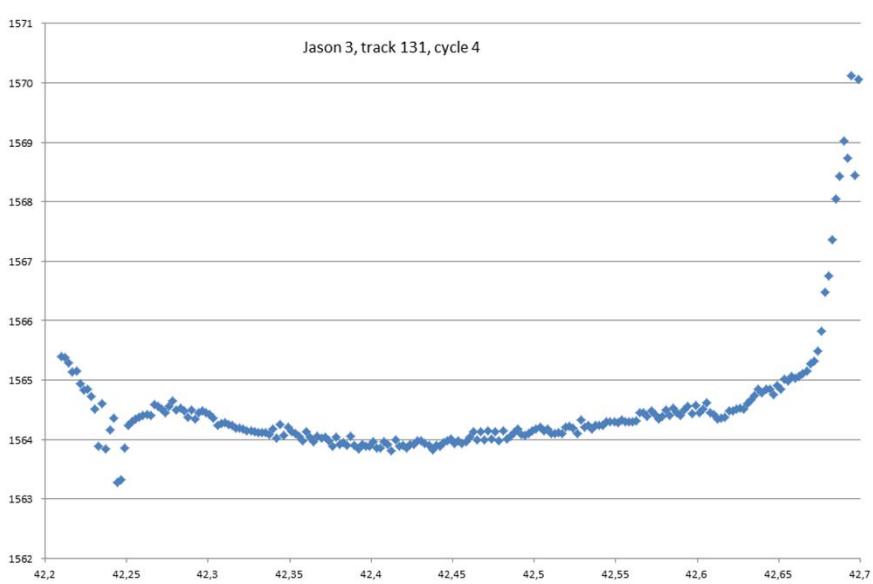
## Accuracy of Jason2, Jason-3 & Sentinel-3A for lake Issykkul (2/2)



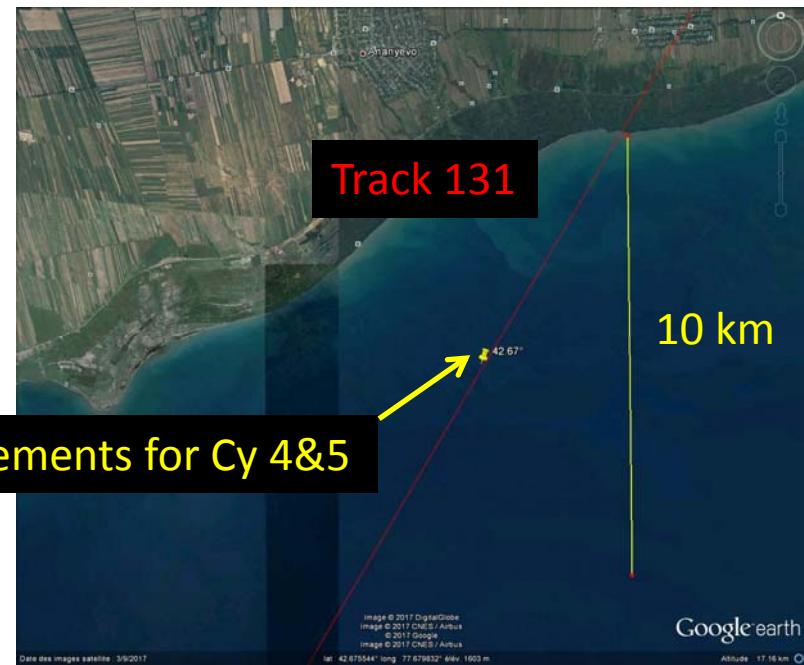
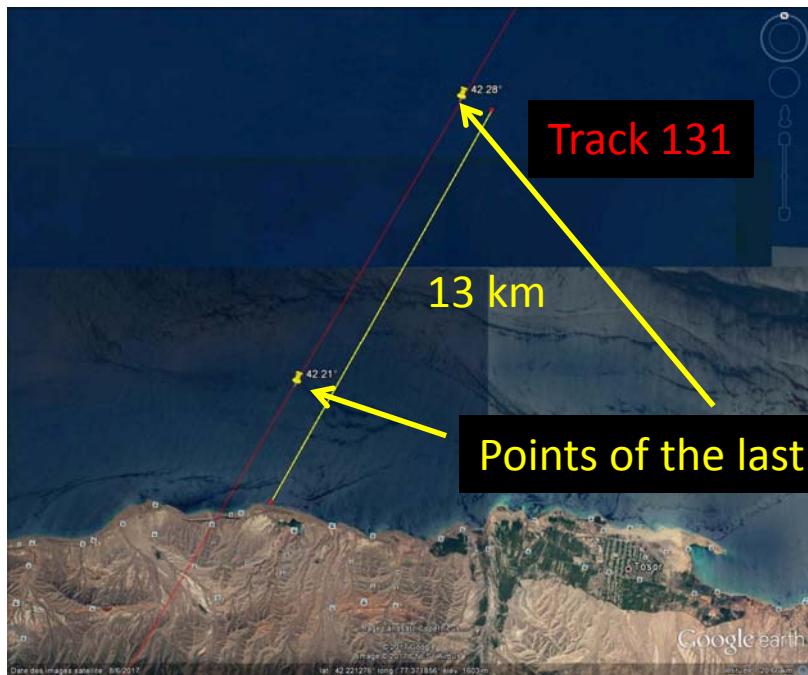


S3A track 66, valid measurements up closer than 1 km from the coast





Jason-3 track 131, valid measurements not closer than 4 up to 13 km from the coast



## Conclusions and perspectives

### Absolute calibration of altimeters:

- ✓ From first experiment in 2004 until the last one in July 2017, the Lake Issykkul became an altimetry C/V site for multi-mission purposes
- ✓ Many solutions have been carried out to mitigate the various sources of errors (Wet and Dry tropospheric correction, antenna height, GPS data processing)
- ✓ 

<b>Sentinel-3A</b> <i>Ocean</i> retracker: <b>-1.4 cm ± 3</b> <i>Ice1</i> retracker offset: <b>28.4 cm ± 2</b>	<b>Jason-3</b> <i>Ocean</i> retracker: <b>-2.8 +/- 4 cm</b> relatively to Jason-2: <b>-3 +/- 2 cm</b>
--	---

### Use of S3A SAR altimetry for lakes:

- ✓ Long term multi-satellite lake monitoring better than **3 cm** accuracy is reachable
- ✓ The radiometer onboard S3A is consistent with model and GPS near the center of the lake
- ✓ The dry tropospheric is at sub centimeter of precision, and wet at the cm with model
- ✓ The SAR instrument allows to measure water height still very close to the coastline (<1 km)

### Future works

- ✓ Use all passes to recompute the bias (using in situ data as level of reference)
- ✓ Installation of communication system for near real time delivery of corrections and biases
- ✓ Perform another field campaign in 2018 with profiling of all S3A&S3B tracks
- ✓ Test new WTC from CLS new developments