

Latest Results for the absolute calibration of Jason and HY-2 using Gavdos/Crete permanent calibration facility

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1. Technical University of Crete, Greece

2. Aristotle University of Thessaloniki, Greece.

3. National Ocean Satellite Applications Service, Beijing, China.

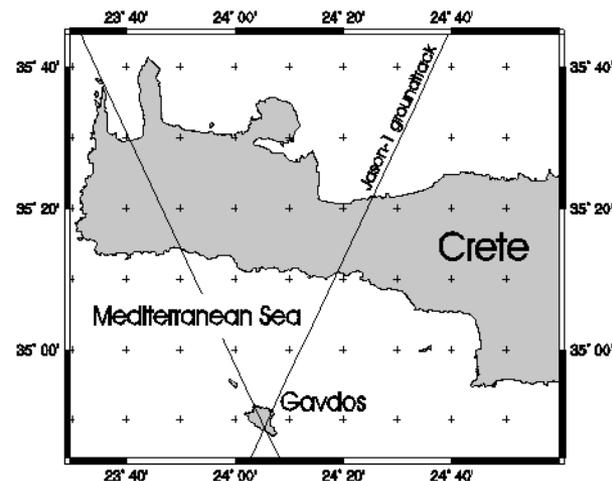
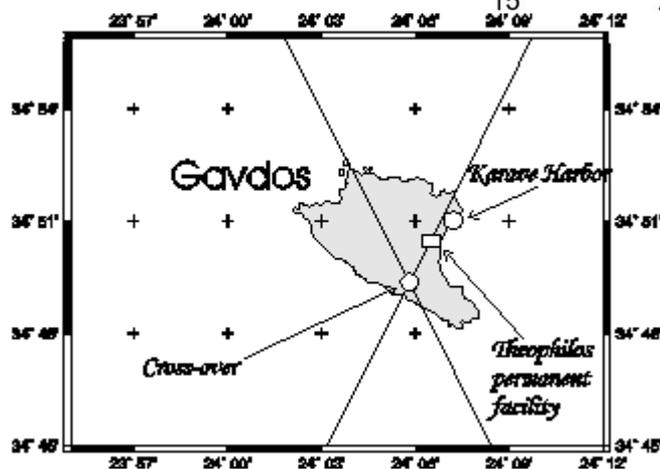
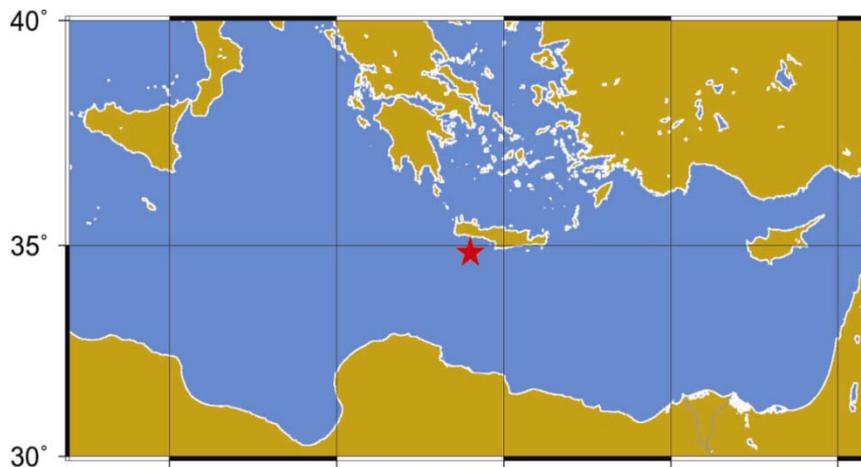
4. First Institute of Oceanography, State Oceanic Administration, QingDao, China.

5. University of Aegean, Greece.

6. Danish Space Centre, Copenhagen, Denmark



Gavdos Permanent Facility



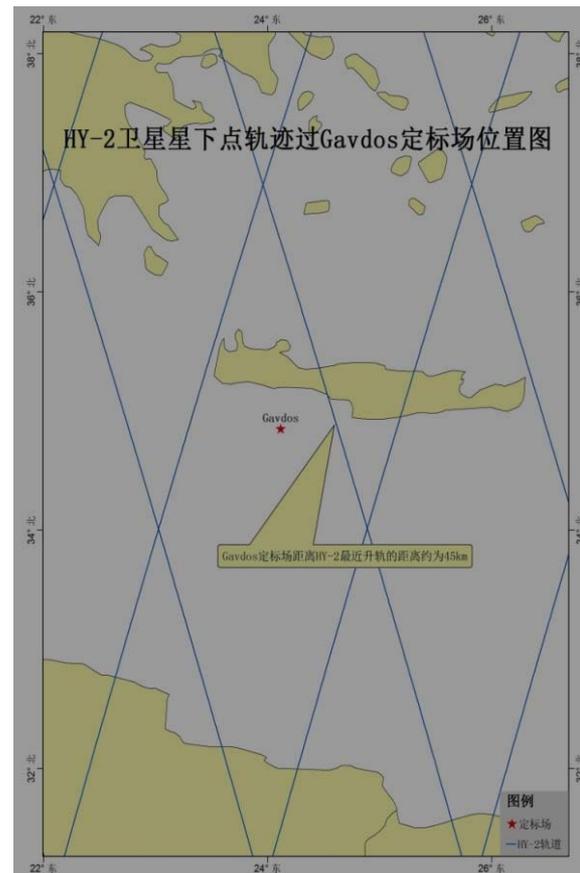
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HY-2 Ground tracks over Crete



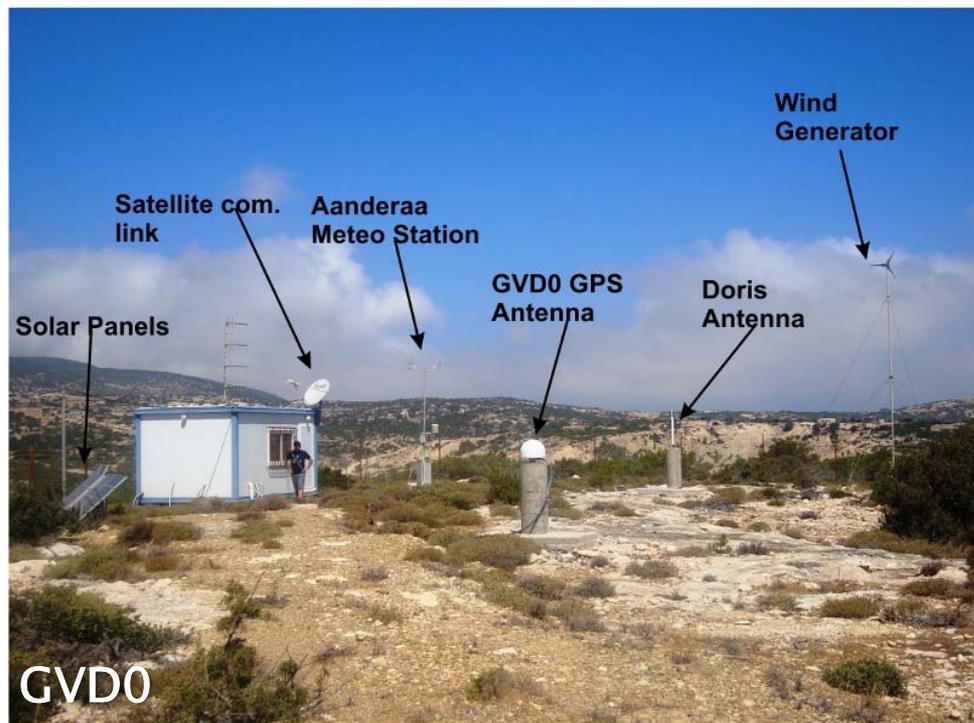
- CRS1 is the Cal/Val site for HY-2
- Only 10 km away from PCA
- South & north track for HY-2 calibration



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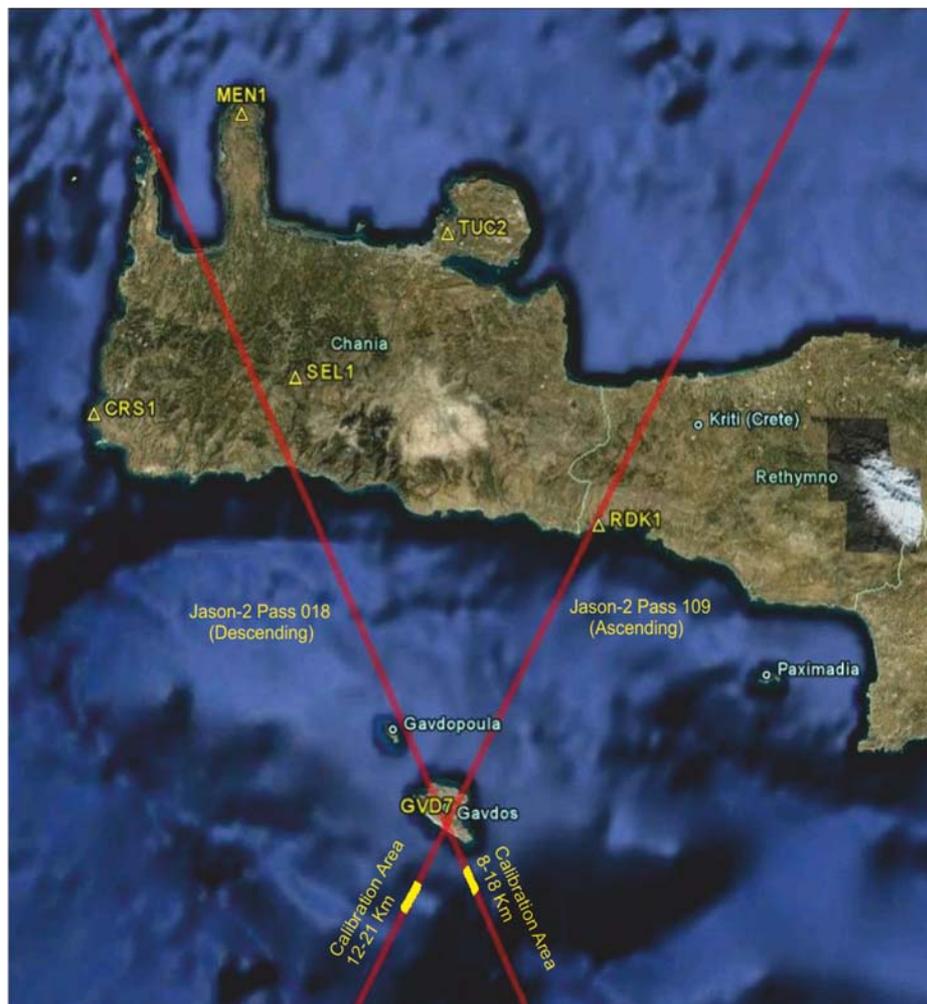
Gavdos and West Crete Facilities



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Jason-2 Calibrating regions

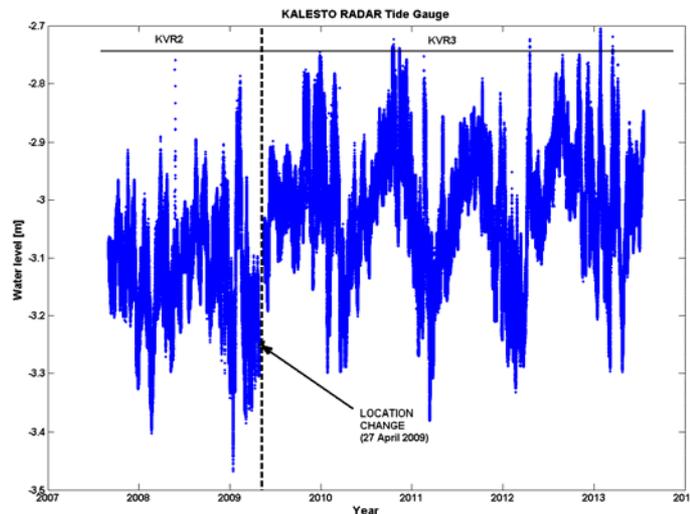


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Estimating sea level at gauges

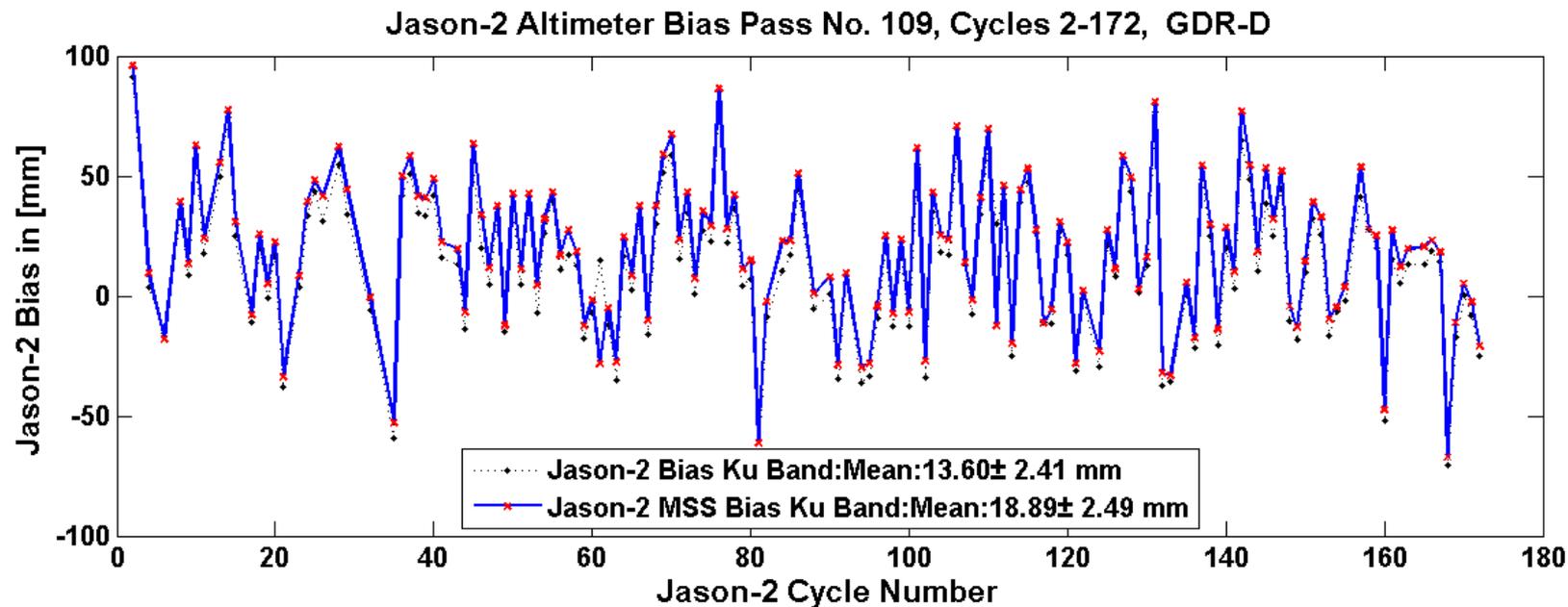
- ▶ Four types of tide gauges, 2 GNSS receivers;
- ▶ Different measuring conditions (well, dock, ..)
- ▶ Robust linear fit using 1-hour data records;
- ▶ Weighted value for estimating sea level.



$$W(t) = a_1 * L_1(t) + \dots + a_4 * L_4(t)$$



Jason-2 bias along pass No.109

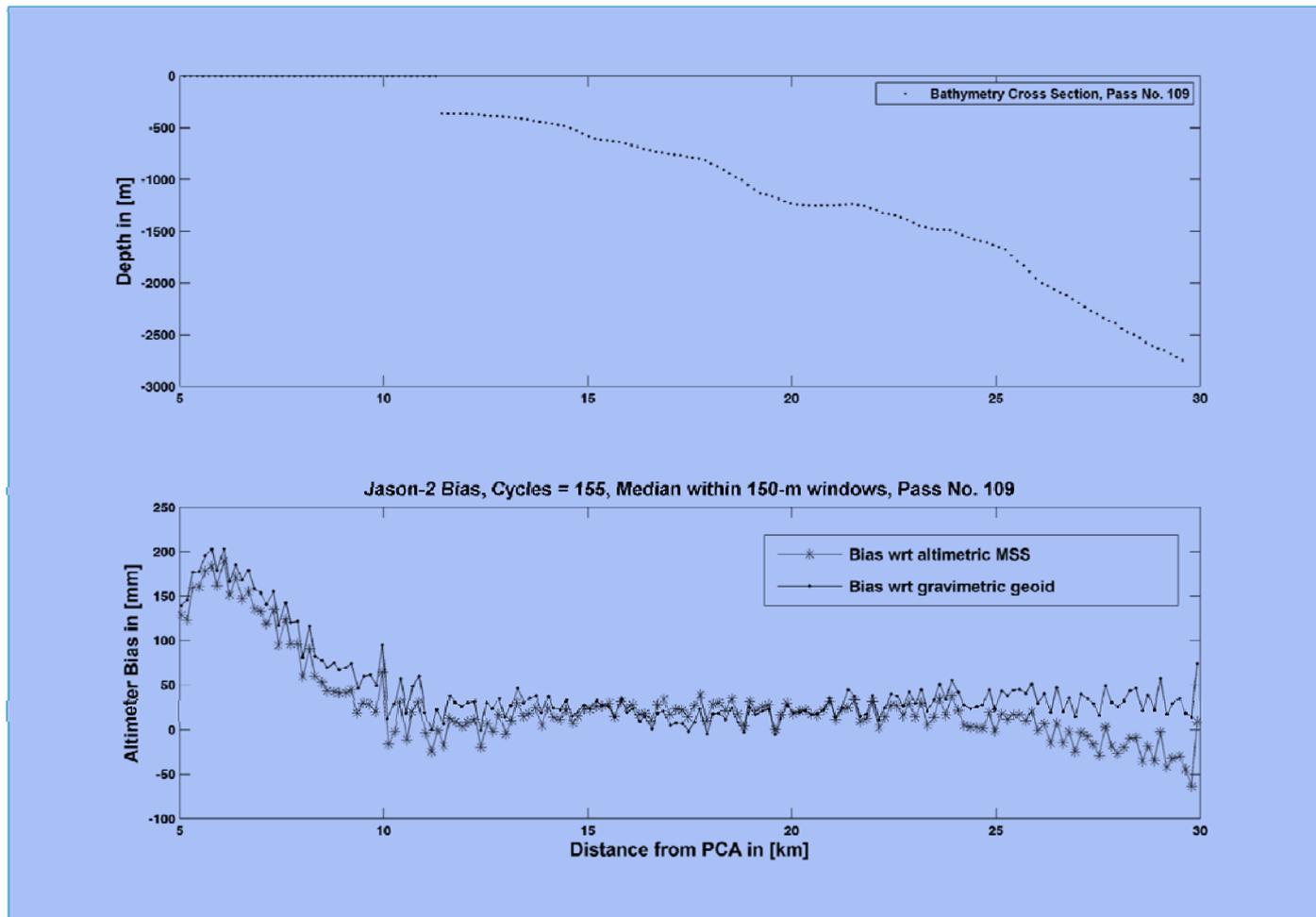


- GDR-D , Cycles:2-172;
- GOCE dynamic topography; Cal region 17.7km-24 km;
- Bias= $13.6 \text{ mm} \pm 2.4 \text{ mm}$, using local geoid model;
- Bias= $18.9 \text{ mm} \pm 2.5 \text{ mm}$, using altimetric MSS reference

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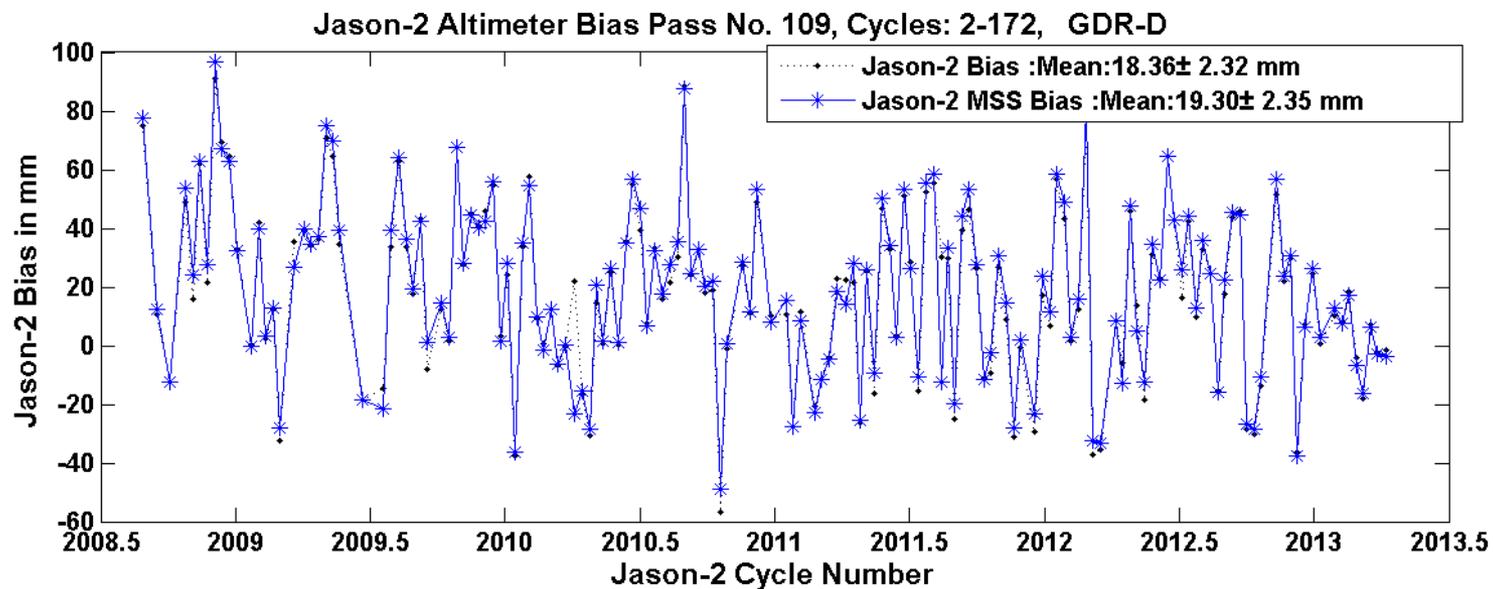
Bias, bathymetry and distance



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Jason-2 bias along pass No.109

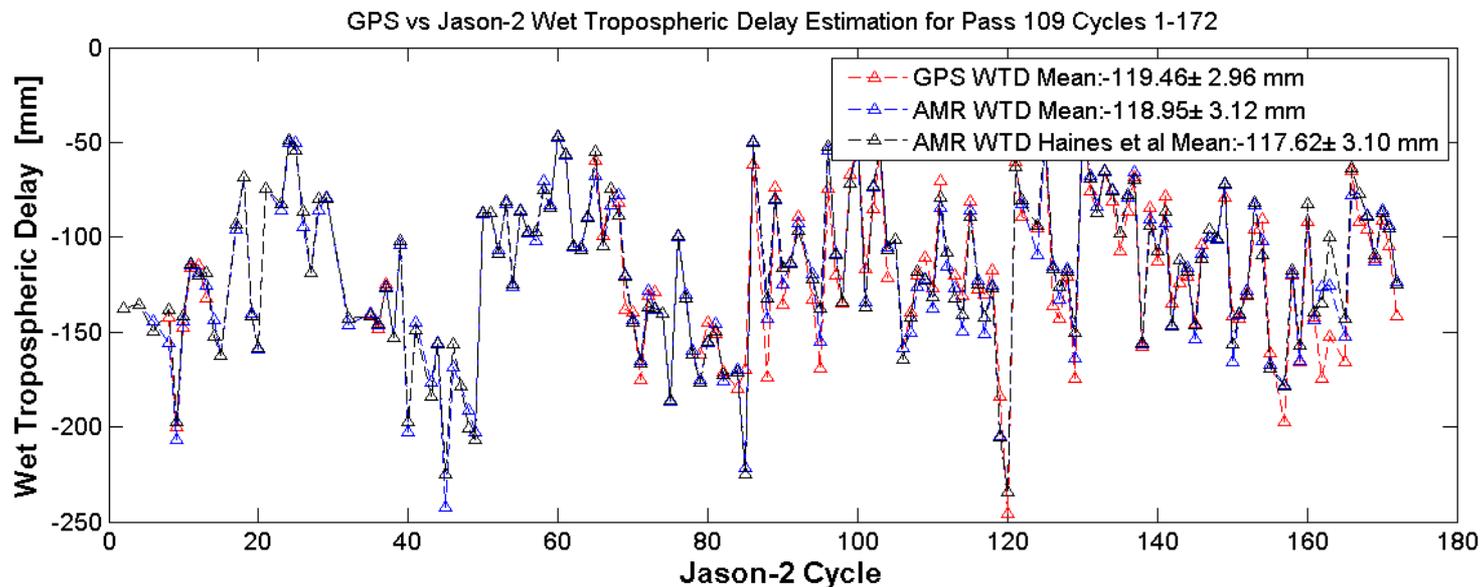


- GDR-D , Cycles:2-172;
- GOCE dynamic topography; Cal region 12.5km-24 km;
- Bias= $18.3 \text{ mm} \pm 2.3 \text{ mm}$, using local geoid model;
- Bias= $19.3 \text{ mm} \pm 2.3 \text{ mm}$, using altimetric MSS reference

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Wet troposphere delays

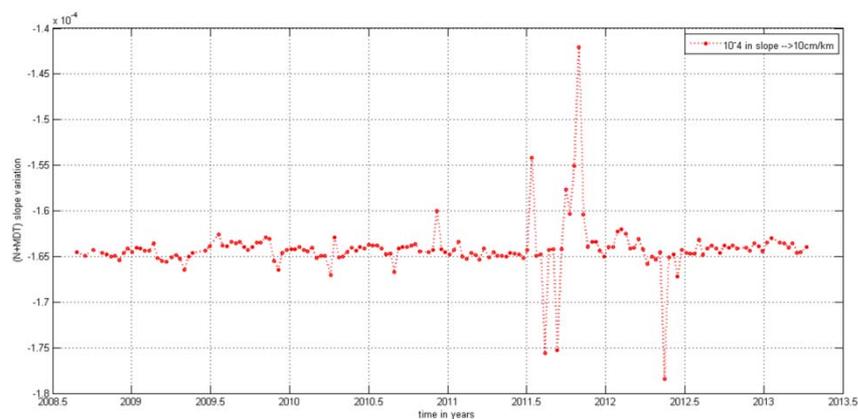
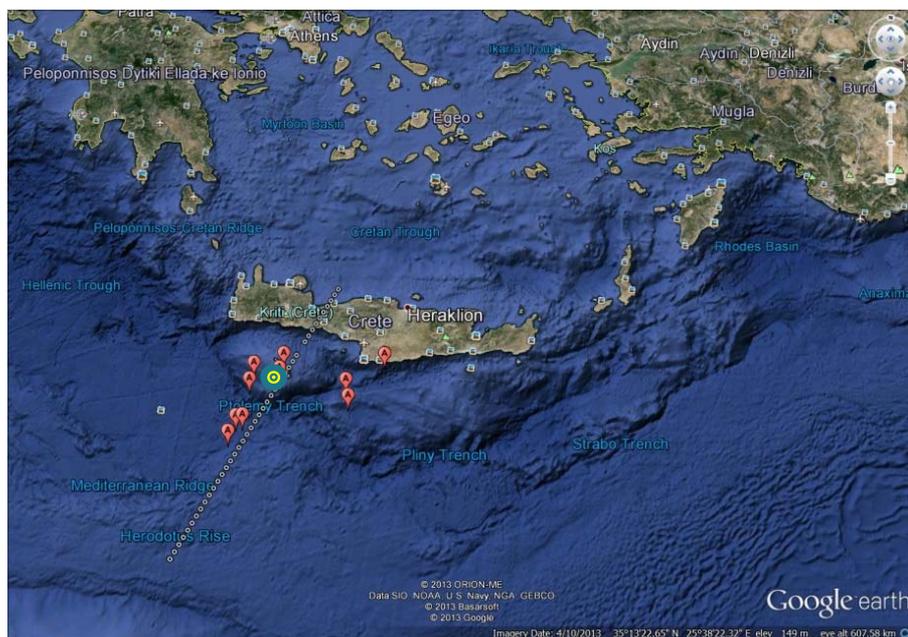


[AMR wet tropo]-[GNSS wet tropo]= $+2\text{mm} \pm 3\text{mm}$;
Cycles=2-172, GAMIT, meteo site data;
GIPSY Processing with GPT model, bias= -11mm .

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Sea level slopes & seismic events



- Locations of earthquake in 2011–2013, Magnitude larger than $M=4$;
- On 27–Sept–2011, $M=4.7$, located close to Jason–2 satellite orbit;
- The large peak on the diagram showing the difference in slopes between SSH and SLA happens on 29–Sept–2011;
- IB have been removed from both SSH and SLA.

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Calibrating HY-2 using CRS1

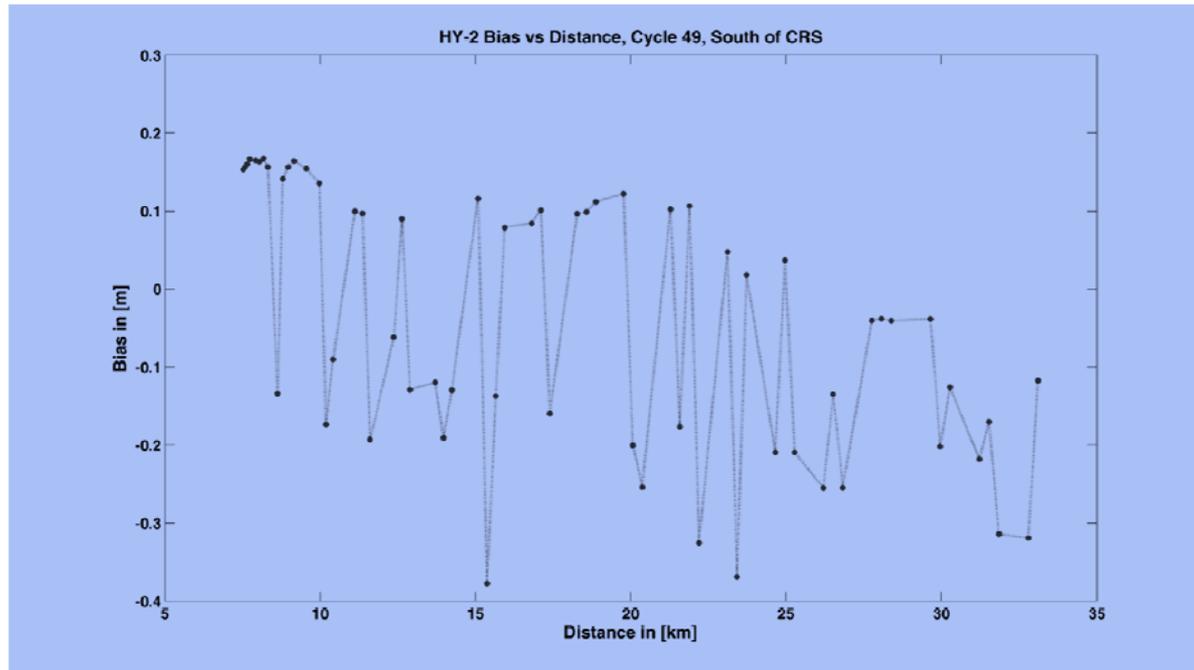


- ▶ I-GDR files: Cycle No. 19–22 (19 June–14 Aug, 2012);
- ▶ Models for ionosphere, dry and wet troposphere, and Sea State Bias.
- ▶ 1-Hz Data , Time-tagging problems, Missing values in orbit.
- ▶ HY-2 Bias = 2.879 m (Preliminary in 2012, Pass No.280)

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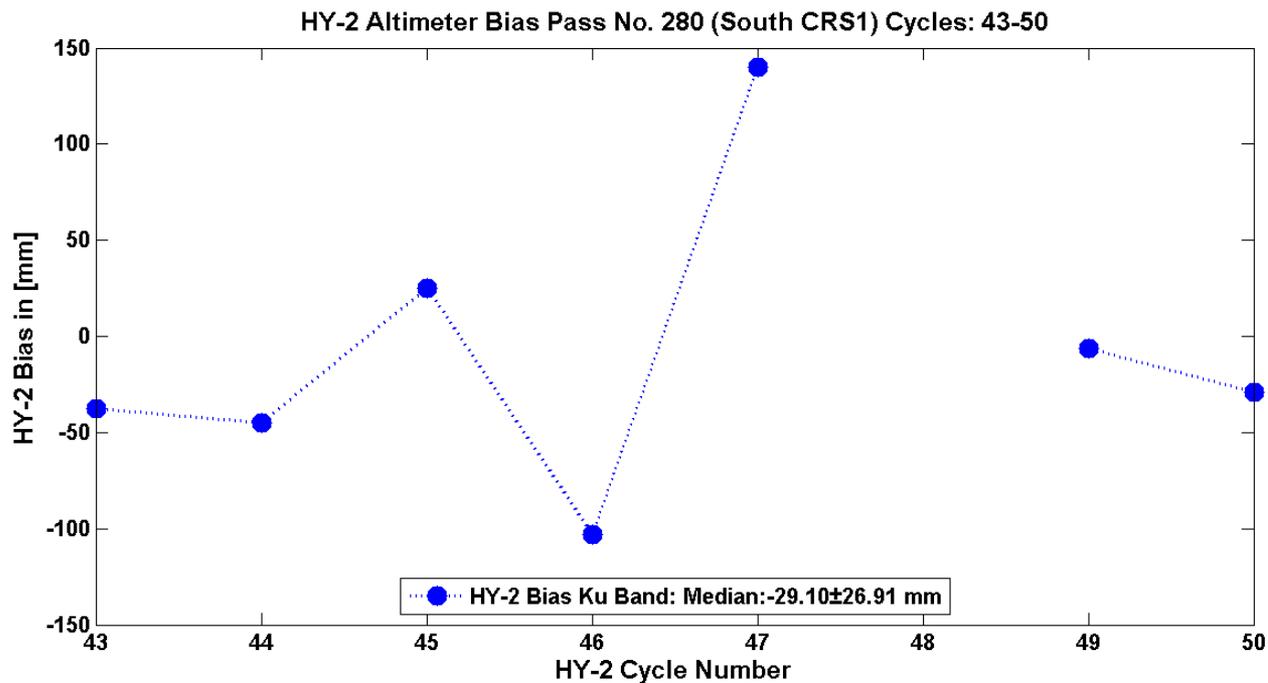
Calibrating HY-2, CRS1, west Crete



Bias values in Cycle=49 as function of distance, South leg.



HY-2 altimeter bias



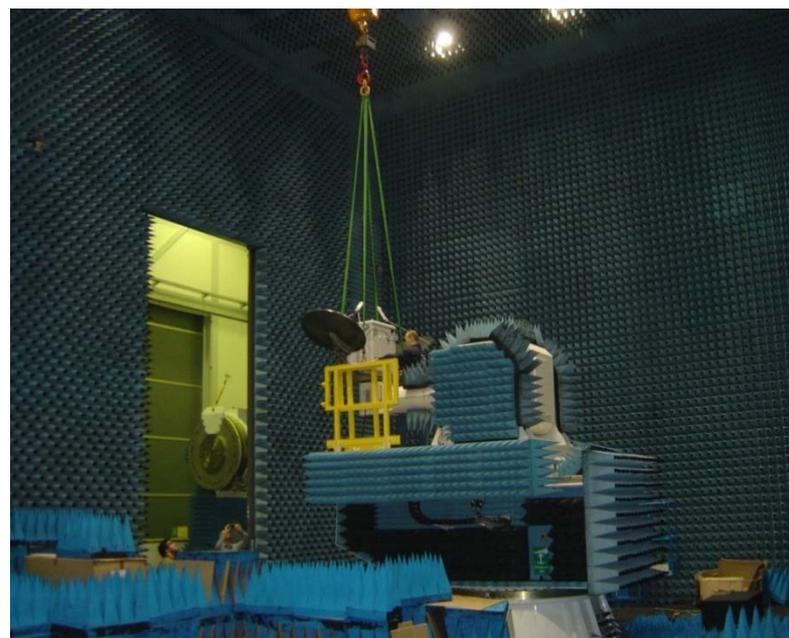
Cycles: 43–50, I–GDR data, 20–Hz, Cycle=48 contains no SSB,
Calibrating regions: 9–16 km (south), 10–18 km (north),
Median bias= -29 mm ± 27 mm, Mean = -1.3 mm ± 40 mm
Wet and dry tropo values from ECMWF model.

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Transponder Status

- ▶ Fully characterized, March–July, 2012 in ESTEC;
- ▶ Transponder is now operational for Cryosat-2.



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Transponder Cal/Val at SLR2



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Transponder reference points for the measurements made for Cryosat-2 calibration, using the SLR2 site in Crete, Greece, on 10-May-2013 20:21:40 UTC.



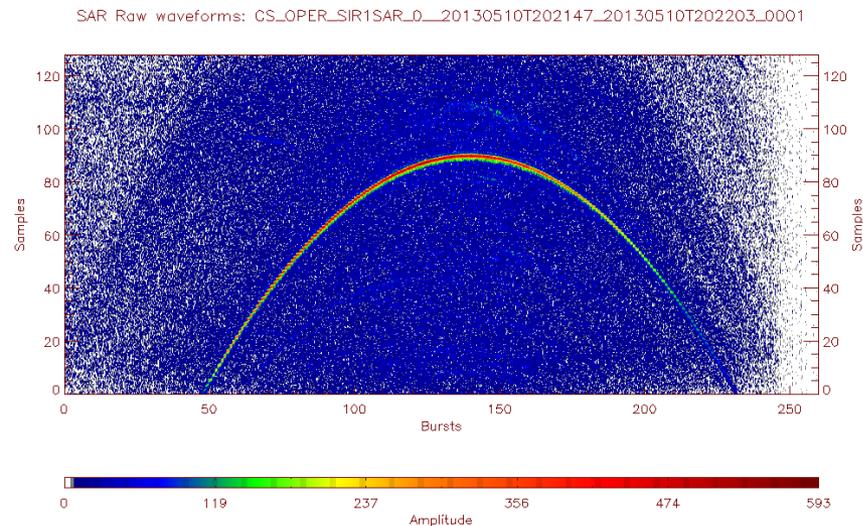
Crysoat-2 calibration successful

Site: SLR2 in North West Crete

Time: 10-May-2013, 20 21 47 UTC

Lat=N 35 32 ' 05.05 ' ' , Long= E24 04 ' 03.6962386 ' ' ,

Ellipsoid Height= 156.275 m



Marco Fornari - Sat May 11 09:05:19 2013

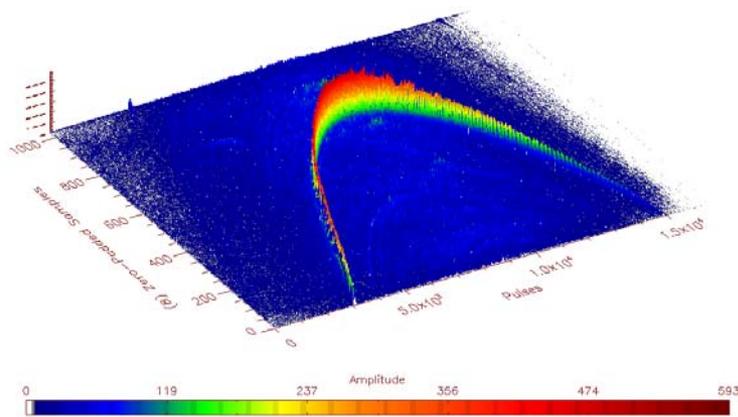
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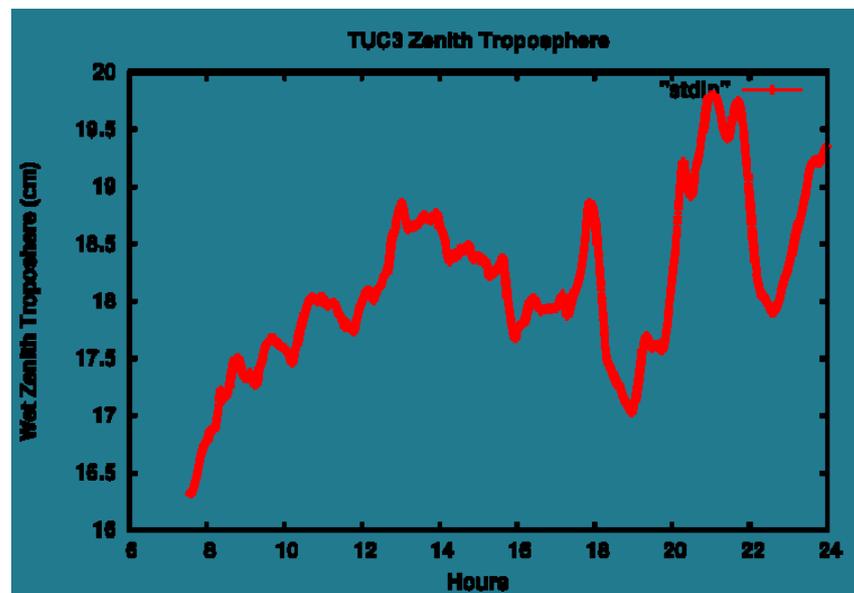
Cryosat-2 transponder Cal/Val

- ▶ Cryosat-2 bias: $B = 0.638\text{m}$ (from FBR data)
- ▶ Time: 10-May-2013, 20 21 47 UTC
- ▶ Cryosat-2 calibrations are on-going.

SAR Raw waveforms: CS_OPER_SIR1SAR_D_20130510T202147_20130510T202203_0001



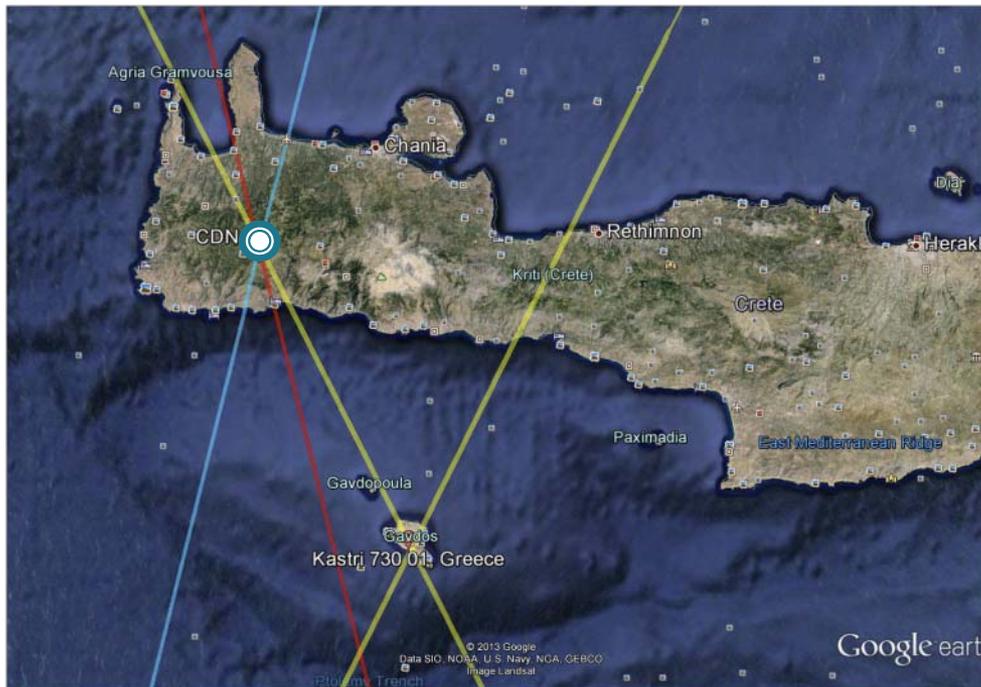
Marco Ferreri - Sat May 11 09:13:14 2013



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Transponder CDN2site, West Crete



Jason-2 mission will be used to perform a calibration of the surrounding terrain at the new location.

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Conclusions

- ▶ Jason-2 altimeter bias (GDR-D, Cycle=2-172, within 12.5-24 km south of Gavdos):
 - $B = +18.3 \text{ mm} \pm 2.4 \text{ mm}$, (geoid reference);
 - $B = +19.3 \text{ mm} \pm 2.3 \text{ mm}$ (MSS reference);
- ▶ AMR Wet Troposphere against GNSS:
 - Pass No. 109 : $+2 \text{ mm} \pm 3 \text{ mm}$.
- ▶ Calibration of HY-2, I-GDR, 20-Hz:
 - $B = -29 \text{ mm} \pm 27 \text{ mm}$ (median); $= -1.3 \text{ mm} \pm 40 \text{ mm}$
- ▶ Transponder operates now for Cryosat-2;
- ▶ Permanent ESA transponder calibration site at CDN2 in 2014 for Sentinel-3 and Jason missions.



Acknowledgements

- ▶ Help and support provided by:
 - ESTEC/ESA,
 - Sentinel-3 science team (Mavrocordatos, Donlon),
 - Cryosat-2: (Parrinello, Fornari),