Absolute calibration of Jason-2 and Saral during the 2013 Ibiza calibration campaign

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Aim
precise calibration of Jason2 and Saral altimeters with the help of 5 GNSS buoys

Experiment coordinator
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Participating teams
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- ROA: J.M. Davila, J. Garate
- GRGS/CNES/OMP: R. Biancale, F. Frappart, N. Roussel
- Puertos del Estado: B. Perez (Ibiza tide gauge & GPS)

Ship
Patrol ship Toralla of the Spanish Navy

Calibration location
Jason2-Saral crossover point North of Ibiza (Spain)
Latitude : 39° 35.74'
Longitude : 1° 42.69'
Jason2 crossing time : 7h 37mn 45s UTC
Saral crossing time : 5h 28mn 49s UTC

Buoys deployment
4 buoys displayed along track and cross track at 1 nautical mile interval around the crossover point + one buoy at that point in order to get position and sea slope

Experiment duration
4 hrs at each deployment site over 3 days

Experiment phases
14 September, 11am-4pm : pre-calibration of the 5 buoys with the Ibiza tide gauge to reference the GPS antennas to the sea level
15 September, 6am-10am : GPS buoy positioning at the crossover point
16 September, 5am-9am : GPS buoy positioning at the crossover point
4pm-8pm : post-calibration of UPC buoys with the Ibiza tide gauge

Oceanic current forecasting
daily current maps from Mercator Ocean

The 2013 Ibiza calibration campaign of Jason2 and Saral altimeters was initiated at Prof. J.J. Benjamin's instigation (UPC) with the fruitful participation of the "Real Observatorio de la Armada" (ROA) of the Spanish Navy who places a 28m long military ship at disposal: the patrol vessel Toralla.
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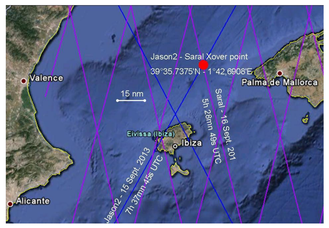
Particular thanks are addressed to LEGOS and IPGP for having made GPS buoys available, to CTOH-LEGOS for providing the Saral and Jason-2's GDRs to the CLS company for having lent localization instruments (Argos buoys and goniometer) as well as to Mercator Ocean for the diurnal delivery of current maps.

Absolute calibration

The absolute altimeter bias ($Bias_{altimeter}$) is estimated as follows (Bonnefond et al., 2013): $Bias_{altimeter} = SSH_{altimeter} - SSH_{in\,situ}$
where $SSH_{altimeter}$ and $SSH_{in\,situ}$ are the *SSH* estimated from altimeter and *in situ* measurements respectively, with SSH from altimeter given by Chelton et al. (2001):

$$SSH_{altimeter} = h - \left(R + \sum \Delta R_{geophysical} + \sum \Delta R_{environmental}\right)$$ with $$\sum \Delta R_{geophysical} = \Delta R_{ion} + \Delta R_{dry} + \Delta R_{wet} + \Delta R_{SSB}$$ and $$\sum \Delta R_{environmental} = \Delta R_{ocean} + \Delta R_{solid\,Earth} + \Delta R_{pole} + \Delta R_{atm}$$

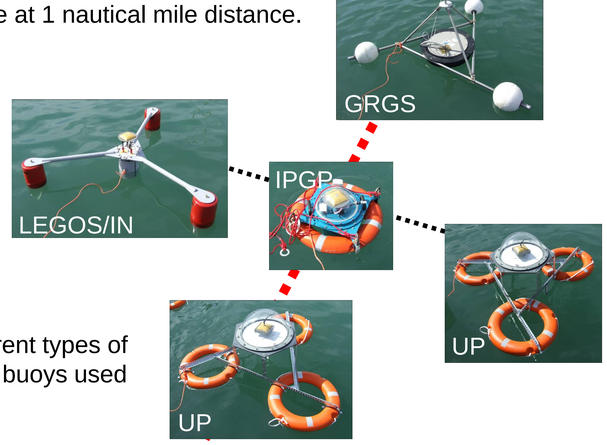
Jason2 and Saral altimeters were cross calibrated at the mixed crossover point North of Ibiza respectively on 15 and 16 September at their ascending passes



The GNSS buoy antennas were first referenced to the sea level at the Ibiza tide gauge

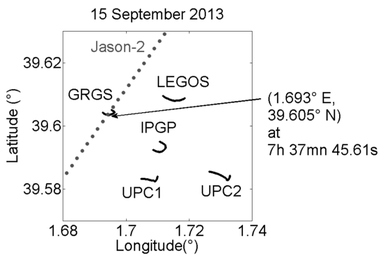
Patrol vessel Toralla

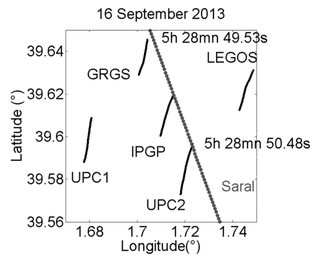
The buoys were located on the track and crosswise at 1 nautical mile distance.



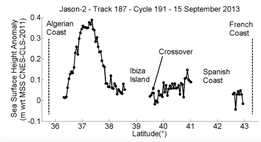
Different types of GPS buoys used

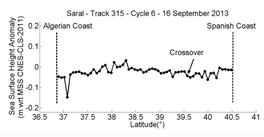
Maps of buoy displacement during 4 hrs





Validity of altimetry-based SSH: Comparison to Mean Sea Surface (MSS)





Differences generally lower < 20 cm

OK for this area

Processing
1. pre-campaign Jason2 and Saral orbit prediction with the GINS/GRGS software fitting SLR data from previous days
2. post-campaign GPS buoy processing with the GINS/GRGS software both in IPPP mode and in semi-dynamical mode and the NRCAN
3. Jason2 and Saral orbit processing with the GINS/GRGS software in semi-dynamical mode fitting GPS/DORIS/SLR tracking data and from GDRs (http://ctoh.legos.obs-mip.fr)

Results
1) calibration of the 5 buoy antennas with respect to the sea level from GNSS and tide gauge data:

2) computation and smoothing of the buoy position from GPS data at the Jason2-Saral crossover calibration site (by interpolation) and at the Jason2-Saral pass times.

3) comparison with the Jason2/Saral altimeter data

Altimeter (Retracking)	Absolute bias = $SSH_{altimeter}$ - SSH_{GNSS} (m) GINS	GIPSY-OASIS	CSRS-PPP
Jason-2 (MLE4)	0.008	-0.009	-0.002
Jason-2 (MLE3)	-0.008	-0.025	-0.018
Saral (MLE4)	(-0.018 ± 0.023)	(-0.047 ± 0.025)	(-0.029 ± 0.022)