The Baleares 2013 Calibration Campaign of Jason-2 and Saral Altimeters

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

Experiment coordinator
J.J. Benjamin Martinez / Universitat Politècnica de Catalunya (UPC)

Participating teams
- UPC: C. Gracia, R. Lopez, A. Tapia, I. Valles, J. Gili
- 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 and phases
4 hrs at each deployment site over 3 days
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.
This research has been funded under the Spanish National R+D+i (ref: CGL2009-13435/CLI).
Particular thanks are addressed to LEGOS and IPGP for having made GPS buoys available, 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

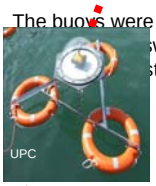
The absolute altimeter bias ($Bias_{altimeter}$) is estimated as follows (Bonnefond et al., 2011):

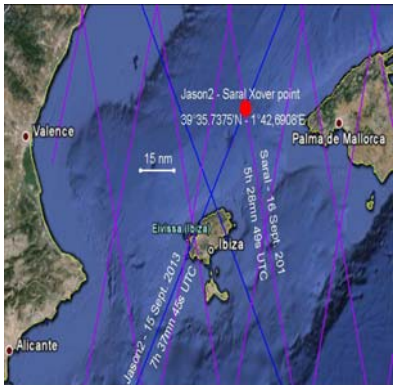
where $SSH_{altimeter}$ and $SSH_{in\ situ}$ are the SSH estimated $in\ situ$ measurements respectively, with SSH from altimeter given by Chelton et al. (2001):

Patrol vessel Toralla Spanish Navy

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

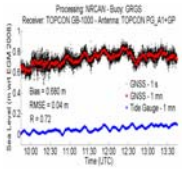
The buoys were located [illegible]swise at [illegible]stance.



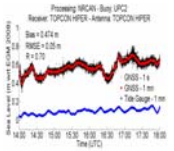


Processing
1. pre-campaign Jason2 and Saral orbit prediction with the GINS/GRGS software fitting SLR data from previous days
2. post-campaign GPS buoy processing with the GINS/GRGS software both in IPPP mode and in semi-dynamical mode and the NRCAN
3. Jason2 and Saral orbit processing with the GINS/GRGS 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 GPS and tide gauge data:
buoy GRGS: 68.4 cm
buoy LEGOS: 35.8 cm
buoy IPGP: 15.3 cm
buoy UPC1: 48.6 cm
buoy UPC2: 47.4 cm



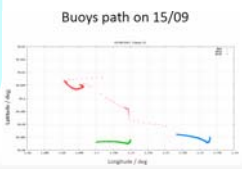
2) computation and smoothing of the buoy position from GPS data at the Jason2-Saral crossover calibration site (by interpolation) and at the Jason2-Saral pass times.

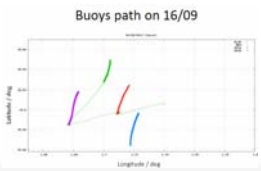


3) comparison with the Jason2/Saral altimeter data
$Bias_{Saral}$ = 0.5 cm using NRCAN SSH estimates
$Bias_{Jason-2}$ to be computed

UPC Processing

The 2013 Balearic campaign GNSS position analysis of the 2013 will be performed with different softwares by different groups (similarly as it is being done in the International GNSS Service for their different products), in order improve the high demanded accuracy for JASON2 and SARAL altimeters precise calibration. In particular JPL GIPSY-OASIS software will be used, with the undifferenced PPP ambiguity fixing strategy. In order to improve the results accuracy, two similar networks are being processed. The first network includes the deployed GNSS receivers and the reference stations. The second one is a control network, defined by using the permanent receivers in the California dense network with a similar distribution as the main altimeter campaign network. In this case, the position of the receivers plying the role of buoys are being processed in the same kinematic way than the actual buoys, in order to compare them with the very accurate positions obtained with GIPSY-OASIS static processing.





Summary of Work Performed

- A network of 10 reference stations was processed as static and as kinematic.
- We processed all the buoys for the first calibration day.
- For the 15th we've processed successfully UPCA, UPCB and MER.
- For the 16th we've processed successfully BLOP, MER For the 16th we've processed successfully BLOP, MER, UPCA and UPCB
- For the second calibration day, we processed the UPC buoys successfully

Conclusions

- The assessment of the kinematic processing of a permanent receiver, with a similar geometry of satellites in view and similar sets of precise orbits, clocks and undifferenced fractional part of carrier phase ambiguities, shows actual errors typically below 3 cm, with peaks up to 7 cm.
- The processing of the buoys, taking into account the Lc residuals and position formal errors, is compatible with an accuracy not far from the previous assessment, at least for some of the buoys (like "MER").
- However the first results with other buoys (like UPCA) present some initial problems, which could be related with periods of lack of useful satellites (to be confirmed).