

# CONTRIBUTION OF IBIZA, ESTARTIT AND BARCELONA HARBOUR SITES FOR ALTIMETER CALIBRATIONS

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## Abstract

The first campaign was dedicated to the Alt-B TOPEX altimeter bias determination in March 1999 at Cape of Begur, NW Mediterranean.

A Balears in situ bias estimation calibration campaign with Spanish-French cooperation was made on September 2013 for the altimeters of Jason-2 and Saral/AltiKa in the Ibiza island area. A similar Spanish/French experience with Jason-1 was made in June 2003 in this geographical area under IBIZA 2003 campaign. Finally, an airborne Lidar campaign was carried out in July 2014, with two strips along two laser ICESat target tracks, one along Barcelona harbour.

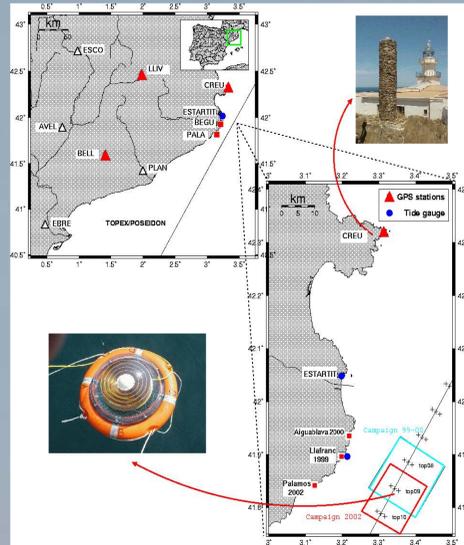
A direct comparison between ICESat and LIDAR DTM results is outlined. The main objective is the integration of spaceborne, airborne and in-situ data for the establishment of calibration of radar and laser space missions in this local area of the western Mediterranean.

These activities were funding under Spanish National Project CGL2009-13435/CLI. Special thanks to the Spanish Navy and the ROA/San Fernando for the Ibiza marine campaigns.

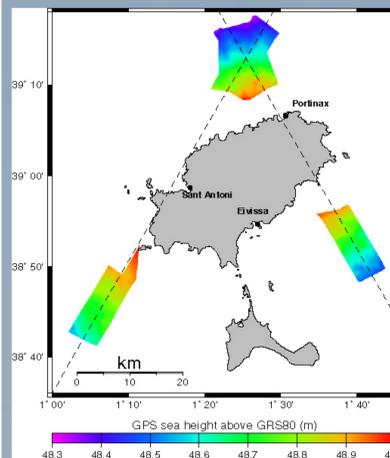
## 1. Cape of Begur calibration site

Marine campaigns at Cape of Begur area for TOPEX Alt-B determination

The analysis have been made using the Altimeter products, MGDR Topex Alt B in 1999 and 2000, and I-GDR Jason-1 in 2002. Table 2: SSHBIAS estimation by single point experiments over point TOP-08 for TOPEX-B and over point TOP-11 for Jason-1 radar instruments. The two values in 1999 corresponds to both similar GPS buoys used simultaneously at that campaign (UPCB and JPLB buoys, respectively). Overflight SSHGPS SSHalt SHHBIAS (UTC time) (m) (cm) 49.12 ± 0.319 49.05 ± 0.04 6.50 ± 32.10 18/03- 08:45:41 T/P 239, 1999 49.09 ± 0.323 49.05 ± 0.04 3.70 ± 32.60 07/07- 07:34:47 T/P 287, 2000 49.24 ± 0.074 49.21 ± 0.04 3.43 ± 7.96 28/08- 15:37:07 J23, 2002 49.29 ± 0.061 49.18 ± 0.08 10.52 ± 10.3 SSHBIAS estimation by single point experiments over point TOP-08 for TOPEX-B and over point TOP-11 for Jason-1 radar instruments. The two values in 1999 corresponds to both similar GPS buoys used simultaneously at that campaign (UPCB and JPLB buoys, respectively).



## 2. IBIZA Altimeter Calibration Campaigns 2003 and 2013



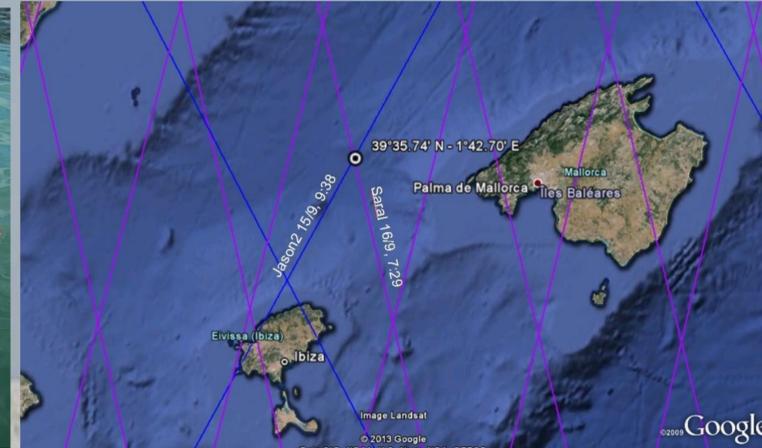
GPS Catamaran MSS determination



Site	GDR-A (mm)	GDR-B (mm)	# of cycles	Reference
Harvest*	+141.8 ±6.3	+97.4 ±7.4	108 / 29	Haines et al.
Corsica*	+107.9 ±6.7	+86.3 ±8.6	84 / 21	Bonnefond et al.
Bass Strait	+152.3 ±7.7	+105.0 ±8.3	18 / 18	Watson et al.
Gavdos	+131.0 ±15	NA	20 / NA	Pavlis et al.
Ibiza	+120.5 ±4.4	NA	33 / NA	Martinez-Benjamin et al.
Regional	+100.0 ±1.0	91.0 ±8.0	21 / 21	Jan et al.

\*Biases given at the 2002.0 reference epoch

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F. Frappart, N. Roussel, R. Biancale, J.J. Martinez-Benjamin, F. Mercier, F. Perosanza, J. Garate Pasquin, J. Martin Davila, B. Perez, C. Gracia, R. Lopez, A. Tapia, J. Gili, M. Hernandez, M. Salazar, P. Bonnefond, I. Valles, "The 2013 Ibiza calibration campaign of Jason-2 and Saral altimeters", Marine Geodesy, DOI: 10.1080/01490419.2015.10087.11, 2015.



General view of the levelling traverse conducted in 2009 and repeated in September 2011 (red line, about 700 m along the northern side of the "Energy Pier", Barcelona harbour, Spain). The levelling chain links points #124 (Levelling Network XdA), the Tide Gauge (point #146) and the Harbour Control Tower (NO point is located at the ground floor of the Tower, whereas the GPS Station- ARP point- is at its roof). Source of the orthophotomap: Institut Cartogràfic i Geologic de Catalunya (ICGC).



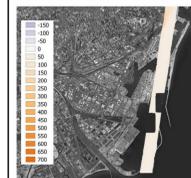
## ICESat Targets of Opportunity (TOOs) near Ibiza, l'Estartit, and Barcelona, Spain

Track	Pass Direction	Date/DOY				Off-Nadir Target Angle	
		L3g	L3h	L3i	L3j		
		Oct-Nov 2006	Mar-Apr 2007	Oct-Nov 2007	Feb-Mar 2008		
0023	Des	31 Oct/304 0.51°	18 Mar/077 0.46°	09 Oct/282 0.55°	24 Feb/055 0.53°		
0209	Asc	13 Nov/317 1.22°	31 Mar/090 1.18°	21 Oct/294 1.07°	07 Mar/067 1.10°		
		Ibiza					
0075	Asc	04 Nov/308 1.01°	22 Mar/081 1.05°	12 Oct/285 1.06°	27 Feb/058 1.03°		
0142	Des	08 Nov/312 3.60°	26 Mar/085 3.49°	17 Oct/290 3.64°			
0261	Des	16 Nov/320 3.27°	03 Apr/093 3.28°	25 Oct/298 3.22°	11 Mar/071 3.30°		
		l'Estartit					
1310	Asc	-	-	-	19 Feb/050 [0.30°]		
0142	Des	-	-	-	03 Mar/063 4.20°		
		Barcelona					
		-	-	-	-		

## AIRBORNE LIDAR CAMPAIGN: SONMICAT-BCN (June 2014)

The validation using LIDAR technology may be useful to fill coastal areas where satellite radar altimeters are not measuring. The ICESat laser altimeter delivers ellipsoidal heights and can be used over land to calibrate the LIDAR instrument.

A new airborne LIDAR campaign flying underneath the tracks L3g-L3j (green and blue) of the ICESat laser altimeter has been at the Barcelona harbour in June 2014. Now, the data analysis is being carried out.



First, an automatic classification of the adjusted points has been taken in order to detect points with error, zero- or very-low intensities.

Second, a simplified manual edition, block by block has been performed by a skilled operator.

