Generalitat de Catalunya
Government of Catalonia

UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

ICC Institut Cartogràfic de Catalunya

SEA LEVEL MONITORING IN IBIZA AND BEGUR CAPE

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ABSTRACT

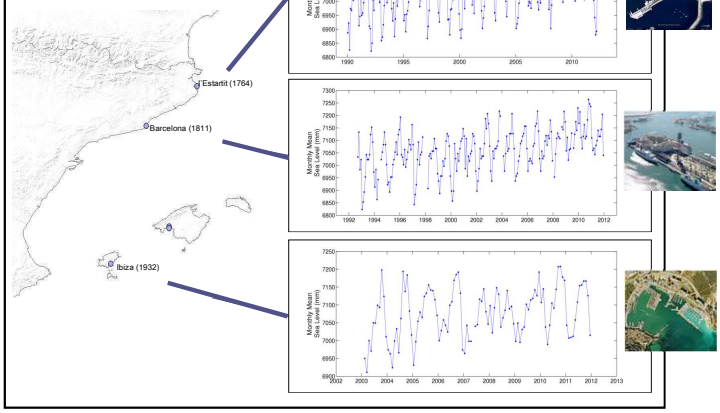
The determination of global and regional mean sea level variations with accuracies better than 1mm/yr is a critical problem, the resolution of which is central to the current debate on climate change and its impact on the environment.

Highly accurate time series from different techniques are needed. Measuring the sea surface height with in-situ tide gauges and GPS data provides an efficient way to control the long term stabilitiy of the radar altimeters and other applications as the vertical land motion and studies of sea level change.

The necessity to validate and calibrate the satellite altimeter, due to increasing needs in accuracy and long term integrity, implies establishing calibration sites with enhanced ground based methods for sea level monitoring.

A description of the actual and future operational geodetic infraestructure and instrumentation at Ibiza, Begur Cape and Barcelona harbour is presented as their applications to sea level monitoring and altimeter calibration. The main objective is the integration of spaceborne, airborne and in-situ data for the establishment of altimeter calibration areas in the western Mediterranean in the framework of Global Change.

CALIBRATION SITES [PSMSL stations] (www.psmsl.org)



l'Estartit calibration site

- Tide gauge series: 1990- . Belongs to PSMSL network.
- Geo-referenced to ICC benchmark (precise leveling).
- CATNET-EUREF GPS station: CREU, CASS
- GPS buoys campaigns: Topex/Poseidon (1999, 2000), Jason-1 (2002).
- Lidar campaigns in june and october 2007.
- ICESat campaigns: L3g (2006), L3h (2007), L3i (2007)

Barcelona calibration site

- Tide gauges series:1992-2008 and 2007- . Owner: Puertos del Estado (www.puertos.es). Belongs to PSMSL network.
- Geo-referenced to ICC benchmark (precise leveling).
- CATNET GPS stations: MARE, PLAN, GARR

Ibiza calibration site

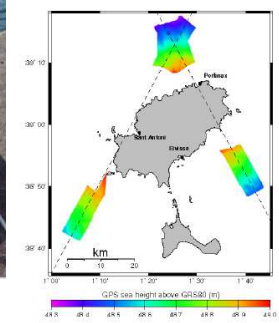
- Tide gauges series: 2002-2010 and 2009- . Owner: Puertos del Estado (www.puertos.es). Belongs to the ESEAS and PSMSL network.
- Geo-referenced to IGN benchmark (precise leveling).
- XGAIB GPS station: EIVI, FORM
- GPS buoys campaign "IBIZA 2003": Jason-1 (2003).
- ICESat campaigns: L3g (2006), L3h (2007), L3i (2007)

GPS networks

CATNET www.icc.cat

XGAIB http://xarxagnss.caib.es

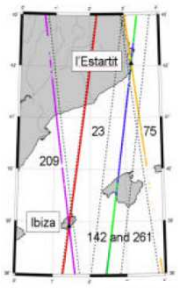
GPS-buoy altimeter calibration

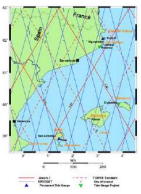


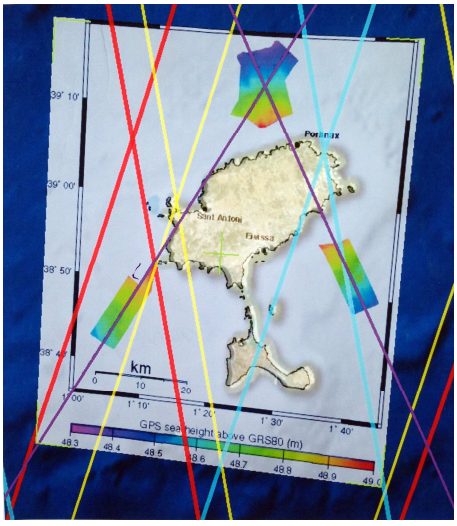
Geographical areas along the Jason-1 traces , mapped by GPS buoys in the IBIZA2003 campaign

Satellite missions

- Topex/Poseidon: 1992 – 2005
- Jason-1: 2001 – 2013
- ENVISAT: 2002 – 2012
- Icesat: 2003 – 2010



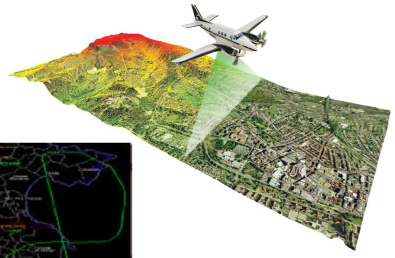




Jason-2: 2008 - [purple]
SARAL/Altika: 2013 - [yellow]
Sentinel 3: 2014 – [red,blue]

Airborne Lidar.calibration at l'Estartit

June 16, 2007



October 12, 2007

Future campaigns

- GPS-buoy campaign in Ibiza calibration site (2014 ?)
- A new airborne Lidar campaign in Barcelona area (end of 2013), flying underneath the track of the Icesat laser altimeter near the Barcelona harbour as it had been made at l'Estartit in 2007.

The validation using Lidar technology may be useful to fill coastal areas where satellite radar altimeters are not measuring due to the large footprint and the resulting gaps of about 20-40 km within the coastline. As first results of the campaign, a DSM of the area will be derived .

The Icesat laser altimeter delivers ellipsoidal heights and can be used over land to calibrate the Lidar instrument. Then the calibrated data can be used over ocean to detect the sea surface height. Currently, no radar altimeter is able to get closer to the coast than about 15-20 km at least, however, significant shallow water tides and ocean dynamics take place at the coast, where it can be observed by tide gauges if available.

Altimetry cannot observe these phenomena, but a Lidar system could be used to connect the two different measurement systems. Since the airborne Lidar is affected by tilts and biases, a calibration should take place over land and only Icesat altimetry currently delivers sound land elevations as opposed to much less accurate radar altimeters over land. The investigations are related to the point that the coastal sea level can be observed with GPS buoys and airborne Lidar campaigns.

SUMMARY

The main objective is the estimation from the time series of sea level change in the areas of Barcelona, l'Estartit and Ibiza for sea level monitoring and altimeter calibration. It is intended that the overall systems will constitute a CGPS stations of TIGA network. The TIGA network of tide gauges collocated with GPS and MET units provides near real-time and long-term data of sea level.

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