Altimeter Calibration and Sea-Level Monitoring Facility in Gavdos, Crete.

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Abstract

The GAVDOS team is in the process of installing a permanent facility for the calibration of radar satellite altimeters and Sea-Level Monitoring on the isle of Gavdos, south of the island of Crete, Greece. The established procedures for the installation of the tide gauge, the Continuous Operating GPS station and the platform for the transponder experiment over the cross-over point are described. The communication link network for controlling the remote equipment and for transferring data from Gavdos to the Operations Control Center at Chania will be given. Emphasis is given in technical issues and reconnaissance problems related to the instrumentation installation and the future operation plans of that facility.

Objectives

To establish an absolute sea level monitoring and altimeter calibration facility on the isle of Gavdos, south of the island of Crete, Greece.

To monitor deformations of the earth's surface at the tide gauges in the area.

To develop a detailed regional geoid and Sea Surface Topography (SST) model.

To involve this project in International programs such as,

- ***Euro-GLOSS**: Global Sea Level Observing System.*
- *The European Union **Operational Forecasting** cluster.*
- ***WEGENER:** Working Group of European Scientists for the Establishment of Networks for Earthquake Research.*
- ***TIGA**: GPS Tide Gauge Benchmark Monitoring--Pilot Project.*

To integrate it with the global geodetic reference frame, maintained by the International Earth Rotation Service (IERS), and the IGS activities in this region.

Purpose

To conduct comparative laser distance measurements between the facility and the satellite radar altimeters, such as T/P, Jason-1, Envisat, etc;

To ensure the unbiased establishment of the Mean Sea Level, as realised by the globally distributed altimeter measurements;

To monitor consistently and reliably any altimeter errors by determining:

- *The altimeter biases and drifts for these altimetry missions,*
- *The bias amongst different missions.*

To cross calibrate different satellite altimeter missions and each one of them, on a common and long term basis

Methodology

Monitor horizontal and vertical land deformation using GPS permanent stations, DORIS beacon and at the tide gauge sites .

Monitor sea level variations within a regional network of tide gauges equipped with GPS and meteorological, oceanographic sensors;. Locations include Gavdos isle, Souda Bay, and Heraklion harbour.

Establish a telecommunications link between the facilities and the Operations Control Center at TUC.

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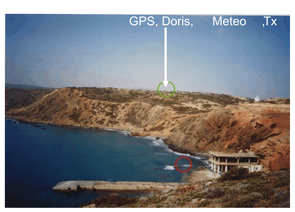
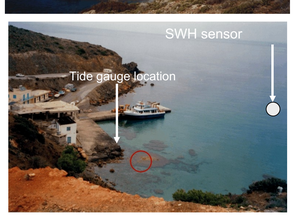
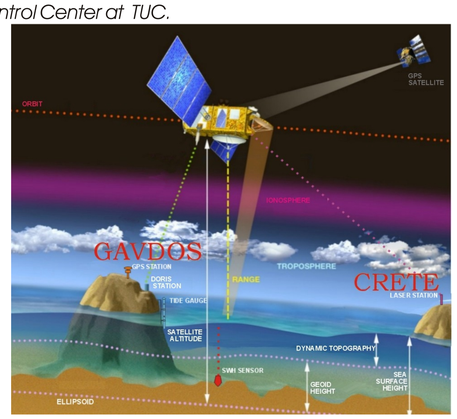




The present situation at Gavdos pier and instrument location instillations. Deployment of the Wave & Tide Record was in May 2002 at a depth of 10 m.



Carry out regional airborne campaigns using an aircraft equipped with laser (for laser topography surveys), airborne gravimeter, inertial unit, GPS, etc (for airborne gravimetry);

Construct the best detailed gravimetric geoid of the region;

Verify radar altimeter measurements with GPS buoy receivers to be placed under the satellite ground-tracks to provide in situ sea surface topography data;

Deploy altimeter transponders, measuring direct distances to the satellite with a ~5mm precision;

Operate a transportable laser on site for precise Satellite Laser Ranging (SLR) tracking of the over-flown satellites, after the end of the validation period for Jason-1;

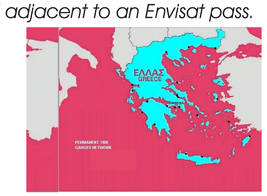
Reduce radar altimeter distances to sea surface heights using spectral algorithms, the airborne and shipborne gravity data, etc;

Verify models and results;

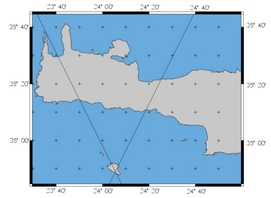
Create Web-site at the Operations Control Center for results dissemination.

Why Gavdos island?

Gavdos is under a crossing point of the ground-tracks of the earth-observing satellite altimeter missions of TOPEX/Poseidon (T/P) and Jason-1, and adjacent to an Envisat pass.



The location of Gavdosisle in the eastern Meditaranean



The Jason-1 and T/P ground track over Crete and Gavdos

The small island is far from the main land, with relatively small topography, and rather simple sea current circulation;

The surrounding geoid is known from in situ measurements and the local tides are small;

Calibration measurements can be made from the isle, twice per cycle (every 5 days instead of 10 days), on ascending and descending tracks, and

The cross-over information can be used to remove possible biases dependent on the direction of the pass.

Expected Results

to understand and monitor the error characteristics of the altimeter measurement biases and their potential drifts;

to improve the media, the instrumental and the geophysical corrections of the altimeter observations from the participating missions;

to provide a highly accurate and high resolution map of the marine geoid in the vicinity of the experiment;

to provide a reliable estimate of the secular and periodic variations of sea-level and contribute to the global tide gauge network;

to detect any instrumental or algorithmic problems with the measurement system of the satellite altimeters in near-real time;

to decouple the vertical land displacement at the facility site from the tide-gauge measured mean sea level of Eastern Mediterranean Sea;

to interpret the signals for their role in climate change and to model coastal ocean tide models with improved resolution;

to yield reliable estimates of horizontal land deformation of the facility with respect to stable Europe, within the first three years of operation;

to be able to detect the vertical component of the land movement for the site (significant for seismic work in the area);

The Partners

- **TUC, Greece**. *Laboratory of Geodesy and Geomatics Engineering, Division of Exploration and Positioning, Technical University of Crete. (Co-ordinator).*
- **JCET, USA**. *University of Maryland Baltimore County, Joint Center for Earth Systems Technology,NASA, Goddard Space Flight Center.*
- **AUTH, Greece**. *Department of Geodesy and Surveying, Aristotle University of Thessaloniki..*
- **IMBC, Greece**. *Institute of Marine Biology of Crete, Department of Oceanography, Greece.*
- **SRISG, Austria**. *Austrian Academy of Sciences, Space Research Institute, Department of Satellite Geodesy.*
- **KMS, Denmark.** *Geodynamics Department, KMS (National Survey and Cadastre of Denmark.*
- **ETHZ, Switzerland**. *Geodesy and Geodynamics Laboratory, Institute of Geodesy and Photogrammetry, ETH Hoenggerberg.*
- **OCA-CERGA, France**. *Observatoire de la Cote d'Azur (OCA), Centre d'Etudes et de Recherches en Geodynamique et Astrometrie (CERGA), CNRS (Centre National de la*