Establishment of a European radar altimeter calibration and sea-level monitoring site for JASON, ENVISAT and Euro-GLOSS – (GAVDOS)

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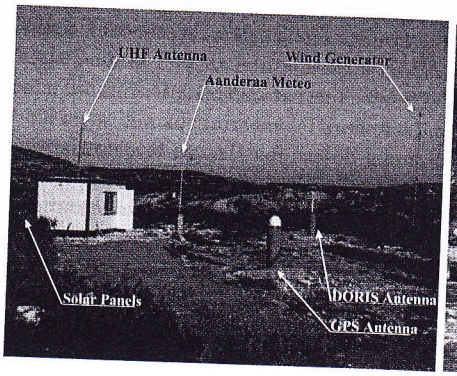
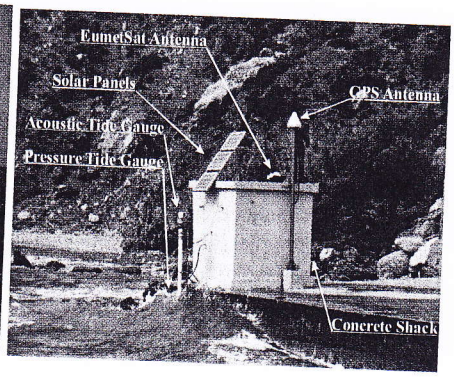
Objectives

Climate change on a global scale is a serious concern for all countries, especially for those with extensive coastlines, near major bodies of water. The reason of course is the effects of this global change on the environment, and in this particular case, the change in the mean sea level (MSL) with the obvious consequences on human activities near coastlines. Radar altimeter-carrying satellites are used to observe the oceans from space, so that we can monitor the short-term and long-term trends.

Unfortunately, these satellites have a limited lifetime, and a long-term record of MSL changes can only be established, if observations from all of these missions are reliably linked to each other over many decades. To maintain such a global observing system by combining research and observations on the surface and from space, we need to "connect" the results from each of the previous missions (e.g., SEASAT, GEOS-3, TOPEX/Poseidon) to the current (e.g., Jason-1, GeoSat Follow-On (GFO), Envisat, etc.), and the future ones for as long as possible. Thus, the radar instruments for each satellite need to be calibrated in a standard fashion so that the MSL observations are independent of the mission that produced them.





The main objectives of this project are: (1) To establish an absolute sea-level monitoring and altimeter calibration facility on the isle of Gavdos, south of the island of Crete, Greece; (2) To monitor deformations of the earth's surface at the tide gauges in the area; (3) To develop a detailed regional geoid and Sea Surface Topography (SST) model; (4) To integrate 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; (5) To integrate it with the global geodetic reference frame, maintained by the International Earth Rotation and Reference Systems Service (IERS), and the International GPS Service (IGS) activities in this region.

Results

The current results of the GAVDOS project are as follows:

- An initial evaluation of the absolute bias for JASON's altimeter, based on the comparison of the tide gauge data with the JASON altimeter Geophysical Data Records from only two cycles (#52 and #53), indicate a 127 ± 78 mm bias. This value is in very good agreement with the generally accepted value of 130 mm obtained at elsewhere with data covering over 60 cycles.
- Precise observation of the tectonics and precise determination of the regional geoid with in situ and data collected with dedicated airborne gravity and sea surface topography flights, allowed the establishment of a successful calibration site in an otherwise unsuitable area (significant tectonic activity and very steep geoid).
- A high-resolution (1min of arc) gravity database and a geoid model (accuracy of 5 cm) have been constructed for the area using all available land, marine and airborne data combined with satellite altimetry heights of the sea surface.
- Radiometer and spectrometer data have been used to validate satellite-independent information on atmospheric water vapor and its temporal variation.
- GAVDOS is registered with EUMETSAT and will soon start public dissemination of the weather and sea-level observations for immediate use in weather and oceanographic forecasting.

Potential exploitation by end-users

The results obtained are of special interest to the Jason-1 and Envisat missions because the altimeter biases and drifts for each of these missions and among different missions will be determined reliably and consistently. Simultaneously, an absolute MSL-monitoring site is established with the local tectonic deformation field in the region of southern Crete, Greece precisely monitored. These observations are of great interest for geodynamic applications in an area (next to the Hellenic trench) that is well known to often generate large magnitude earthquake events.

This integrated facility, due to its nature and its open ocean location, is appropriate and will make its data and products available for use in forecasting the weather of eastern Mediterranean and monitoring long-term climate changes. Also, the system will be capable for monitoring extreme events (storm surges, etc.) in the proximity. The proposed facility underpins research relevant to the European component of the global observing systems for climate and oceans and operational forecasting of environmental constraints on offshore activities.

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