Altimeter Calibration and Tectonics Inference Oceanographic Network (ACTION): from OSTM to SWOT

E. C. Pavlis[1], K. Evans[2], P. Milas[3], D. Paradissis[3], B. Massinas[3], and X. Frantzis[4]

1) Goddard Earth Sciences and Technology Center (GEST/UMBC), Baltimore, MD, USA
2) Joint Center for Earth Systems Technology (JCET/UMBC), Baltimore, MD, USA
3) Nat. Technical University of Athens (NTUA), Athens, Greece
4) Technical University of Crete (TUC), Chania, Greece

epavlis@umbc.edu

Abstract

We will report on recent results and on the extension of the eastern Mediterranean Altimeter Calibration network—eMACnet, to an Aegean-wide network of coastal tide gauges equipped with GNSS receivers and offshore buoys near OSTM groundtracks (ACTION). In collaboration with the Nat. Tech. Univ. of Athens (NTUA), the Hellenic Navy Hydrographic Service (HNHS) and the Hellenic Center for Marine Research (HCMR), the original network is expanding to cover all of the Aegean area, from the northernmost site at THASOS to the southernmost one on GAVDOS. The south Aegean is already adequately covered from four tide gauge sites equipped with CORS GNSS: at MANI-KARAVOSTASI on southern Peloponnese, EMPORIO on the island of Chios, KASTELI on northern Crete and PALEKASTRO on the easternmost edge of Crete. Additional tide gauges and GNSS will now be deployed at KYMI-EVIA and NEA SKIONI, before the end of 2012, to densify the network in the mid- and northern Aegean. The primary purpose of the extended network is the absolute calibration and validation of altimetry missions through the continuous monitoring of sea level and tectonics at locations near the OSTM mean groundtrack. This Aegean-wide network samples at the moment the OSTM/Jason-2 tracks 18, 33, 94, 109, and 185, some of them in more than one location. It will support current and future altimeter missions JASON-2/3, ENVISAT, Cryosat-2, HY-2A, JASON-CS and SWOT, especially the latter, requiring calibration over an area rather than a single track. In discussions with HCMR we have also reached agreement for the future use of their open-sea buoys once we outfit them with CORS GNSS receivers. Furthermore, HNHS has a funded proposal to obtain new, state-of-the-art tide gauges with GNSS receivers to replace their old equipment throughout their Aegean network, and for two additional buoys (NOAA's DART II type) and equipment for open-sea environmental monitoring. The main thrust of the project at the moment is to connect the currently deployed equipment with the global grid so that the data can be collected and made available in near real-time (e.g. on GTS). Our facilities will contribute the collected data to many other projects in the area (CLIVAR, WMO initiatives, IOC, GCOS, GOOS, GGOS, etc.) and the European Tsunami Warning System (ETWS). We will present the latest results from the current network and the latest bias estimates for OSTM/Jason-2.

RECENT UPDATES

During the summer of 2012 the CHIO site at EMPORIO, Chios, was completed with the installation of a Continuously Operating Reference Station (CORS) powered from the national grid and connected to internet for direct control and delivery of the data remotely.

The GAVDOS AQUATRAK™ facility was upgraded with the addition of a telemetry system that sends the sea-level measurements directly to IOC and releases them to GTS, in a similar manner as in KASTELI.

PUBLICATIONS

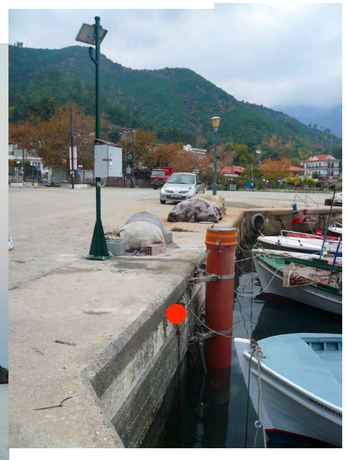
Milas, P., B. Massinas, and D. Paradissis, (2012), "Tide Gauge Data Comparison Between a Radar-type and a Mechanical-Float-type system, Using FFT", Metrologia 2012, February 3-4, 2012, Nat. Tech. Univ. of Athens, Greece.

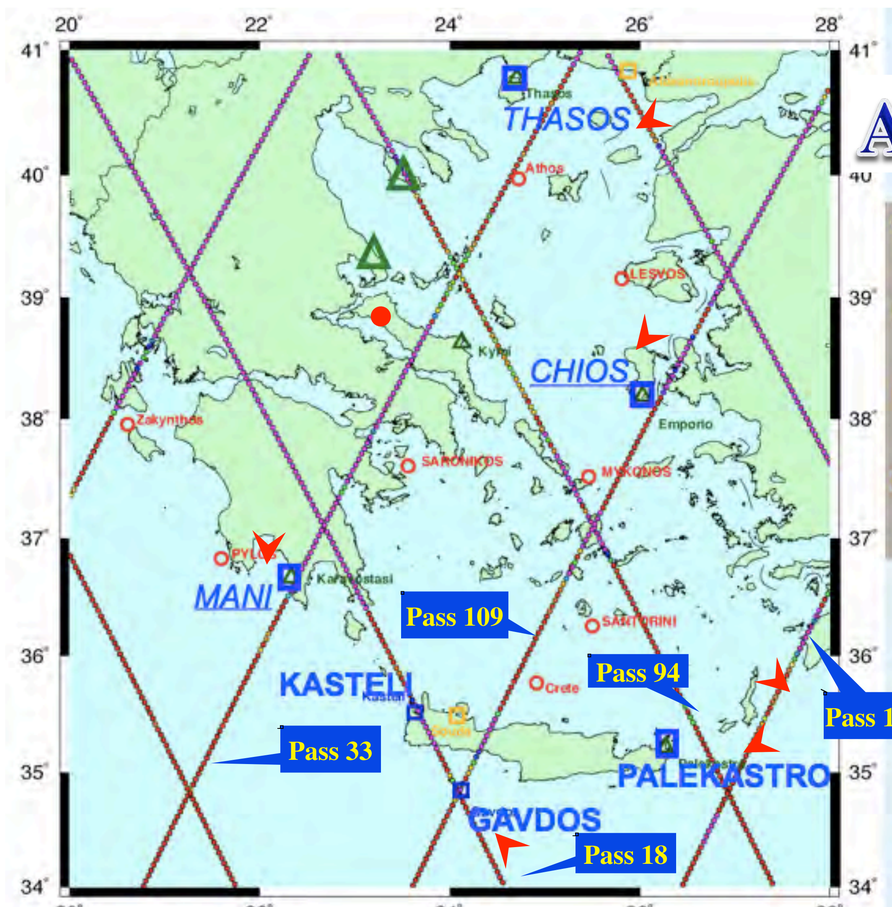
Mertikas, S. P., E. C. Pavlis and P. Drakopoulos. 2003. GAVDOS: A satellite radar altimeter calibration and sea-level monitoring site on the island of Gavdos, Crete, H. Dahlin , N.C. Flemming , K. Nittis, S.E. Petersson eds. *Building the European Capacity in Operational Oceanography*, Proceedings of the 3rd EuroGOOS Conference, 3-6 December 2002, Athens, Greece, pp. 258-264, Elsevier Oceanography Series 69.

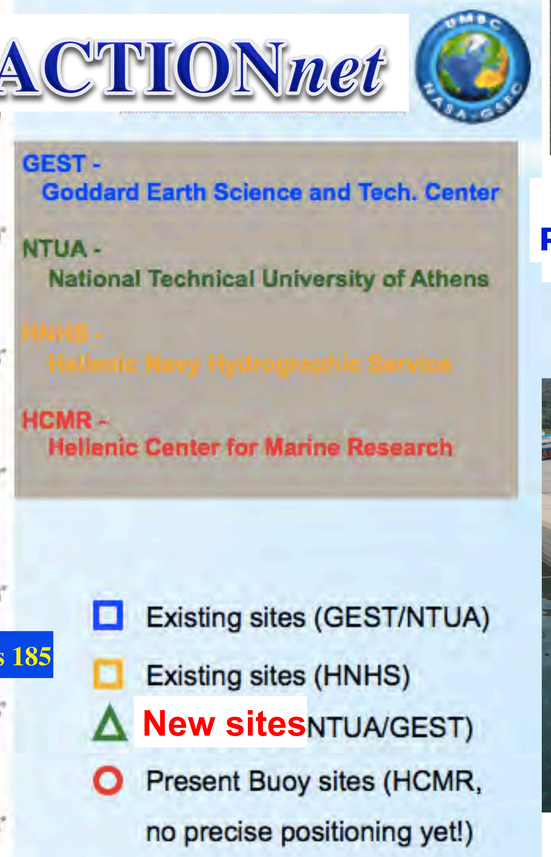
Pavlis, E. C. 1999. Tectonics, Sea-level Monitoring and Altimeter Calibration With a Regional GPS Array, G. Maul ed. *Proc. of the International Symposium on Marine Positioning, INSMAP 98*, Nov. 30 – Dec. 4, 1998, Melbourne, Florida.

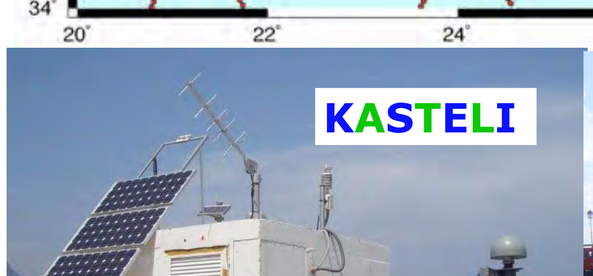
Pavlis, E. C., S. P. Mertikas and the GAVDOS Team. 2004. The GAVDOS Mean Sea Level and Altimeter Calibration Facility: Results for Jason-1, 3rd Jason special issue, *Mar. Geod.*, (27), 3-4, DOI: 10.1080/01490410490902106, pp. 631-655.

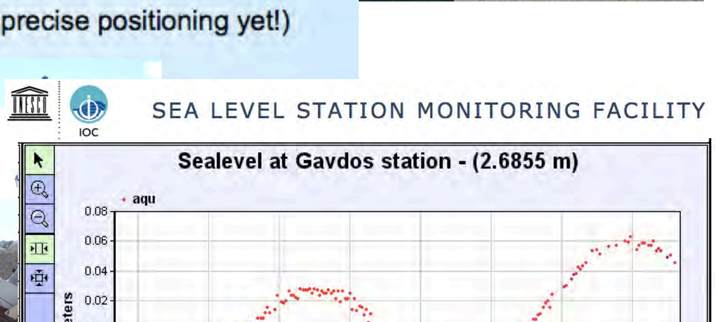
Somieski, A., B. Buerki, A. Geiger, H.-G. Kahle, E. C. Pavlis, H. Becker-Ross, S. Florek and M. Okruss. 2006. Tropospheric Water Vapor from Solar Spectrometry, and Comparison with JASON Microwave Radiometer Measurements, accepted, *J. of Geophys. Res.*, (Atmospheres).







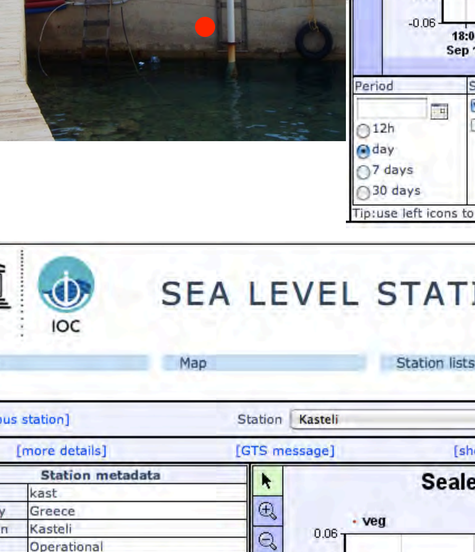




GNSS and RADAR & FLOAT TIDE GAUGES AT KASTELI, CRETE

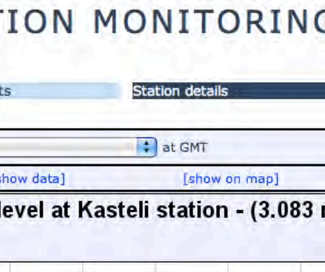
RADAR TIDE GAUGE RECORD FROM IOC's ONLINE SITE →

JASON 1 & 2 Calibration Results
from
Global Absolute Calibration Sites



OPEN SEA BUOY PLANNED for Cal/Val & Tsunami Warning System

NOAA-Designed DART II Buoy to be purchased and deployed by the Hellenic Navy Hydrographic Service south of Gavdos next year (discussions with SAIC in progress)



ETD DART™ offers promising new improvements:
- Significant reduction in ship charter hire costs
- Safer and less complicated deployments
- Eliminates need for large deployment ship/skilled crew
- Improved vandalism protection
- Lower anticipated life-cycle costs

Summary

•The Aegean network *eMACnet* was the outgrowth of the Gavdos facility that was established during 2001-2003. The current network includes several new systems at KASTELI, PALEKASTRO, MANI, THASOS, and EMPORIO, Chios. Data collected by the network have been used with the JASON-2 GDR-T records from cycles 14 to 32 and the latest corrections released by the project, to estimate the absolute bias of the Poseidon altimeter. A total of 35 comparisons resulted in the following estimate: Editing at 3-σ: 177 ± 18 mm scatter about mean: 104 mm

The recently released GDR-D and PISTACH data are now utilized in a reanalysis of the 20 Hz JASON-2 data to obtain refined bias estimates, eliminating possible land-contamination errors, on a continued basis. The current network, "ACTION", is proposed for the calibration/validation of SWOT, given the wide and diverse area that it covers, and the maturity of the deployed equipment. Data are made available as much in real time as possible, to cover other areas of interest in sea level data. The network will be extended with the contribution of additional sites over the Aegean from our partner, the Hellenic Navy Hydrographic Service (HNHS), and they are also in the process of procuring an open-sea buoy of the EDT DART type manufactured by SAIC under license from NOAA. The buoy will be deployed by HNHS's own ship and crew, in a location south of Gavdos. Possible locations are shown above.

This project is funded by NASA's ROSES 2007 Program under Grant Number NNX08AR50G, whose support is gratefully acknowledged.