

# Results from the Eastern Mediterranean Altimeter Calibration Network - eMACnet



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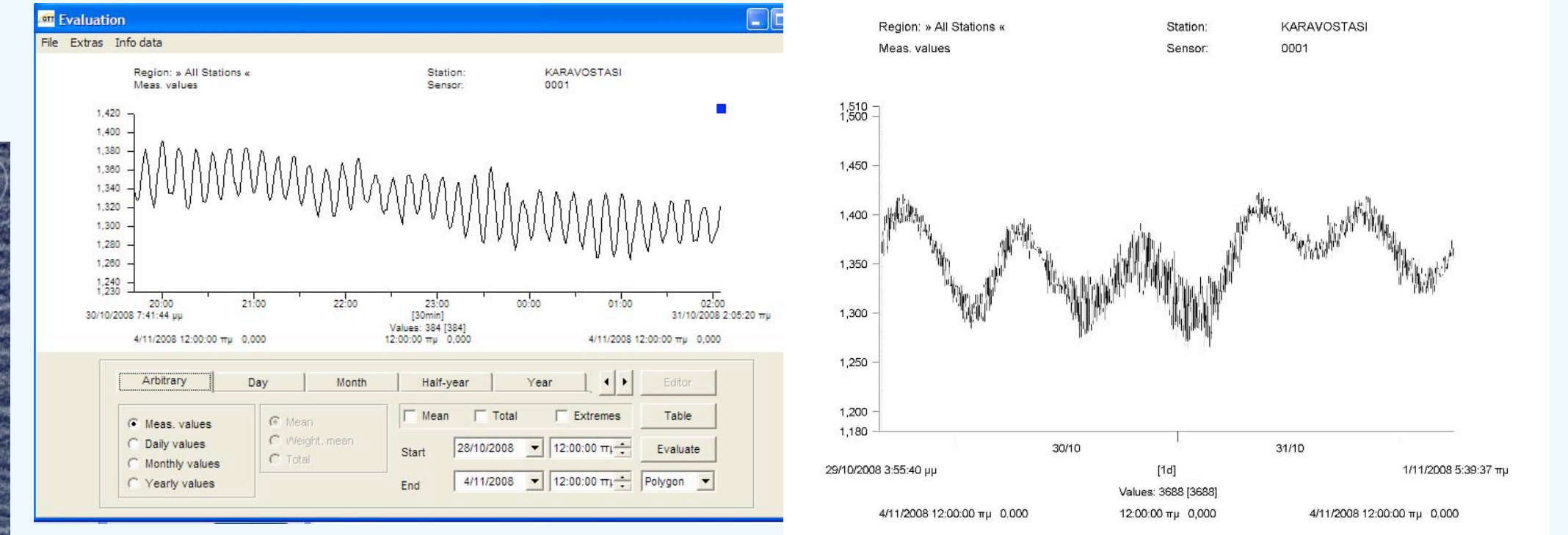
## Abstract

The eastern Mediterranean altimeter calibration network (eMACnet) is the result of expanded collaboration efforts in the Aegean area. By 2003 we had established the Gavdos permanent absolute calibration facility, a joint EU, NASA, and Swiss Federal Government effort. This was further expanded with NASA funding over the past three years to include a second site at Kasteli, Crete, Greece, both of these sites operating with the collaboration and efforts of the local team from the Tech. Univ. of Crete. The two sites at Karave, Gavdos, and Kasteli, Crete are located under the Jason-1 ground-tracks (pass 018 and passes 018 and 109 respectively). The Gavdos "Karave" facility will be moving in January 2009 to its final and originally intended location, on the new pier, a move that will improve vastly the protection of the facility from heavy winter storms and minimize the need for maintenance. Over the past year we have expanded our team to include the *Nation. Tech. Univ. of Athens*, the *Hellenic Center for Marine Research* and the *Hellenic Navy Hydrographic Service*, in an attempt to obtain at a minimal cost data from existing facilities operated by these groups or access to future sites that are now being deployed (see figure below). Some of the new sites are open sea buoys that we will collaboratively instrument with additional equipment (e.g. GPS, OBP recorders, etc.) to allow their data contribute to the calibration/validation process. We present here preliminary results from the expanded network, covering the tandem flight phase of JASON 1 & 2.

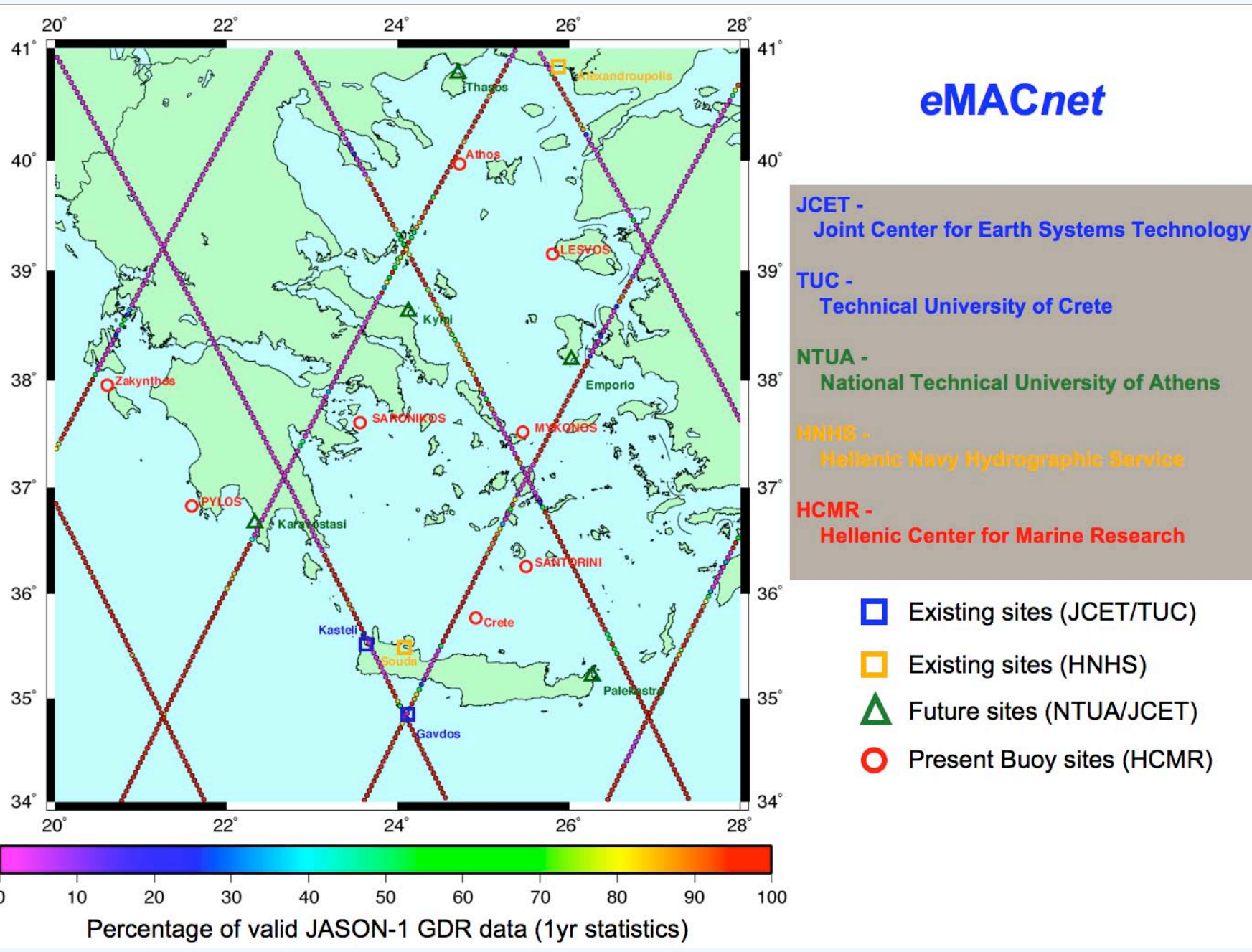
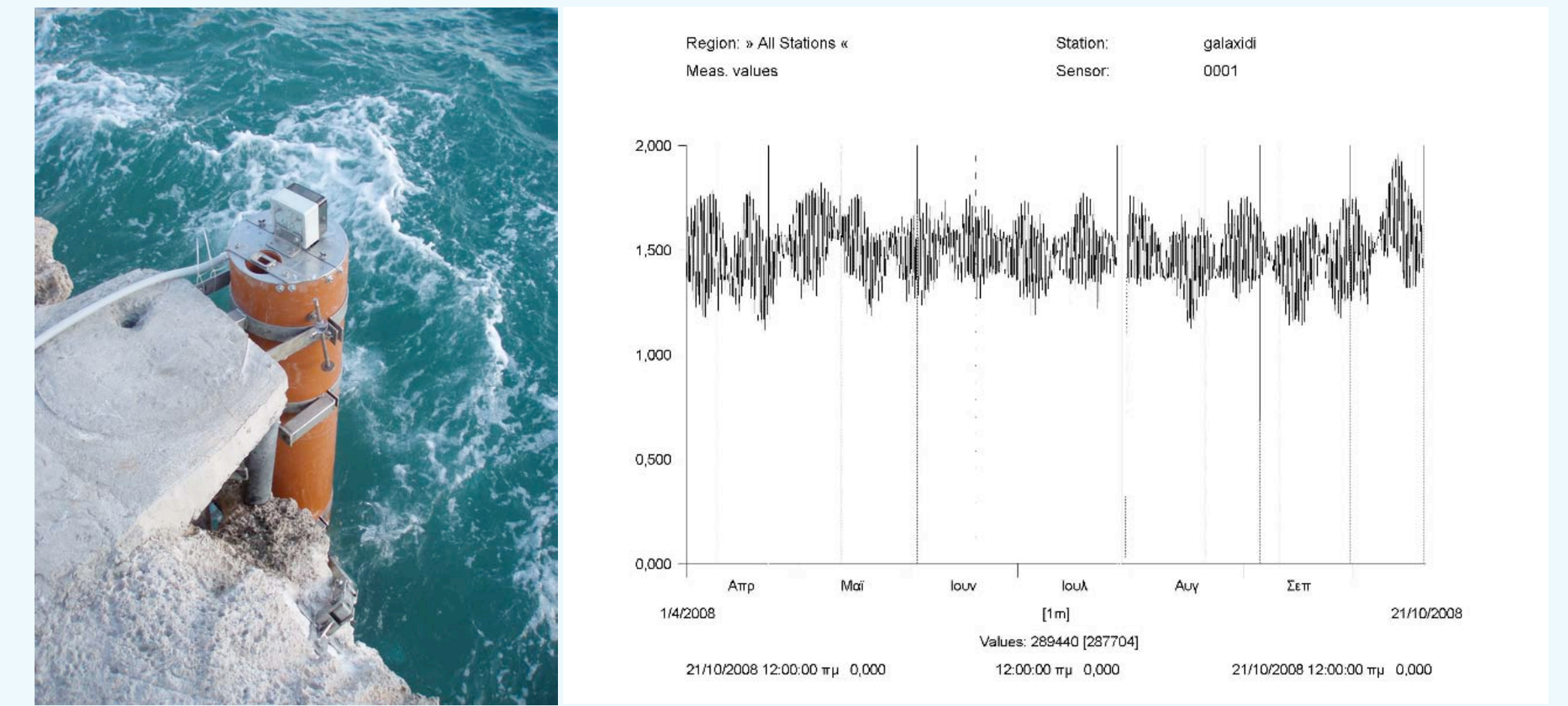
## New Sites of KASTELI (CRETE) and KARAVOSTASI (MANI)



## First Data Record from KARAVOSTASI



## A 6-month Series from older site at GALAXIDI



## JASON-2 Calibrations over Gavdos for Cycles 1 - 9 (Based on ITRF2005 positions)

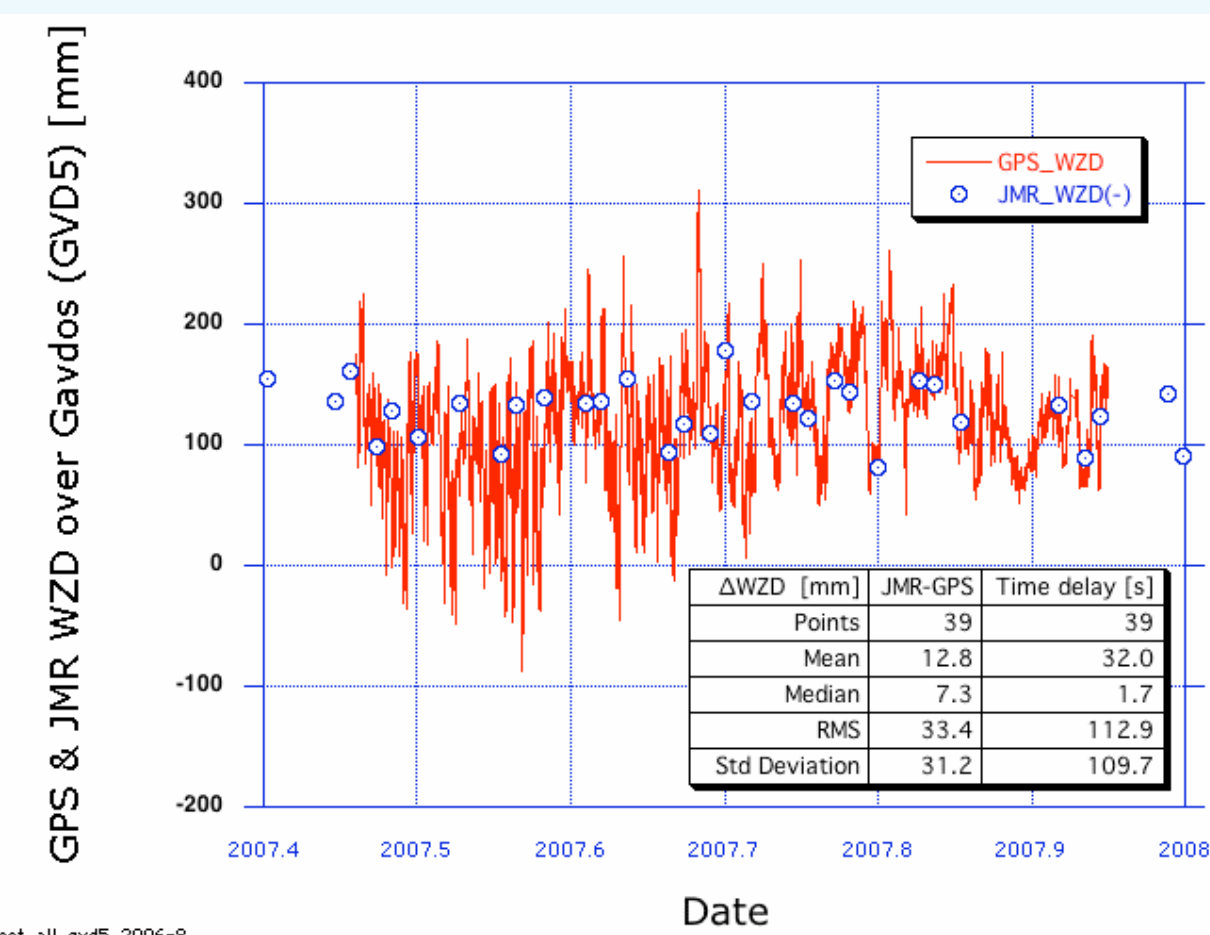
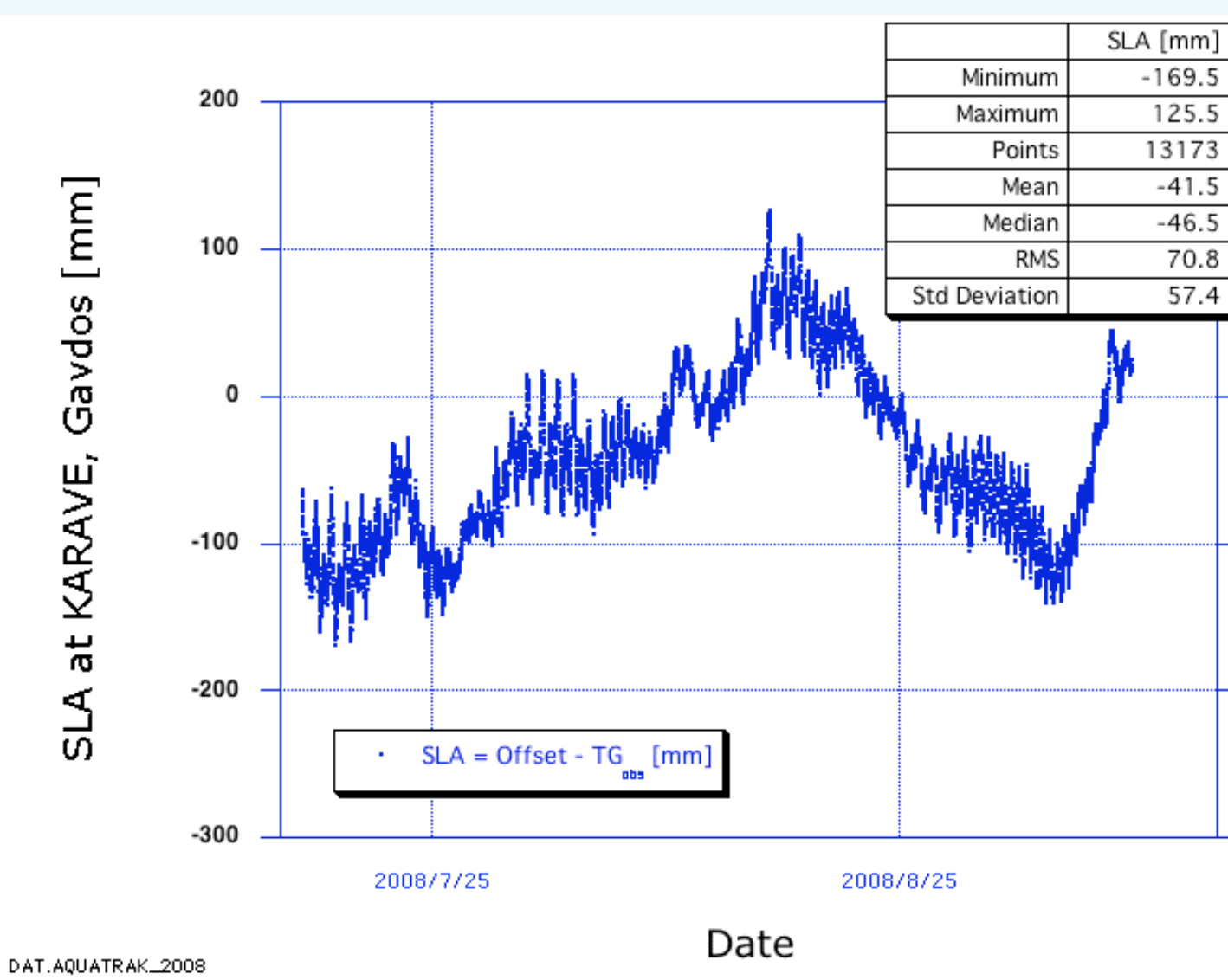
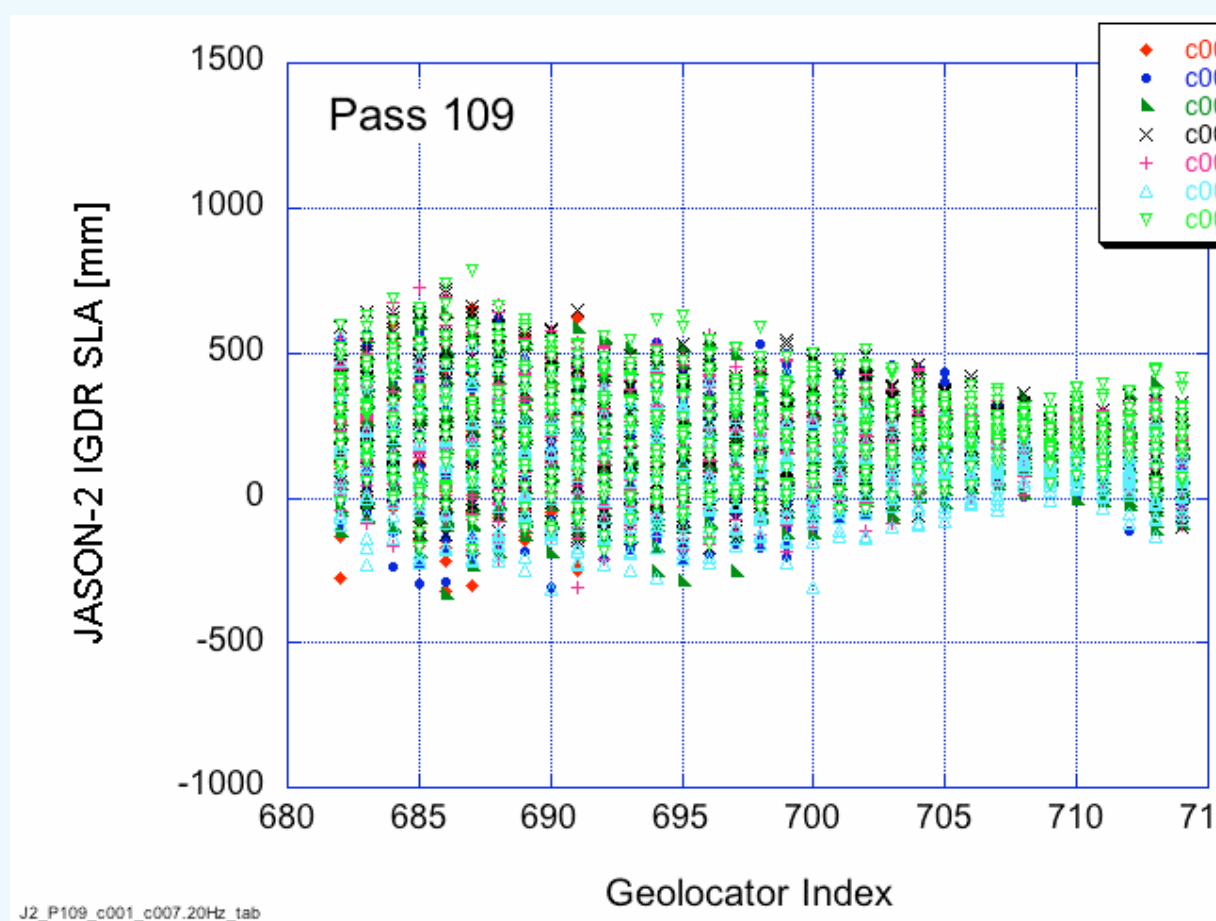
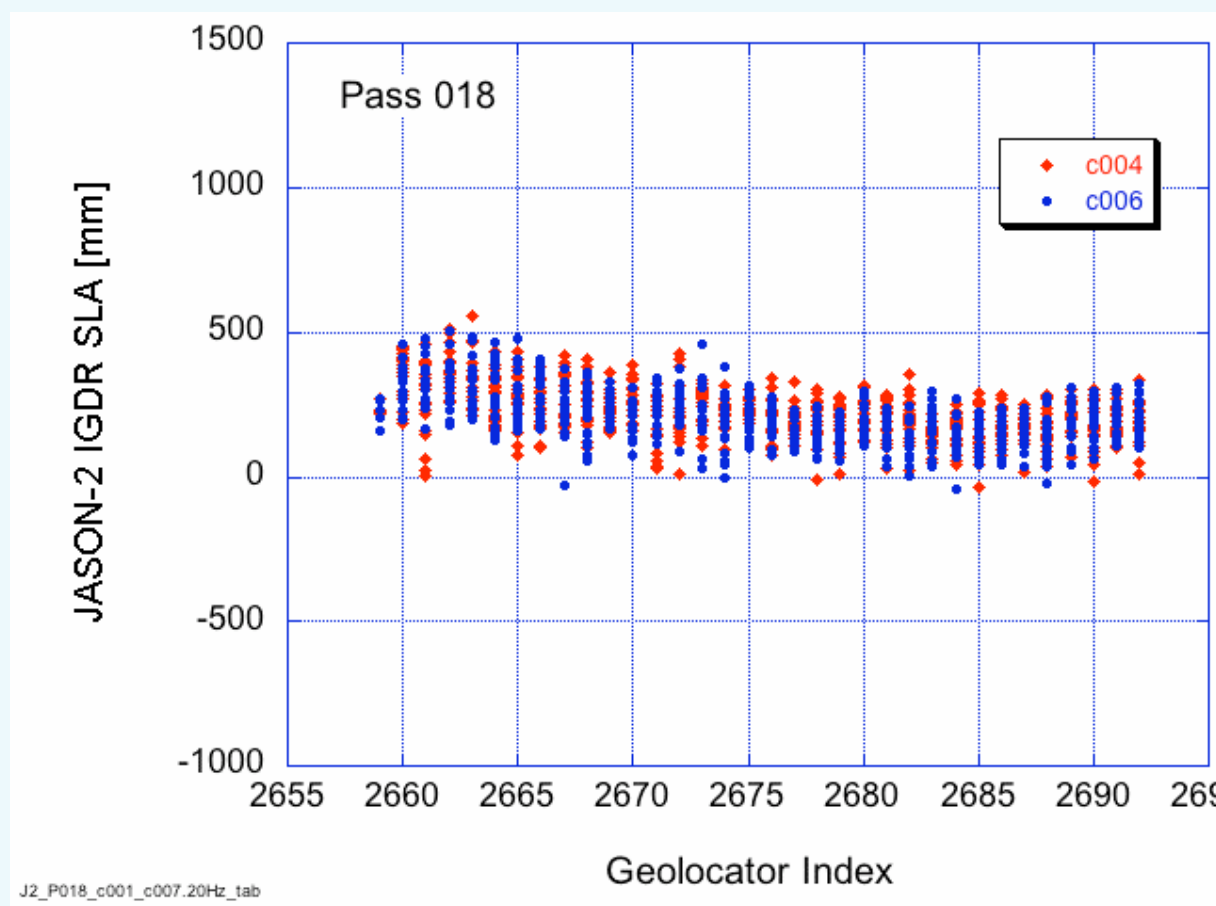
### Preliminary Bias Results for JASON-2

Pass 018: 2 cycles 258.0 ± 10 (formal)

Pass 109: 7 cycles 229.6 ± 47 (formal)

Weighted mean of 9: 234.6 ± 16\* mm

\* Statistics of mean based on pass 109 only



### WZD Calibration with Ground GPS

Comparison of GPS-derived WZD at GVD5 (30 min averages) with JMR values obtained from GDR-C release.

Comparison point is closest to the GVD5 location.

Time delay provides a measure of how close the two measurements were made in time.

## Summary

An evaluation of the seasonal signal near the tide gauge and in the far field, where the altimetry is collected, indicates a correction to our bias estimate of 8 mm [Papadopoulos, 2006]. Re-analysis of the Gavdos GPS network 2007 data using ITRF2005 referenced precise orbits resulted in a small height change at KARAVE of -0.0055 mm.

The adoption of the new coordinates allows us to use the newly available GDRs from NASA Goddard [B. Beckley], based on improved (GSFC) ITRF2005 orbits [Zelensky et al. 2008], referenced to GDR-Bs (corrected for JMR errors) and using an ITRF2005-consistent parametric SSB model [B. Beckley].

When all these corrections are accounted for in our calibration scheme, they reduced the observed bias to 107.5 ± 8 mm.

At the new jetty at Karave a second tide gauge (RADAR, KALESTO® by OTT), was successfully deployed by TUC in the summer of 2007.

A second location on mainland Crete at KASTELI is now instrumented with a VEGAPULS® RADAR tide gauge and state of the art GNSS receiver. The data from both sites will be available in real time via Internet, as soon as the GPRS communications systems are installed (before the end of 2008).

Our next-year efforts rely on additional collaborations with groups from the Nat. Tech. Univ. of Athens (NTUA) and the Hellenic Center for Marine Research (HCMR). Our plans include the instrumentation of a deep-sea buoy either south of Gavdos or at one of the existing HCMR locations, to be used for altimeter Cal/Val work and to contribute to the European Tsunami Warning System (ETWS).

In an ongoing collaboration with NTUA, we are now installing six new tide gauges (float type) with GPRS-enabled data access for real-time monitoring, at sites which cover additional Jason-2 tracks (5-6 in total). One site is already operational (KARAVOSTASI) and the rest will be in place by early 2009.

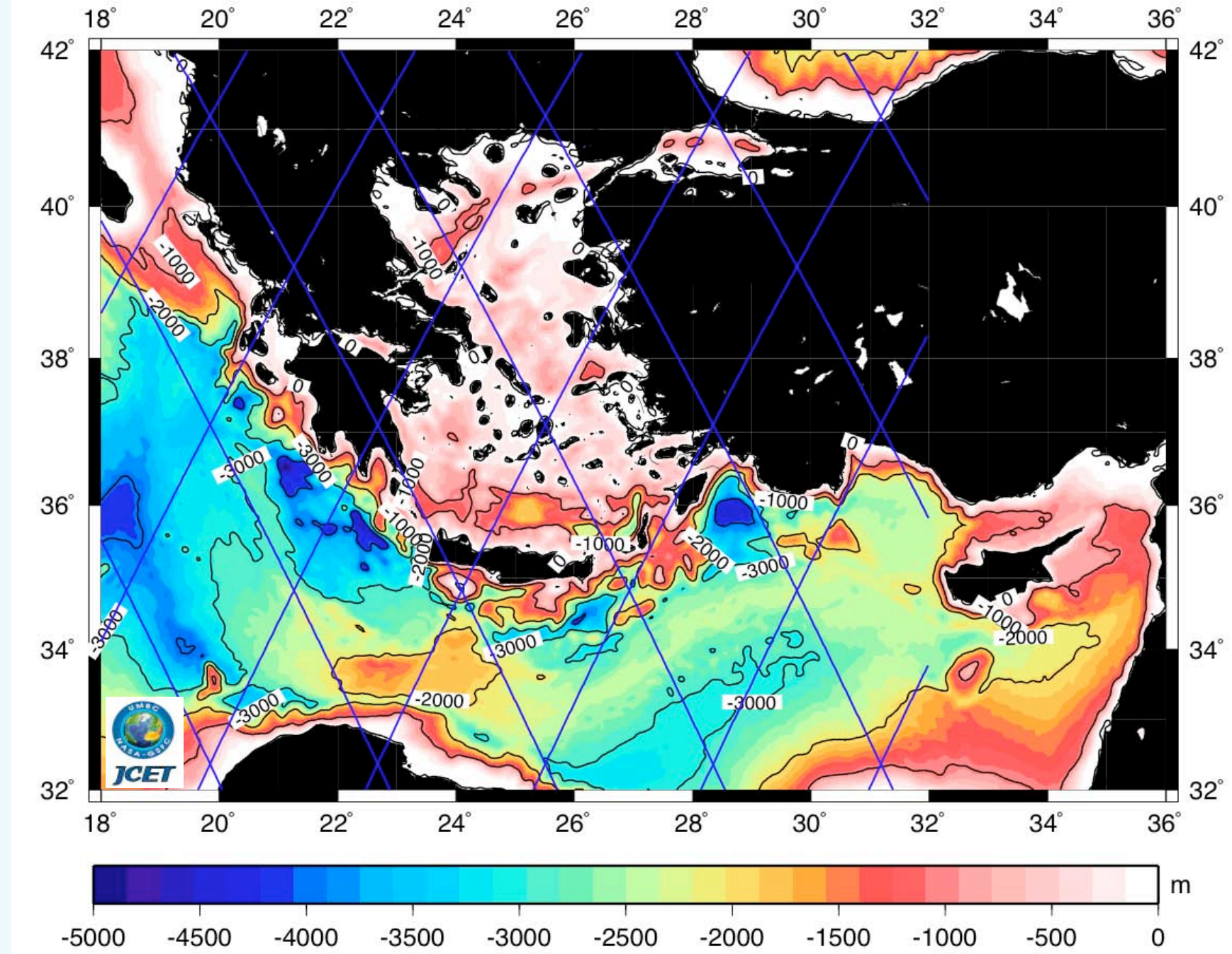
Comparison of WZD from JMR GDR-C data and those derived locally from GPS observations at KARAVE, Gavdos, indicate an agreement at 7-10 mm with standard deviation of 30 mm.

Preliminary results for JASON-2, based on only 9 passes over KARAVE, Gavdos, indicate a bias of 234.6 ± 16 mm, the statistics are very preliminary though. All results are based on IGDR data with GSFC orbits.

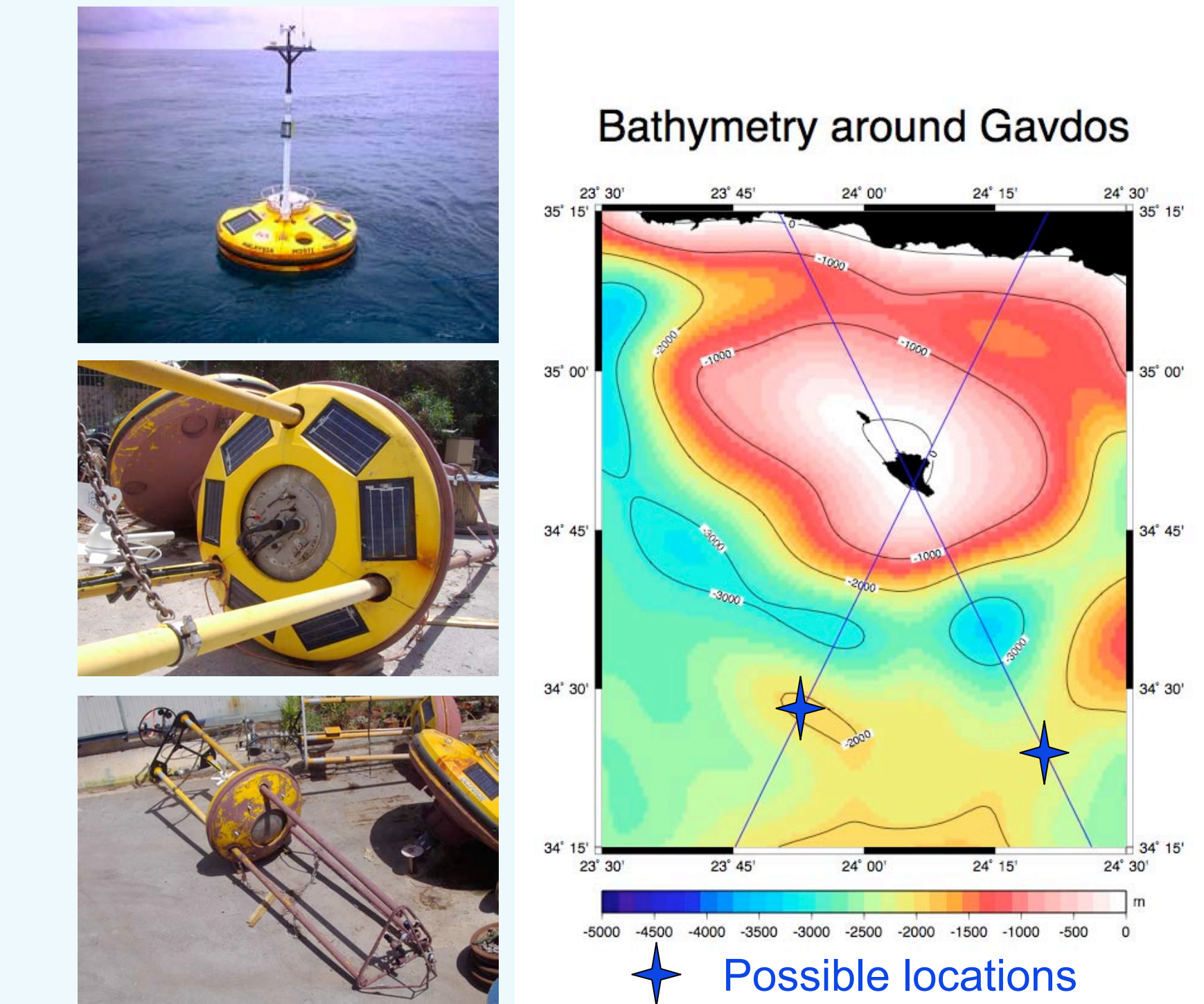
A complete re-analysis of all data sets is in progress and as soon as all JASON-1 corrections are finalized, we will report these results in a detailed publication.

Special thanks to Brian Beckley, Nikita Zelensky and the GSFC team for providing an excellent data set to work with.

## Bathymetry of the Eastern Mediterranean along with JASON-1 groundtracks



## Wavescan Buoy System Deployed by HCMR in the Aegean as part of their POSEIDON III Network



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. Pettersson eds. *Building the European Capacity in Operational Oceanography*, Proceedings of the 3<sup>rd</sup> EuroGOOS Conference, 3-6 December 2002, Athens, Greece, pp. 258-264, Elsevier Oceanography Series 69.

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

## JASON-1 Re-Calibrations over Gavdos for Cycles 70-90 With the Release of ITRF2005

Coordinates based on ITRF2005 (1 year of data)

ITRF2005 Orbits (GSFC, Luthcke et al.)

JMR corrections (Desai model)

New Parametric SSB (ITRF2005-compatible, Beckley/GSFC)

Revised Gavdos GVD5 Height: 21.7805 m

Previous Gavdos GVD5 Height: 21.7620 m

Δh Correction to previous Bias: -0.0185 m

Δh Correction due to TRF change: 0.0246 m

Correction due to Seasonal ΔSLA: -0.0080 m

Δh due to ΔGDR from v.A to v.B (cycle dependent)

REVISED JASON-1 BIAS: 107.5 ± 8 mm

