



Eastern Mediterranean Tide Gauge Network – eMACnet

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Abstract

The eastern Mediterranean Altimeter Calibration network—eMACnet, is the result of collaborative efforts in the Aegean since 2001. Originally with one permanent absolute calibration facility (Gavdos) and recently with a second site at Kasteli, Crete, Greece, both of these sites in collaboration with a local team from the Tech. Univ. of Crete. Since 2008 our team expanded to include the Nat. Tech. Univ. of Athens (NTUA). The primary purpose of the extended network is the calibration and validation of altimetry missions. However, over the past years we have initiated a near real-time release of sea-level observations from our sites using EUMETCAST and the GTS. We hope that the availability of that data will help in other applications beyond altimeter calibration. The locations of our sites for example are also of interest to tsunami warning networks. We thus intend to provide our observations in near real-time to the European Tsunami Warning System (ETWS). At present, KASTELI in western Crete is delivering 1-minute sampled data every 15 minutes via EUMETCAST, and the original site at GAVDOS will follow by early September, 2011. Four more tide gauges are in operation at the sites of PALEKASTRO, eastern Crete (with CGRS), MANI-KARAVOSTASI, in southern Peloponnese, EMPORIO, Chios, and THASOS, in Northern Aegean. An additional system along with a CGRS receiver will be deployed at KYMI, north of Athens on the island of EVIA, followed by one on northern mainland Greece. Our cooperation with the Hellenic Navy Hydrographic Service (HNHS) will allow us to tap into the network of tide gauges that they operate, while they will benefit from the availability of our data, making the combined network one of the most complete in the Aegean area. Our future plans include in addition to installation of more stations the completion of CORS GNSS systems at all of the existing sites for a complete and absolute characterization of sea-level change in the area.

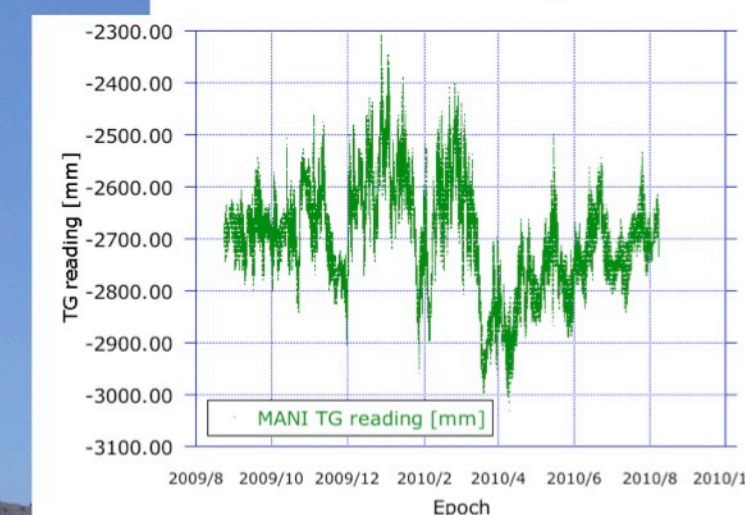
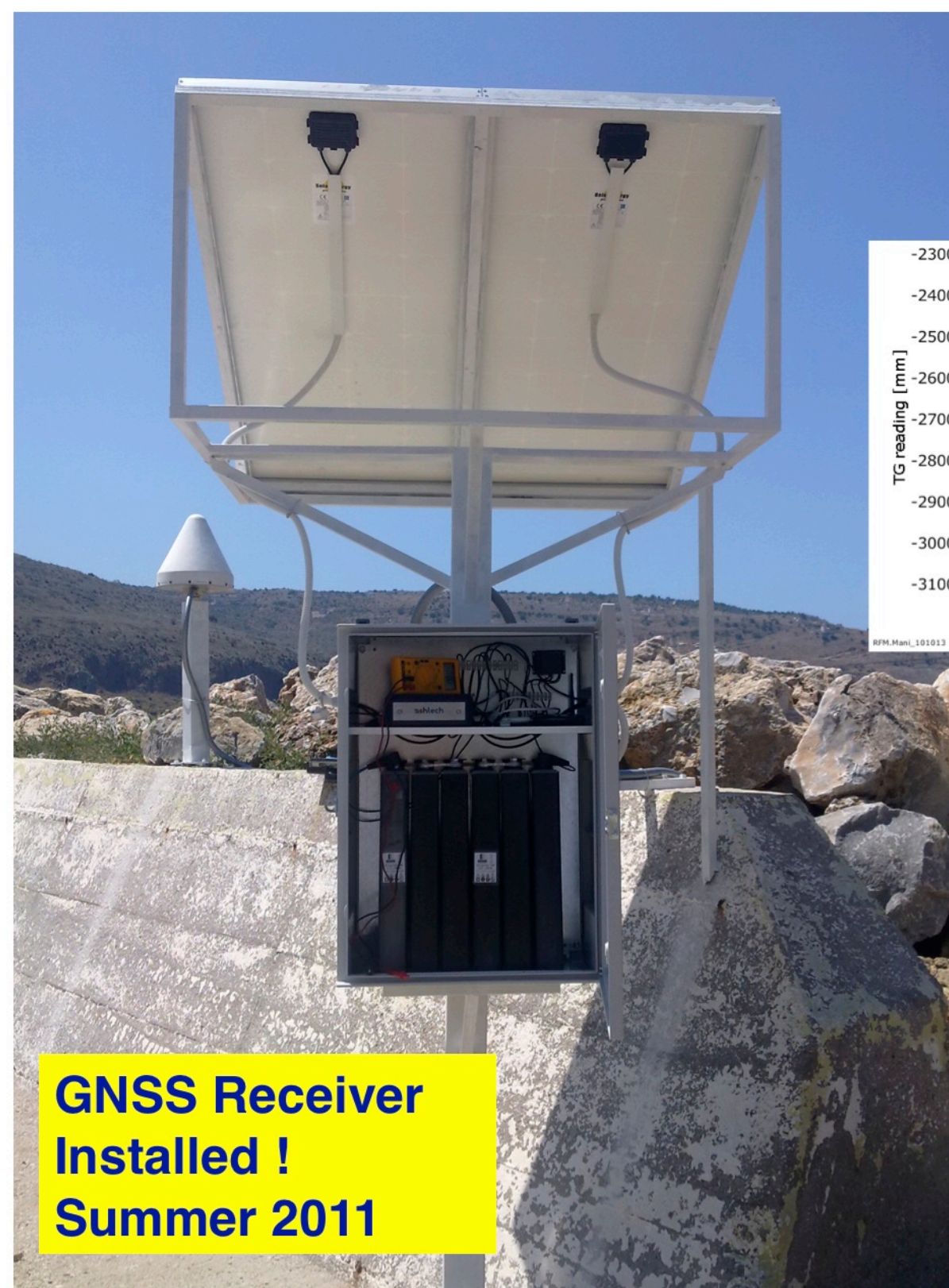
During the summer of 2011 the MANI site was completed with the installation of a Continuously Operating Reference Station (CORS) and the required power generating facility since the location is not on the national grid. The facility is designed to support the addition of a telemetry system that will send the sea-level measurements directly to EUMETSAT and release them to GTS, in a similar manner as in KASTELI.

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.

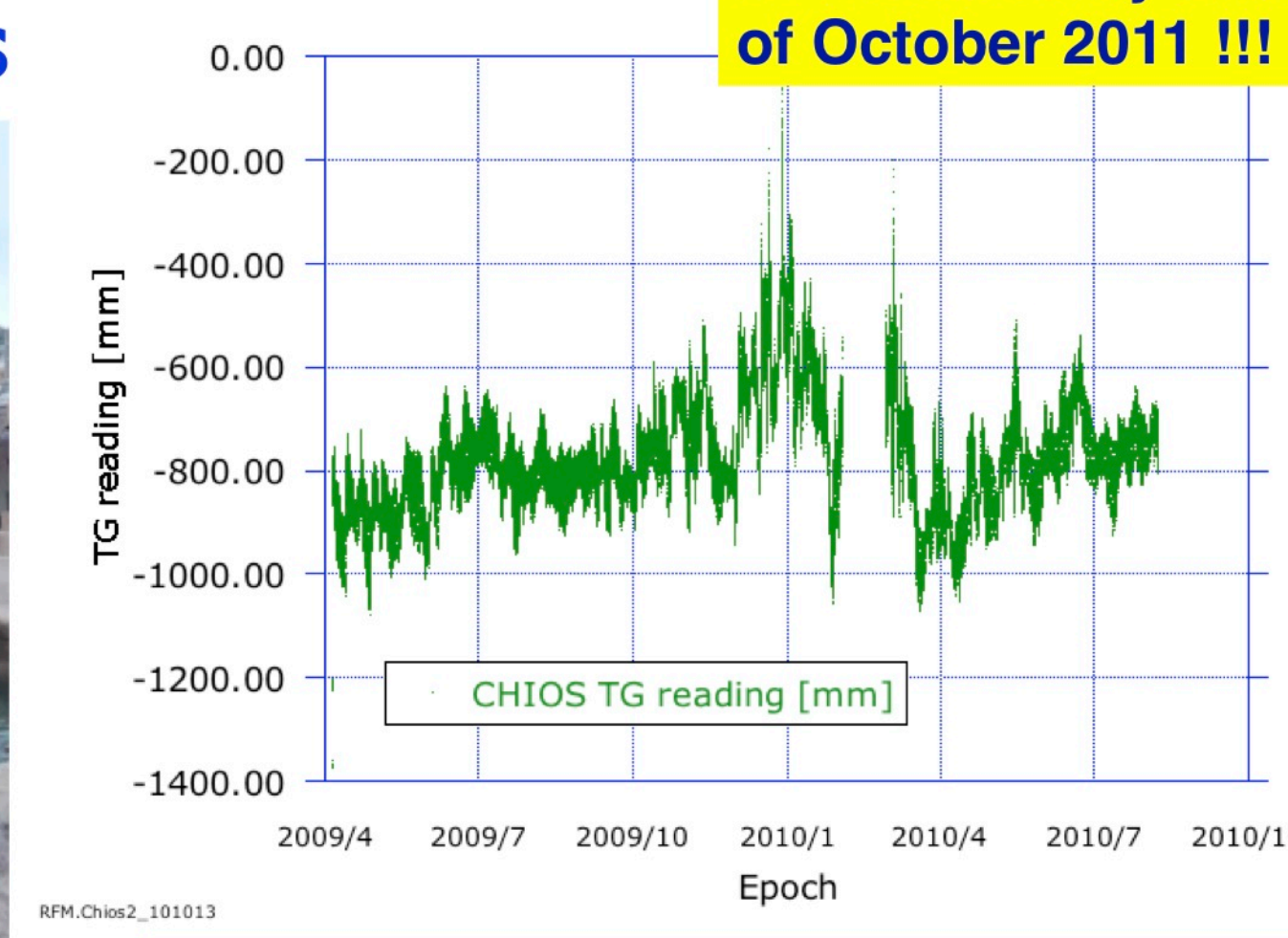
Pavlis, E. C., S. P. Mertikas and the GAVDOS Team. 2004. The GAVDOS Mean Sea Level and Altimeter Calibration Facility: Results for Jason-1, 3rd Jason special issue, *Mar. Geod.*, (27), 3-4, DOI:10.1080/01490410490902106, pp. 631-655.

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).

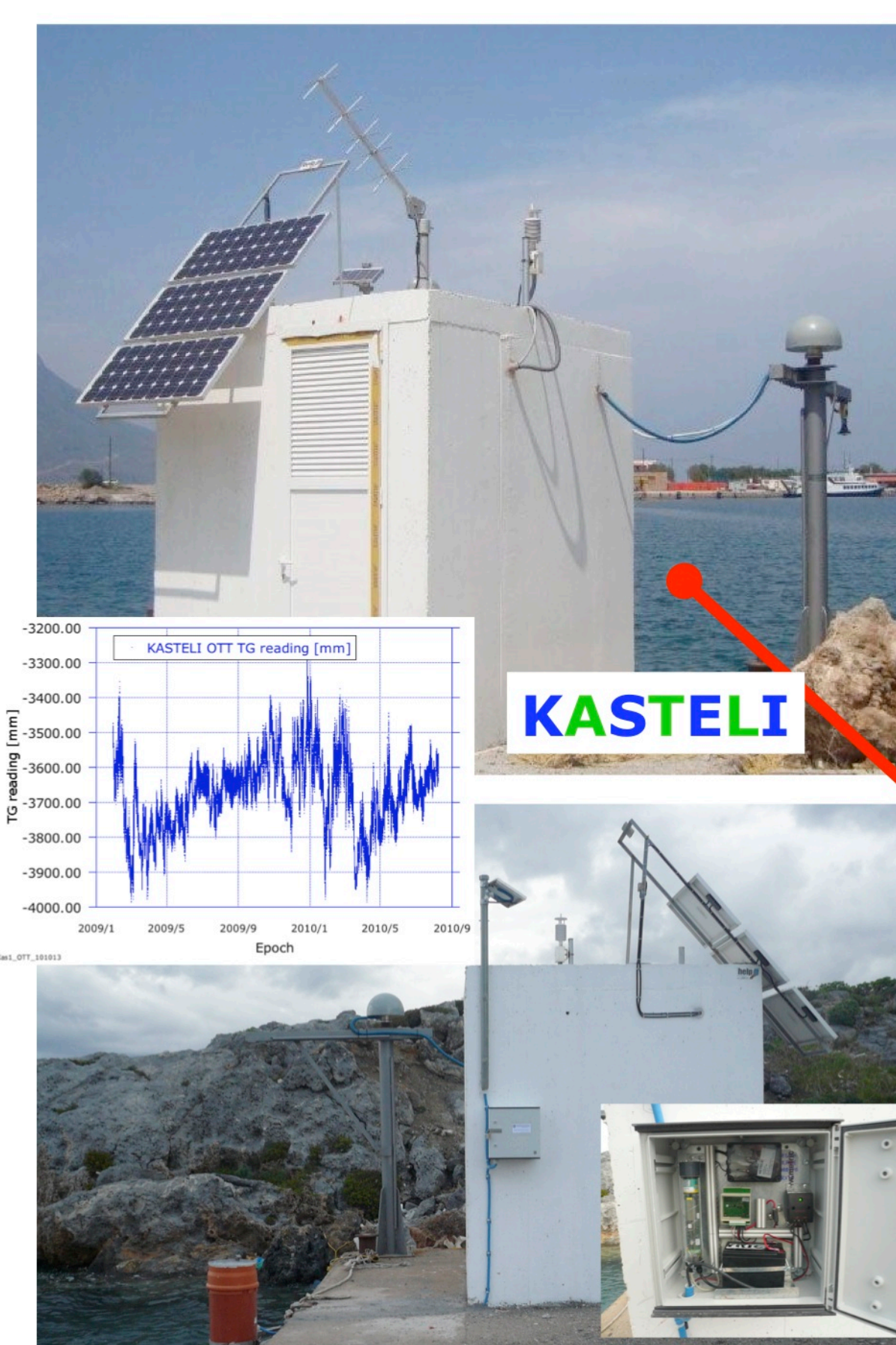


MANI-KARAVOSTASI

EMPORIO, CHIOS



GNSS Receiver will be installed by end of October 2011 !!!

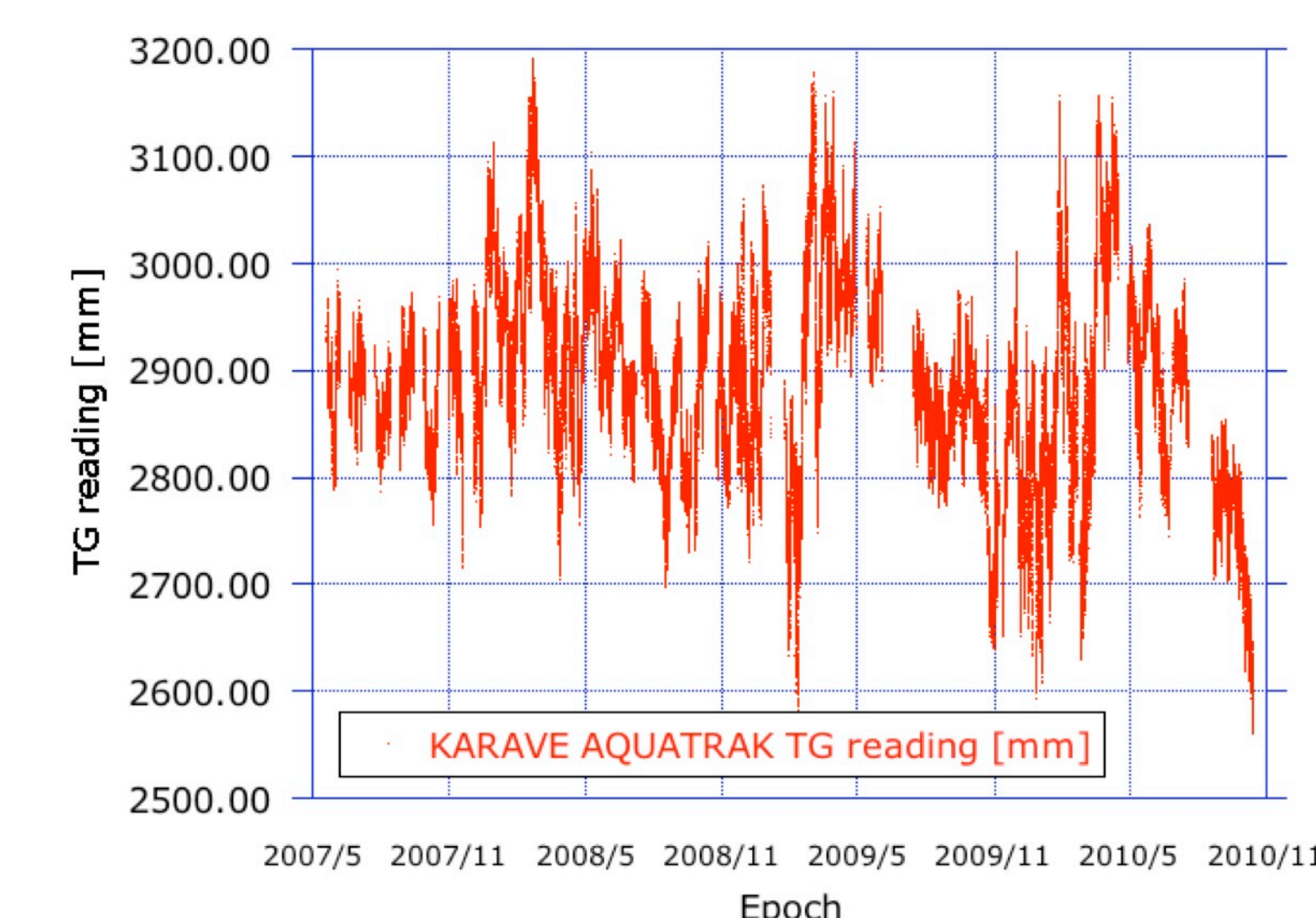


RADAR & FLOATER TIDE GAUGES AT KASTELI, CRETE

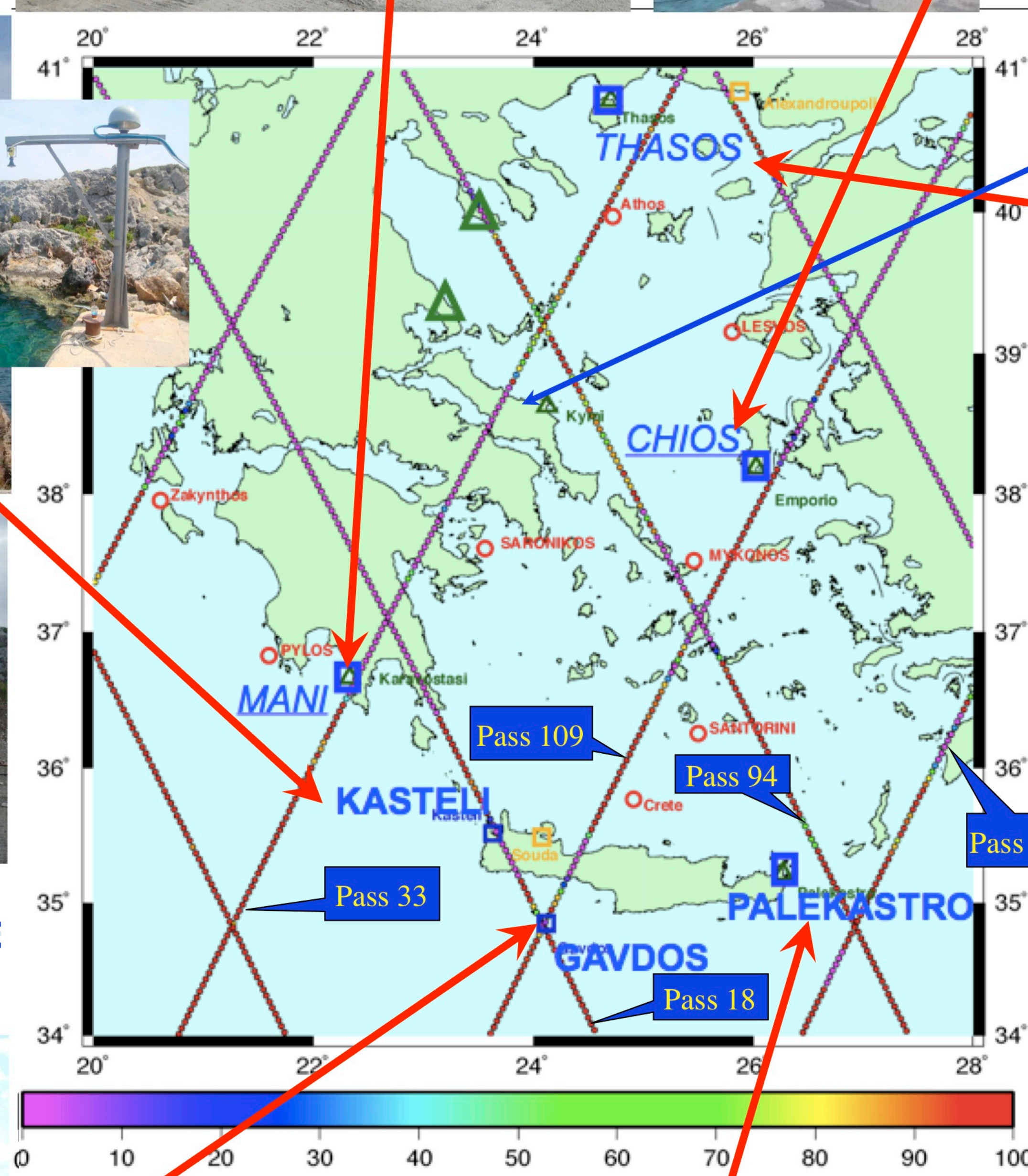


PALEKASTRO, CRETE GPS

RELOCATED (FALL 2010) GAVDOS KARAVE, CRETE



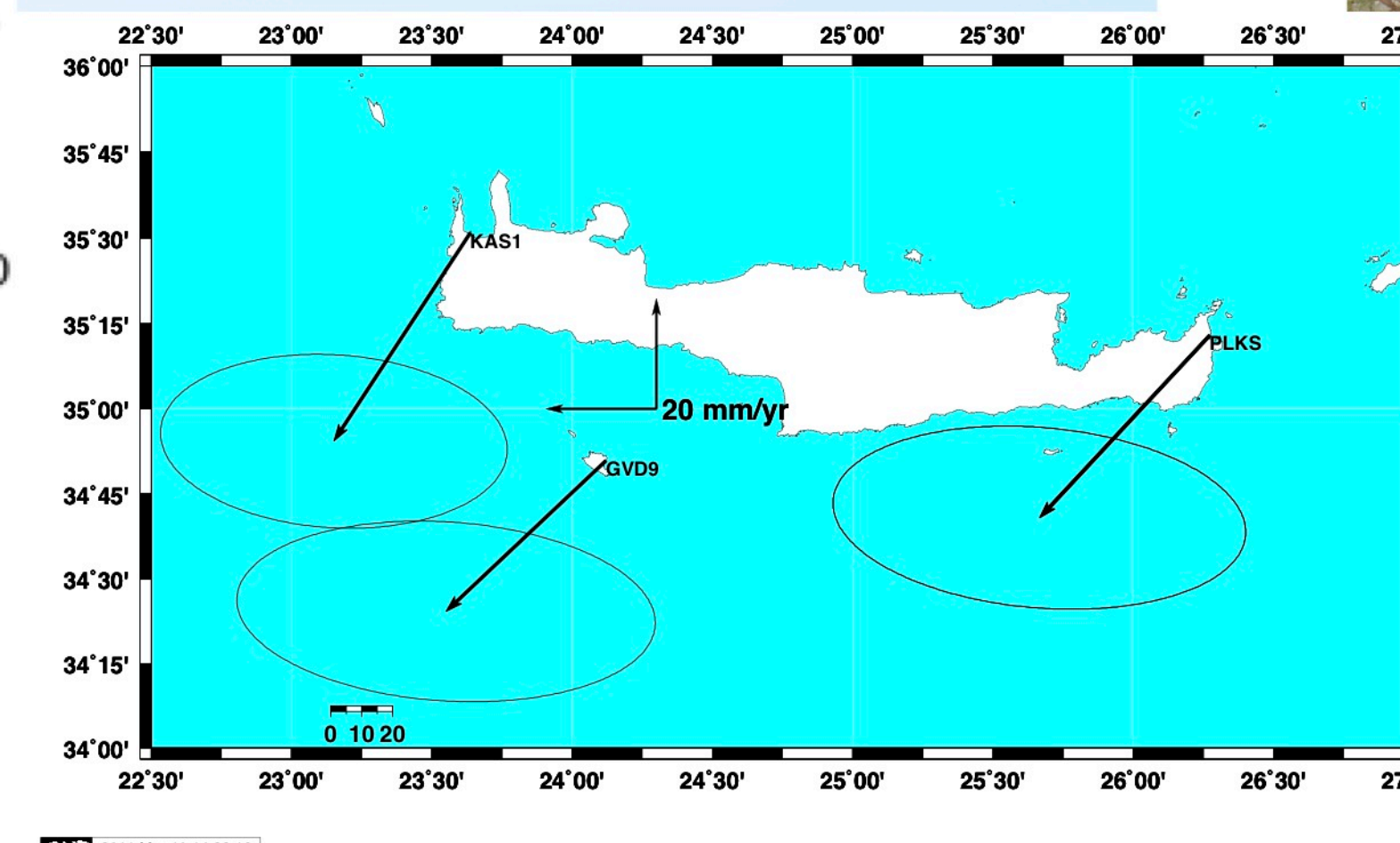
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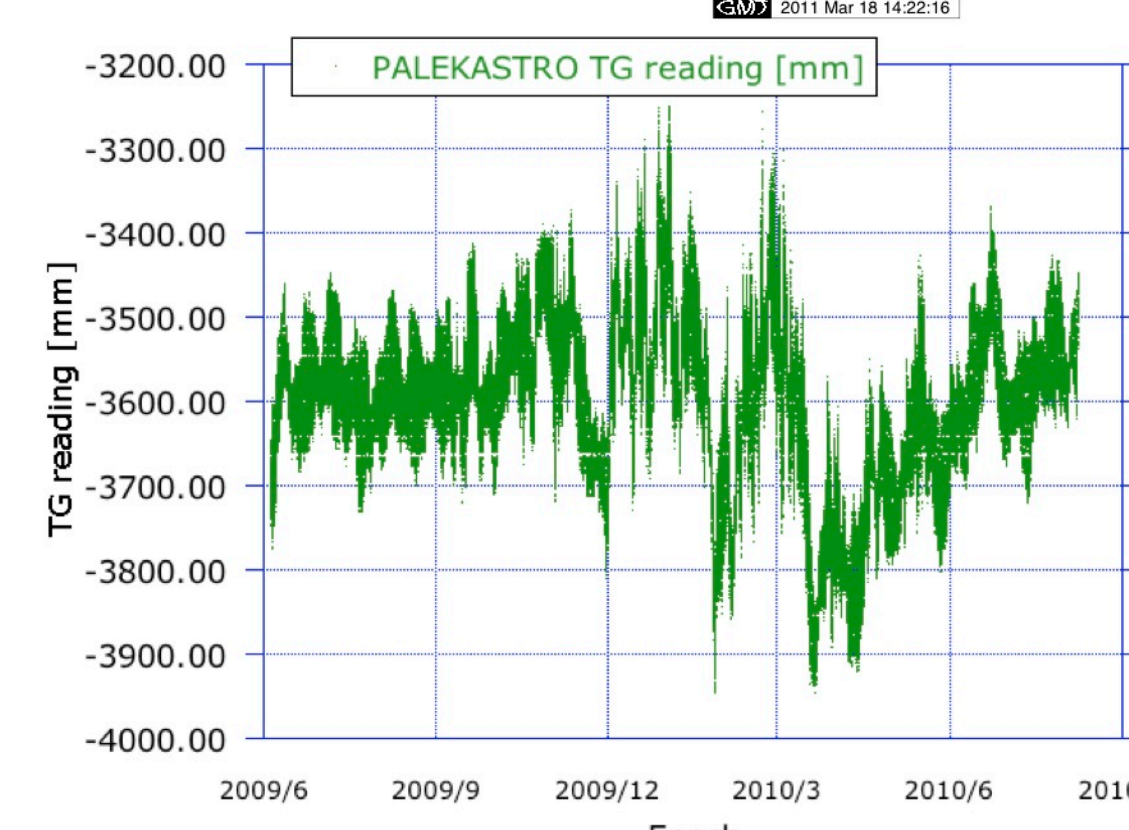
ONLY ONE SITE LEFT TO BE INSTALLED: KYMI, ON EVIA, TIDE GAUGE PLUS GPS (Spring '12)

GEST - Goddard Earth Science and Tech. Center
NTUA - National Technical University of Athens
HNHS - Hellenic Navy Hydrographic Service
HCMR - Hellenic Center for Marine Research

- Existing sites (GEST/NTUA)
- Existing sites (HNHS)
- New sites (NTUA/GEST)
- Present Buoy sites (HCMR)



GPS-derived velocities from GAMIT/GLOBK based on the recent 2008-2011 data set

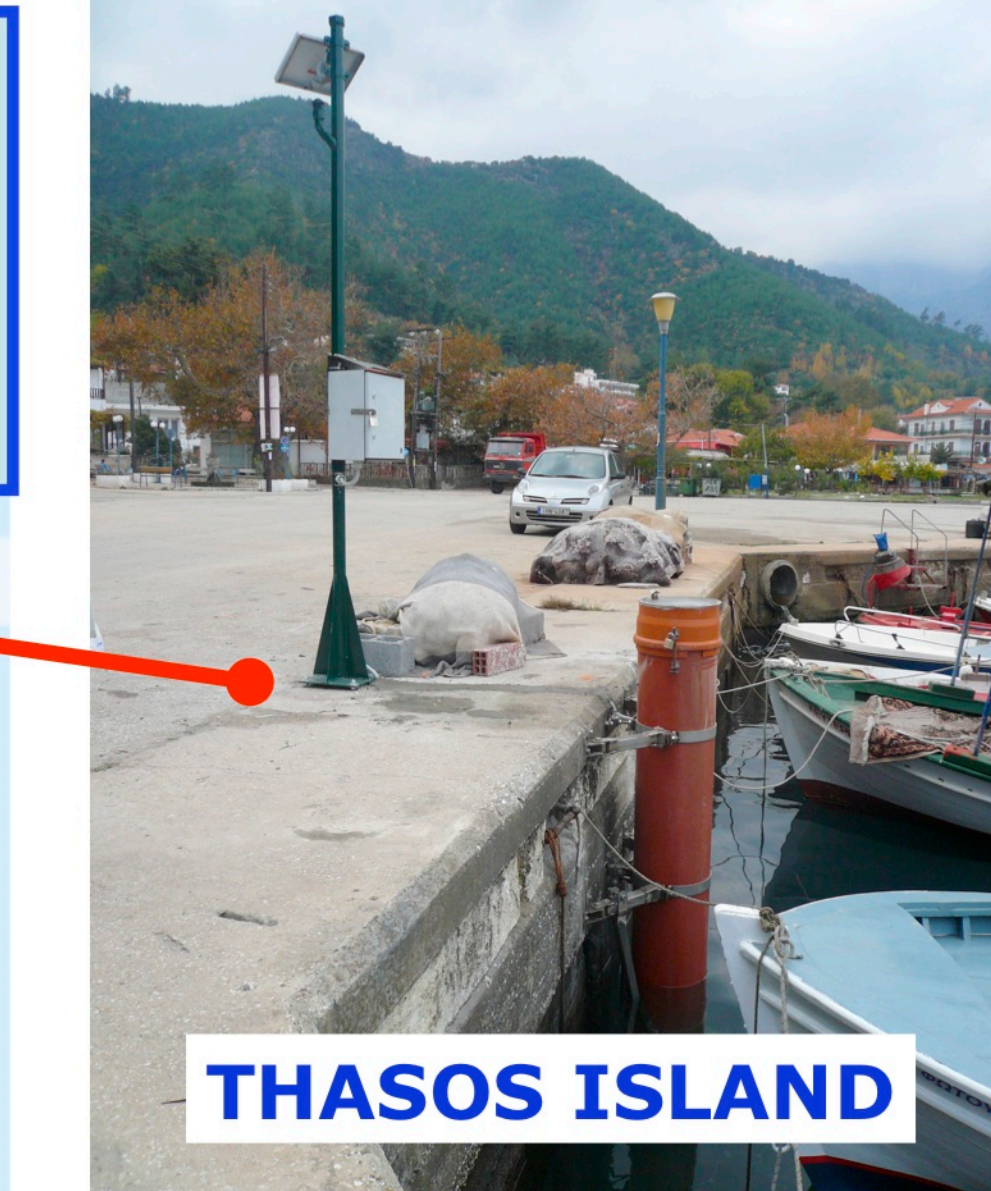
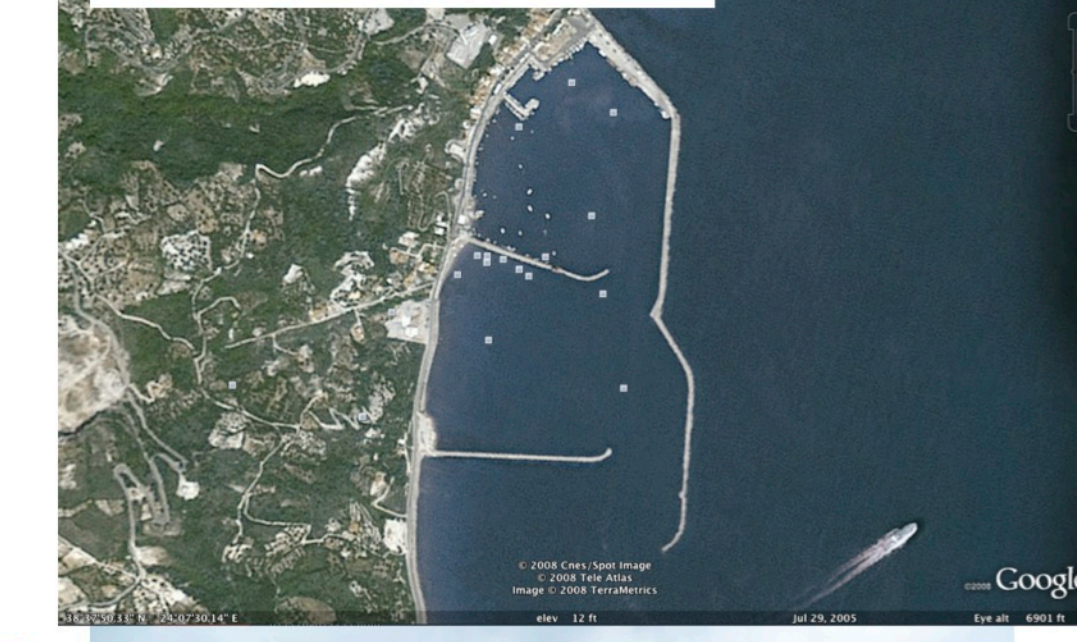


Aegean region tracks of OSTM and the eMACnet network. In cyan the operational sites, in yellow the future site of KYMI (Evia).

Future Sites NEA SKIONI



KYMI on EVIA



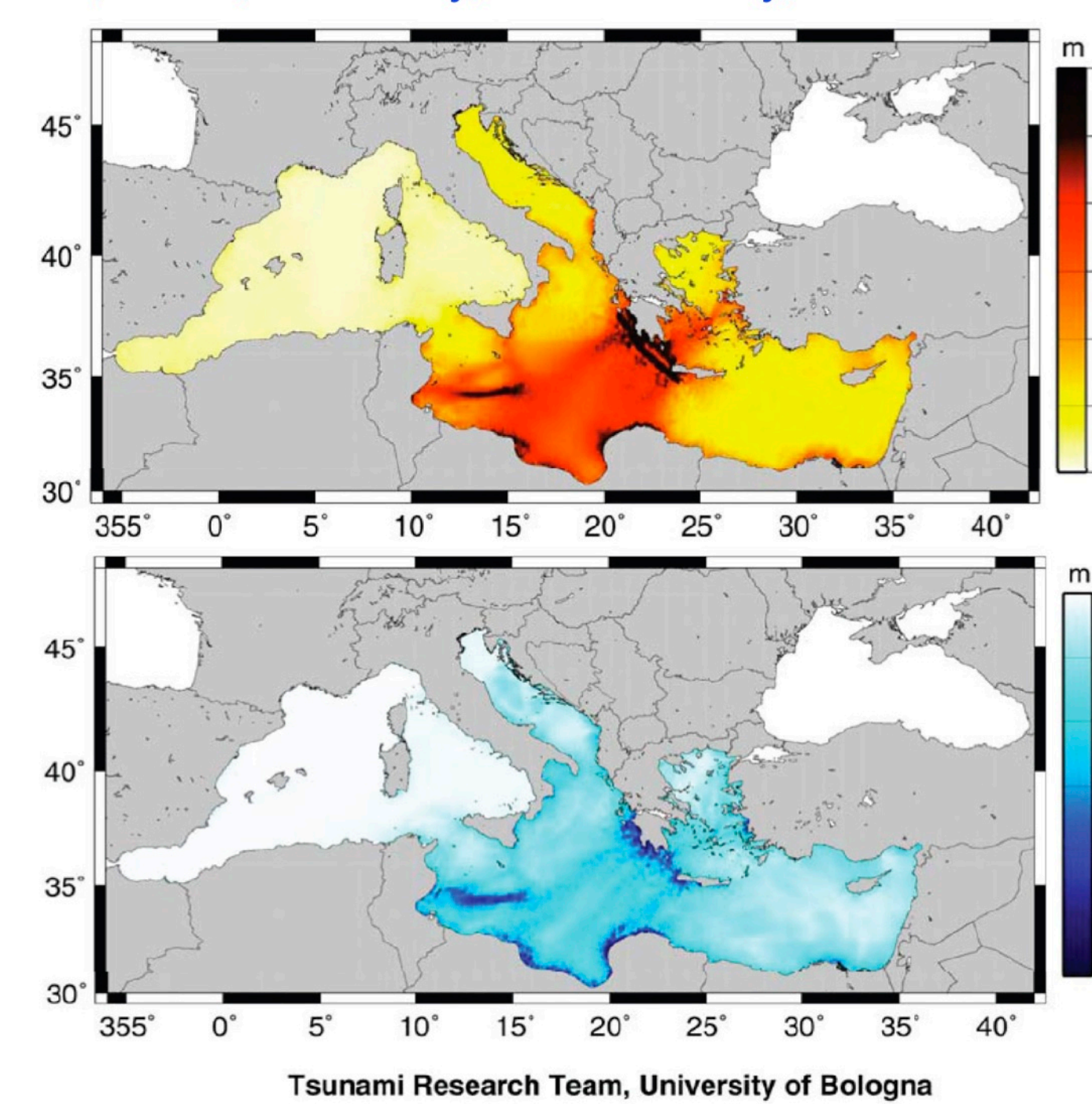
Typical Installation of a Thalimedes™ System



Tsunami Hazard for Eastern Mediterranean

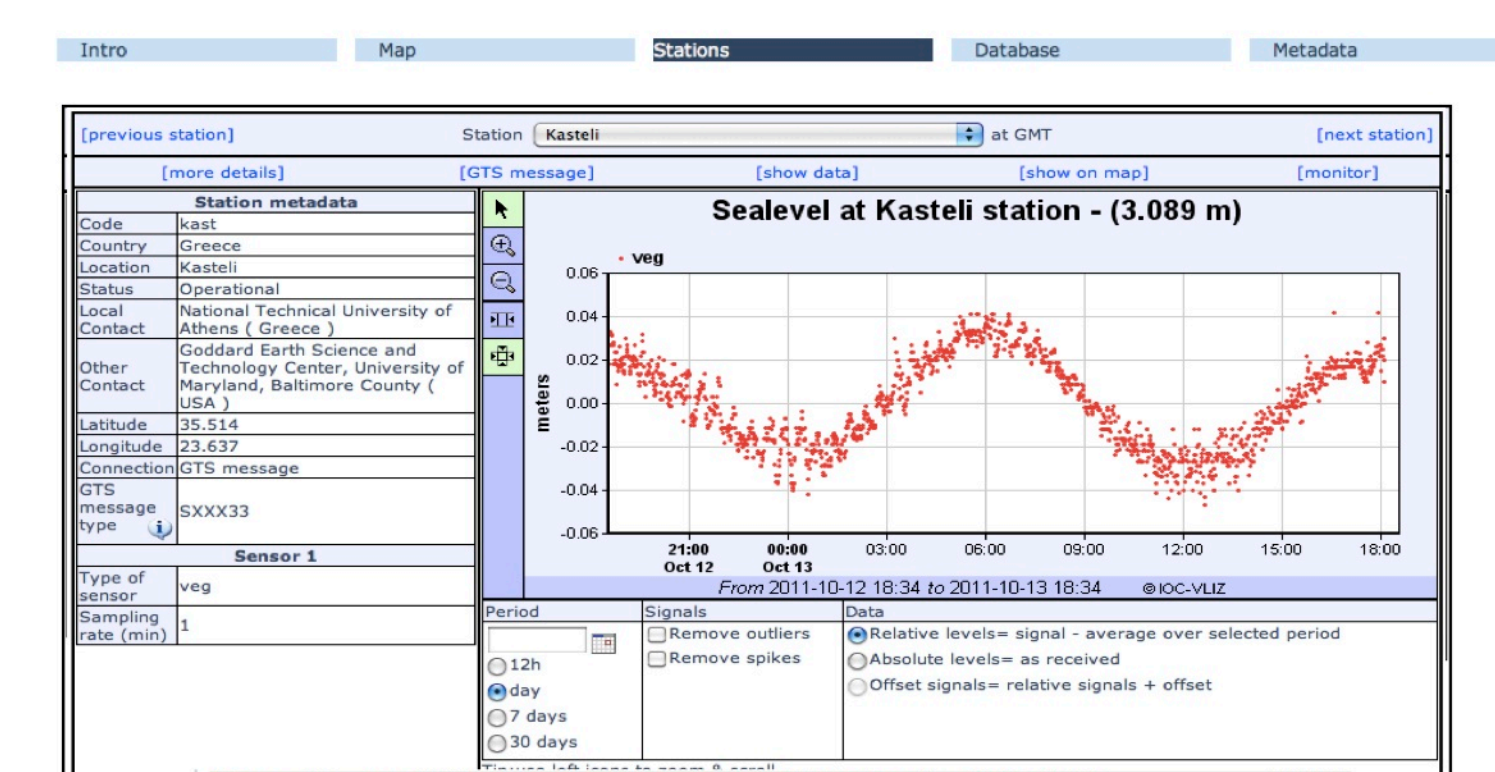
Tsunami maxima (red) and minima (bleu) from predictions of the Bologna group (right), and below, their progression of a western Crete tsunami and associated sea level anomalies.

Tinti, S. (2007), Overview of the activities of the ICG/NEAMTWS, presented at NEAMTWS III, Bonn, Germany, 7-9 February, 2007.



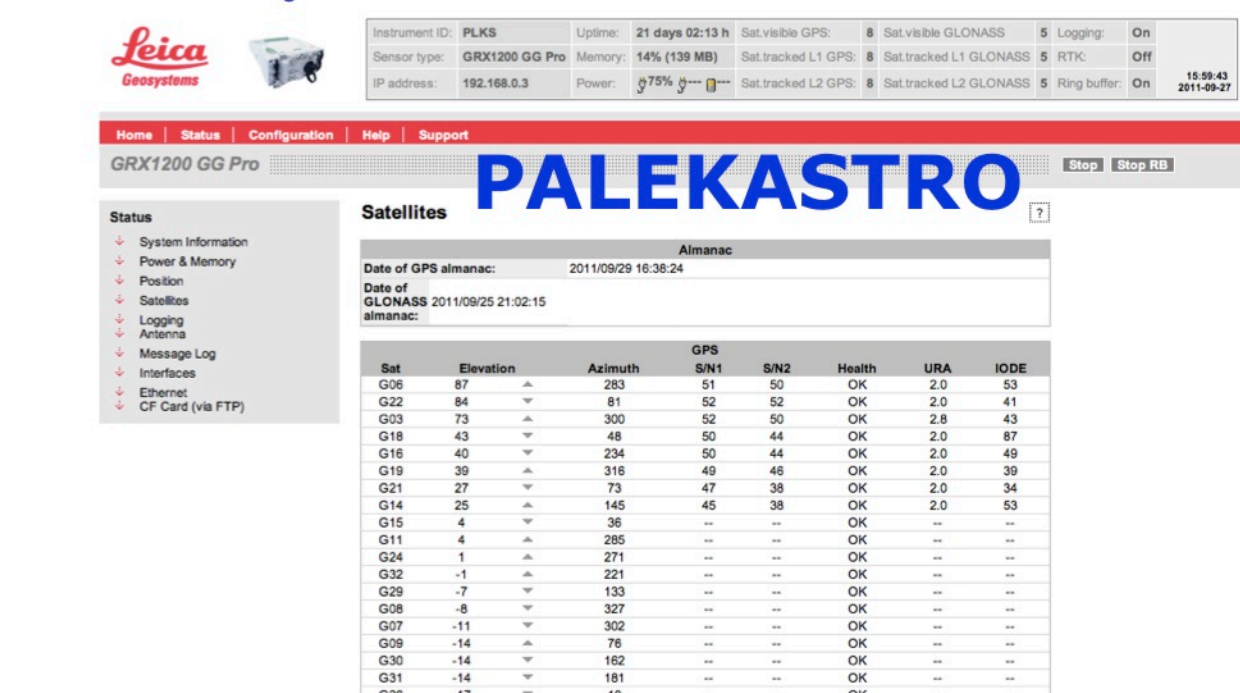
Sea-level data on GTS

SEA LEVEL STATION MONITORING FACILITY



MANI

Remotely Controlled GNSS Receivers



Summary

The Aegean network eMACnet is the outgrowth of the Gavdos facility that was established during 2001-2003. The current network encompasses the KARAVE site on Gavdos, the KASTELI site that was established during 2004-2008, and five new sites that are now instrumented under the new network. One of these is co-located at KASTELI, to calibrate the new float-type tide gauges (Thalimedes™ of OTT) with the RADAR-type system (VEGAPULS 61™) which we installed in 2007. The data are collected locally as well as via DCP upload to METEOSAT and then downloaded from EUMETSAT's internet facility. A new site with identical system and a CORS GNSS is now operating at PALEKASTRO, at the easternmost tip of Crete. Three other tide gauges were installed and now operate at MANI, THASOS, and EMPORIO, Chios. The last site is slated to go to KYMI, Evia in early 2011 and it will be equipped with a CORS GNSS also. The MANI site now has a GNSS receiver installed and EMPORIO, Chios will also have a GNSS receiver installed by the end of October 2011. The old KARAVE site on Gavdos was relocated to its final position at a permanent housing provided by the Hellenic Navy Hydrographic Service in the fall of 2010. The new site (GVD9) was tied to the old one (GVD5) via GPS and leveling surveys.

Data for sea-level from the network are applicable to many areas: altimeter calibration (original purpose for the network), for a tsunami warning system, the monitoring of regional sea-level and the coastal studies for coastal erosion, etc. The GNSS data are also used for the tectonic monitoring of seismic hazards, since the network is situated in an area that is tectonically one of the most active in the world.

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