Rendiconti online Soc. Geol. It., Vol. 2 (2008), 1-3

Tsunami Warning prototype in the frame of the EC NEAREST project.

FRANCESCO CHIERICI (*), NEVIO ZITELLINI (**), PAOLO FAVALI (***), LAURA BERANZOLI (***), LUCA PIGNAGNOLI (**), DAVIDE EMBRIACO (***), GABRIELA CARRARA (**), GIUDITTA MARINARO (***), NADIA LO BUE (***), STEPHEN MONNA (***), FRANCESCO GASPARONI (°), FLAVIO FURLAN (°), FEDERICO BRUNI (°)

ABSTRACT

Prototipo di Tsunami Warning nel quadro del progetto EC NEAREST

Nell' ambito del progetto NEAREST finanziato dalla EC sono stati sviluppati alcuni elementi di un sistema di allerta per tsunami, fra i quali un prototipo di detector di onde anomale istallato a bordo dell' osservatorio abissale GEOSTAR: l' osservatorio con il detector di onde anomale ha operato per un anno nel Golfo di Cadice, a 3200m di profondità

Key words*: seafloor observatories, tsunami detection, 1775 earthquake, Cadiz Gulf*

INTRODUCTION

On August 25th 2007 a tsunami detector installed onboard the multiparametric observatory GEOSTAR (FAVALI *et alii*, 2006) was successfully deployed at 3200 b.s.l. in the Gulf of Cadiz, Portugal (Fig. 1). This activity is within the NEAREST EC Project (http://nearest.bo.ismar.cnr.it/). Among other deliverables, the NEAREST project will produce and test the basic parts of an operational prototype of a near field tsunami warning system. This system includes an onshore warning centre, based on the geophysical monitoring networks which are already operating, and a tsunami detector installed on board GEOSTAR. On land the warning centre is in charge of collecting, integrating, and evaluating data recorded at sea. At the sea bottom, data are recorded and processed by an advanced type of tsunami detector which includes a pressure sensor, a seismometer and two accelerometers. The detector communicates acoustically with a surface buoy in two-way mode. The buoy is equipped with meteo station, GPS and tiltmeter and is connected to a shore station via satellite dual-link. The prototype is designed to operate in tsunami generation areas for detection-warning purpose as well as for scientific measurements. The tsunami detector sends a near-real-time automatic alert message (Fig. 2) when a seismic or pressure threshold are exceeded. Pressure signals are processed by the tsunami detection algorithm and the water pressure perturbation caused by the seafloor motion is taken into account. The algorithm is designed to detect small tsunami waves, less than one centimetre, in a very noisy environment. Our objective is to combine a novel approach to the tsunami warning problem (DART website), with a study of the coupling between the water column perturbations and seafloor motion, together with the long term monitoring of geophysical, geochemical and oceanographic parameters.

NEAREST PILOT EXPERIMENT IN CADIZ GULF

The Gulf of Cadiz is a highly populated area, prone to devastating earthquakes and tsunamis (e.g., 1755 Lisbon earthquake, BAPTISTA *et alii*, 2003). More than ten years of geological and geophysical investigations offshore SW Iberia have been collected (multibeam bathymetry, side-scan sonar, high-resolution and multichannel seismics, and sampling which probed the first kilometres of the upper crust at various resolution) (see Fig. 1).
Recognition and mapping of active tectonic structures likely to generate large earthquakes and tsunamis have been performed.

THE TSUNAMI DETECTOR

The tsunami detector is capable of real-time recognition and transmission of sea water anomalies and seismic signals to

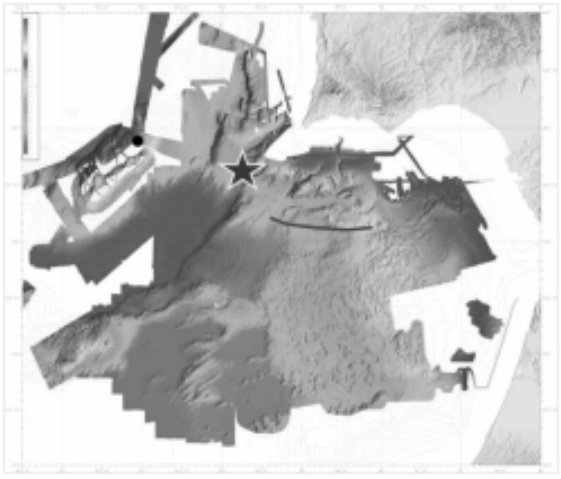

Fig. 1: Deployment site in the Gulf of Cadiz

(**) Istituto di Radio Astronomia-INAF
(**) Istituto di Scienze Marine-CNR
(***) Istituto Nazionale di Geofisica e Vulcanologia (INGV)
(°) Tecnomare S.p.A.

shore stations. The new Tsunami detector (grey labels in the sensors in the table below), is installed onboard the pre-existent GEOSTAR multiparameter abyssal observatory, that can collect a wide variety of different geophysical and oceanographic data (Fig. 3).

Sensor	rate	Acquisition
Triaxial broad band seismometer	100Hz - 3 comp. (0.016-100 Hz f.r)	Continuous + triggered events
Triaxial accelerometer	100Hz - 3 comp.	Continuous + triggered events
Hydrophone	100Hz	Continuous
Pressure sensor	15sec or 1-5 sec	Continuous
Accelerometer +Gyros (Structure attitude)	100Hz - 6 comp. (0.3 mg at 2g)	Only on triggered events
Gravity meter	1Hz	Continuous
CTD + Transmissometer	1smp/hour	Continuous
ADCP	1profile/hour (40 layers/3 comp.)	Continuous
Currentmeter	5Hz	Continuous

The tsunami detection procedure is based on trigger on pressure and seismic events:

- Seismometer: trigger on local strong earthquakes (STA/LTA);
- Pressure: detection of sea level anomalies (Tsunamis wave): trigger on processed sea level data compared to the assigned threshold (MOFJELD, 2000).

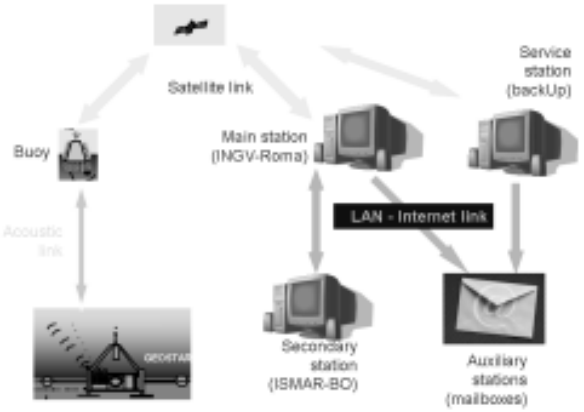

Fig.2

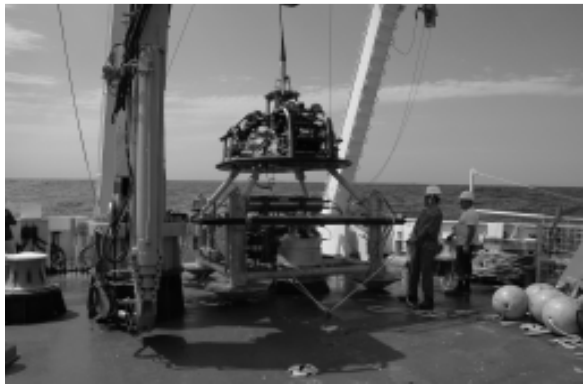

Fig. 3: GEOSTAR observatory

REFERENCES

BAPTISTA M. A., MIRANDA J.M., CHIERICI F. & ZITELLINI N. (2003). - *New study of the 1755 earthquake source based on multi-channel seismic survey data and tsunami modelling*, Natural Hazards and Earth System Sciences, **3(5)**, 333-340.

DART DATA WEB SITE:
http://www.ngdc.noaa.gov/seg/hazard/DARTData.shtml.

MOFJELD H.O. (2000) - *Tsunami Detection Algorithm* Available at: http://nctr.pmel.noaa.gov/tda_documentation.html

FAVALI P., BERANZOLI L., D'ANNA G., GASPARONI F., MARVALDI J., CLAUSS G., GERBER H.W., NICOT M., MARANI M.P., GAMBERI F., MILLOT C. & FLUEH E.R. (2006) – *A fleet of multiparameter observatories for geophysical and environmental monitoring at seafloor*, Ann. Geophys., **49**, 2/3, 659-680.