Project n. 037110

NEAREST

"Integrated observations from NEAR shore sourcES of Tsunamis: towards an early warning system"

Instrument: STREP

Thematic priority: 1.1.6.3 GOCE (GlObal Change and Ecosystems)

FINAL PUBLISHABLE ACTIVITY REPORT

Period covered: from 1/10/2006 to 31/03/2010

Date of preparation: **June 2010**

Start date of project: 1/10/2006

Duration: **3 years + 6 months**

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Project coordinator organisation name: ISMAR BO

FINAL PUBLISHABLE ACTIVITY REPORT

To face the geo-hazard connected to the tectonic structures that are potentially tsunamigenic and are located near the coast, as it occurs in the whole Mediterranean area, the consortium coordinated by ISMAR within the NEAREST project proposed to install the tsunami-detection sensors directly on top of the tsunamigenic structure. The continuous monitoring of the potential tsunami source becomes thus the "heart" of the Tsunami Early Warning System (TEWS) prototype implemented within NEAREST. In fact, after decades of intensive studies we still do not know if a tsunami is generated subsequent to an earthquake occurring at sea. This fact has heavily limited the development of an efficient method to prevent the loss of lives in populations residing in coastal areas when the tsunamigenic earthquake occurs. Besides, it is almost impossible to fill vast marine areas with sensors able to detect the tsunami immediately after its generation, as installing and maintaining an extensive network of sensors is extremely costly. Our limitations in case a seismic event occurring close to the coast were clear during the Samoa-Sumatra recent events. On Sept. 29 2009, at 17:48Z, a moment magnitude Mw 8.1 earthquake (Global CMT Havard project), with hypocenter at 33 km depth, impacted the Samoa Islands region with the generation of a tsunami. The first tsunami warning was issued sixteen minute later, at 18:04Z, by the Pacific Tsunami Warning Centre with 17:59Z forecast for tsunami arrival to the closest tide gauge of Pago Pago. So, at the time of the warning, the tsunami already impacted the closest island. The following day, another strong earthquake occurred offshore Sumatra but, this time, without generation of tsunami.

In the frame work of NEAREST the Gulf of Cadiz was selected as test area because:

i) earthquake and tsunami prone, as testified by the 1st November 1755 Lisbon Earthquake;
ii) the source areas of 1755 earthquake was located at sea;
iii) the good knowledge of the tsunamigenic sources location thanks to a decade of intense geophysical and geological investigations;
iv) the potential tsunamigenic sources are very well geometrically defined;
v) the tectonic sources are located near the coast.

Given these "a priori" conditions, NEAREST planned not only to implement a regional TEWS, but also to detect the tsunami close to the generation area and follow it until the moment of its impact on the coast. This approach gave to NEAREST the opportunity to study the "tsunami generation problem" and to provide an operational example for the civil authorities/institutions to implement and maintain a permanent regional TEWS. To accomplish the abovementioned project objectives a pool of ten scientific institutions and one private company was involved in the project as contractors:

Participant name	**Participant short name**	**Country**
Istituto di Scienze Marine di Bologna - CNR	ISMAR-BO	Italy
Fundação da Faculdade de Ciências da Universidade de Lisboa	FFCUL	Portugal
Consejo Superior de Investigaciones Cientificas	CSIC	Spain
Alfred-Wegener-Institute fur Polar-und Meeresforschung	AWI	Germany
Université de Bretagne Occidentale	UBO	France
Istituto Nazionale Geofisica e Vulcanologia	INGV	Italy
Technische Fachhochschule Berlin	TFH	Germany
Instituto Andaluz de Geofísica	UGR	Spain
Instituto de Meteorologia	IM	Portugal
Centre National pour la Recherche Scientifique et Technique	CNRST	Morocco
XISTOS Développement S.A	XISTOS	France

Summarising, NEAREST (Integrated observations from **Near** Shore Sourc**es** of **T**sunamis: towards an early warning system) planned:

i) to complete the identification and characterisation of large potential tsunami sources located near shore in the Gulf of Cadiz;

ii) the improvement of near real-time detection of signals by a multiparameter seafloor observatory to be used in the development of an Tsunami Early Warning System (TEWS) prototype. The NEAREST methodological approach was based on the cross-checking of multiparameter time series acquired on land by seismic and tide gauge stations, on the seafloor and in the water column by broad band Ocean Bottom Seismometers (OBS) and a multiparameter deep-sea platform.This latter was equipped with real-time communication to onshore warning centres located in Lisbon, Rabat and Granada.

iii) the improvement of integrated numerical models enabling more accurate scenarios of tsunami impact and the production of accurate inundation maps in selected areas of Algarve (SW Portugal), strongly affected by the 1755 tsunamis;

iv) the search for sedimentological evidence of tsunami records to improve the knowledge on the recurrence time for extreme events, trying also to measure the key parameters for the comprehension of the tsunami-impact processes.

The methodology proposed by NEAREST can now be extended to other near-shore potential tsunamigenic sources, such as the Central Mediterranean (Western Ionian Sea), Aegean Arc and Marmara Sea. In view of the stated targets, NEAREST main activities and results can be summarized as follows:

1) Completion of the identification and characterisation of the potential large tsunami sources in the Gulf of Cadiz and in SW Portugal.

2) Development of a Tsunami Early Warning System (TEWS) Prototype based on the direct monitoring of a potential tsunamigenic structure located near the coasts of SW Iberia.

3) Sedimentological evidence of paleo-tsunamis and paleo-earthquakes.

4) Circulation of project information.

1) Completion of the identification and characterisation of the potential large tsunami sources in the Gulf of Cadiz and in SW Portugal.

The large amount of geological and geophysical investigation offshore SW Iberia available to NEAREST partners allowed the recognition and the mapping of the active tectonic structures plus the mapping of the sediment instabilities that may trigger and/or enhance tsunamis. Notwithstanding this level of knowledge, to achieve the full comprehension of the source region, it was required to proceed one step further by unravelling the possible existence of common decollement faults between the various tsunamigenic structures and to correlate the earthquake activity with ruptures and faults. To reach this stage of understanding it was needed: (a) to detect precisely the low magnitude earthquake events and (b) to define the crustal velocity of the offshore of SW Iberia. To achive these goals NEAREST consortium:

i) reviewed approximately 20,700 km multi-channel seismic lines, and 180,000 km^2 of multi-beam bathymetry and reflectivity data of the Gulf of Cadiz. The main outcome of this work, coordinated by FFCUL, is the new tectonic map presented in figure 1. Two major results are noteworthy: the estimation of the maximum magnitude earthquake of each one of the mapped active faults (fig. 1 and Table 1).

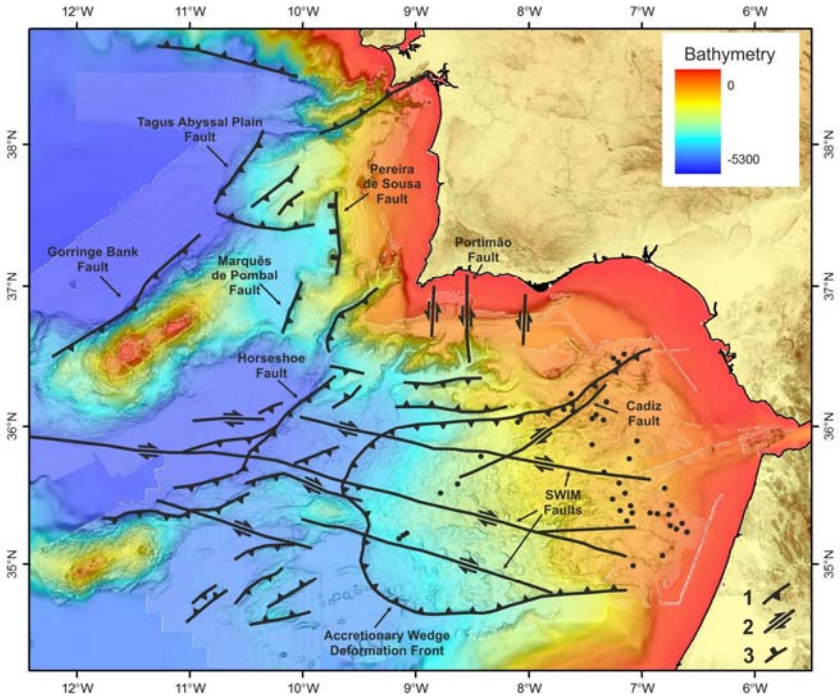


Figure 1 – Tectonic map of SW Iberia resulting from this study.

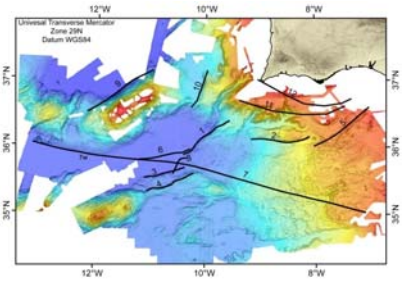
A major result was the discovery of a set of regional active, possibly dextral, transcurrent faults, WNW-ESE oriented and distributed over a band 600 Km long termed "SWIM Faults". (Zitellini et al., 2009, The Quest for the Africa-Eurasia plate boundary West of the Strait of Gibraltar") published by EPSL;

ii) reviewed the sediment re-mobilisation due to slope instabilities carrying out the integrated analysis of the mentioned geophysical datasets and sediment cores acquired since the early nineties. The parameters of each of the relevant landslides of the Gulf of Cadiz were outlined, including information of water depth range, head-scarp (height, width, and length), total surface affected, surface of the deposit, slope gradient (source area and depositional area), run-out distance, volume and estimated age. Mass movement typologies in the Gulf of Cadiz are dominated by mass slides and gravity flows (Table 1).

The alternation between transparent (debris flows) and stratified units (hemipelagic) observed on the seismic profiles could suggest a cyclic activity of the faults associated to the flows. For example, Sand flows, seem to be associated with the distal parts (> 10 km basinward) of the North Gorringe avalanche. Regarding the characterization of the Gulf of Cadiz slides, we can infer that the largest movements tend to occur in deep waters (water depth ranges between 2000 and 5000 m) with important height drops (> 1.5 km) and source areas with moderate to high slopes (average 8º). The area of the mass movements ranges from relatively small (190 km2) as at the Marques de Pombal to large (2800 km2), as it is the case of the complex South Gorringe slide (Table 1). Run out distances average 30 km. The transported volumes range from very laminar slides as the Marques de Pombal (1.3 km3) to large displaced masses as in the South Gorringe which reaches up to 210 km3.

Regarding the age of emplacement, although order events (Miocene-Pliocene) have long been identified in the Gulf of Cadiz, the mapped landslides range in age from Upper Pleistocene to Holocene. In summary, most of the landslides identified in the Gulf of Cadiz occur in deep waters and are of small volume, and rarely may trigger a destructive tsunami.

Fault	kinematics	length_km	Max. Magnitude (surface)
1	reverse fault	96	7,38
2	thrust + dextral strike slip	98	7,39
3	reverse fault	70	7,22
4	reverse fault	85	7,32
5	reverse fault	112	7,46
6	thrust + dextral strike slip	85	7,32
7	dextral strike slip	561	8,27
8	reverse fault	38	6,91
9	reverse fault	129	7,53
10	reverse fault	68	7,21
11	reverse fault	180	7,70
12	reverse fault	166	7,66
2+5		213	7,78
1+8		130	7,53
1+6		165	7,65
1+8+10		198	7,74
1+6+7w		350	8,03
Acc. Wedge	thrust (from Gutscher et al 2002)		~8.5



Name	Type	WDR (m)	Heigth drop (m)	Affected area (km2)	Surface of deposit (km2)	Gradient of source area	Gradient of deposit	Run-out distance (km)	Volume (approx.) km3	Age
Portimao	Debris flow	2000-3800	1800	2770	586	10°	<1°	20	12	Upper Pleistocene-Holocene
N-Gorringe	Rock-Debris Avalanche	2908-5100	2192	378	280	11°	1.5°	35	61	upper Pleistocene
S-Gorringe	Rotational - Debris flow	3500-4800	2300	2800	1000-1400	8°	2° - <1°	18 - 47	210	Plio-Quaternary
M. Pombal	Translational - Debris flow	2575-3900	1325	190	260	3.5°	<1°	23	1.3	Holocene

Table 1. *Synthesis of the main characteristics for the slide events investigated in detail in the NEAREST project. WDR: Water depth range.*

However, the Gorringe Bank rock and debris avalanche seems to be the exception, as it may generate important tsunamis: waves up to 10 m high, reaching the Portuguese coast in around 30 minutes and the Spanish and African coast after about 60 minutes, as obtained by recent numerical tsunami modelling;

iii) carried out a refraction experiment along two transects (fig. 2) using the facilities of partners CSIC and UBO. The location of each transect was selected after pre-stack depth-migration (Fig.3 and Fig. 4) of several MCS lines available in the area and after the production of the new tectonic map of the study area summarized in Figure 1. The main goals of this experiment were the establishment of a clear relationship between seismicity and the location and kinematics of the known active faults identified in the Gulf of Cadiz and the production of a reliable velocity model.

Until now, the relationship between seismicity and the location and kinematics of the known active faults identified in the Gulf of Cadiz was not clearly understood due to the lack of offshore stations and a reliable velocity model in the area. These limitations prevented a better location of low magnitude earthquakes. When good velocity information is available, it was shown that seismic activity concentrated around the major tectonic structures. Thus, NEAREST carried out a refraction experiment along two transects (fig. 2) using the facilities of partners CSIC and UBO. The location of each transect was selected after pre-stack depth-migration (Fig.3 and Fig. 4) of several MCS lines available in the area and after the production of the new tectonic map of the study area summarized in Figure 1.

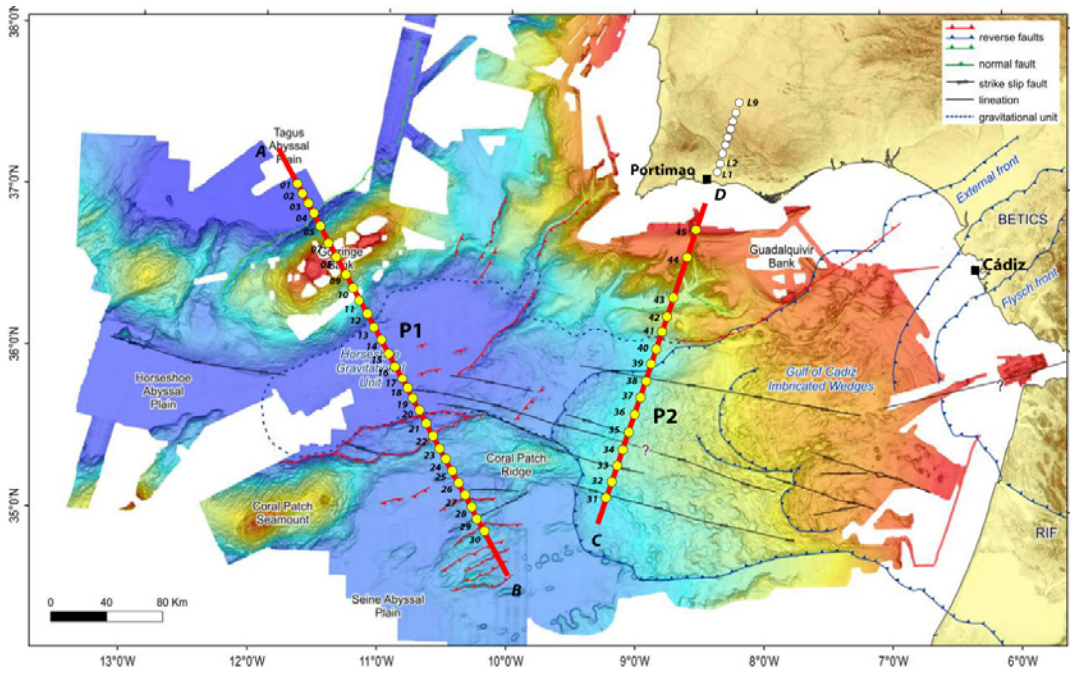


Figure 2 - Bathymetric map of the study area (data from SWIM compilation) . Red lines show the Wide-Angle seismic profiles that were shot (P1 and P2). Yellow dots labelled 01 to 45 indicate the OBS location along both profiles. White hexagons labelled L1 to L9 show land stations deployed during shooting along P2.

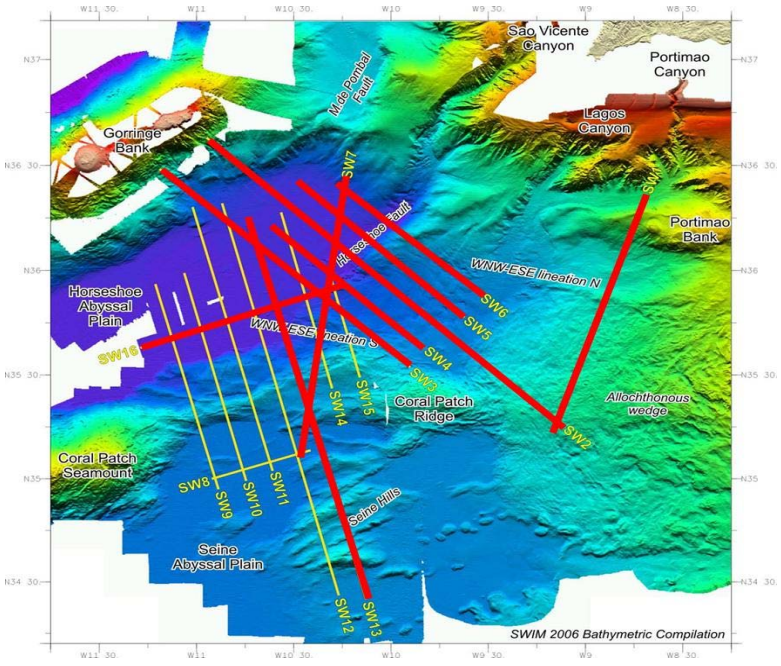


Figure 3 - Map showing the MCS profiles acquired during the SWIMM-2006 survey and available to NEAREST. Thick red lines show location of the 10 profiles that have been fully processed up to PSDM by CSIC.

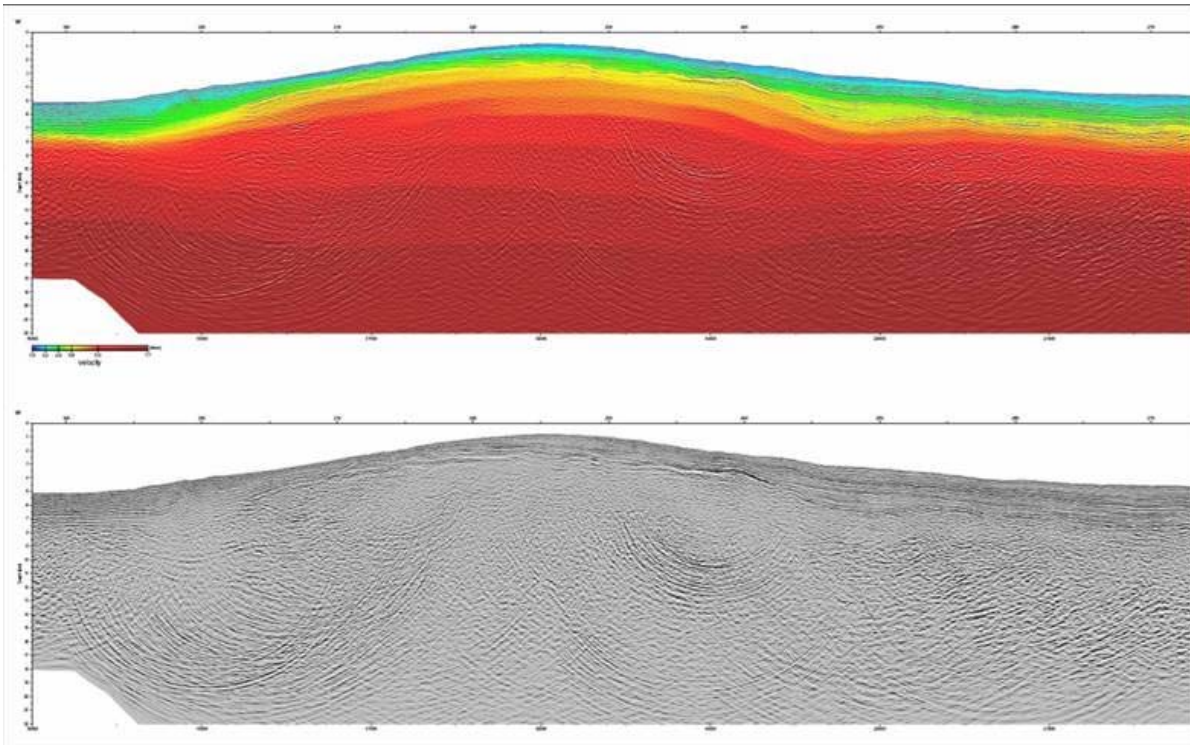


Figure 4 - (top) Pre-stack depth migration of eastern half of profile IAM-4 with the migration velocities superimposed. (bottom) Pre-stack depth migration of profile IAM-4. This profile runs from the Gorringe Bank towards the Horseshoe Abyssal. See figure

The outcome of these tasks enables the answering to old questions about the nature of the crust underneath the Gorringe Bank and between SW Iberia and Morocco. Figure 5 and Figure 6 summarized the major results. The velocity distribution of Gorringe Ridge and Tagus Abyssal Plain is similar in contrast to the Coral Patch – Seine Abyssal Plain which presents well developed, 6-7 km thick, oceanic crust. We may reach the important conclusion that the basement high of the Gorringe Ridge is the result of an highly serpentinized exhumed mantle. The velocity distribution across the SW Iberia and Morocco (Fig. 5), on the other side, shows, for the first time, robust evidence of 7-8 km-thick oceanic crust underneath the sedimentary wedge that covers the internal Gulf of Cadiz. This crustal oceanic segment should have been emplaced there during the early phase of continental spreading between Iberia and Africa, in the context of Mesozoic Atlantic spreading. The northern part of P2 displays a relatively sharp ocean-continent transition zone concentrated in a ~50 km-wide band, that ends with the ~30 km-thick continental crust of the SW Iberian shelf. These results constitute a major constrains for the geodynamic understanding of this sector;

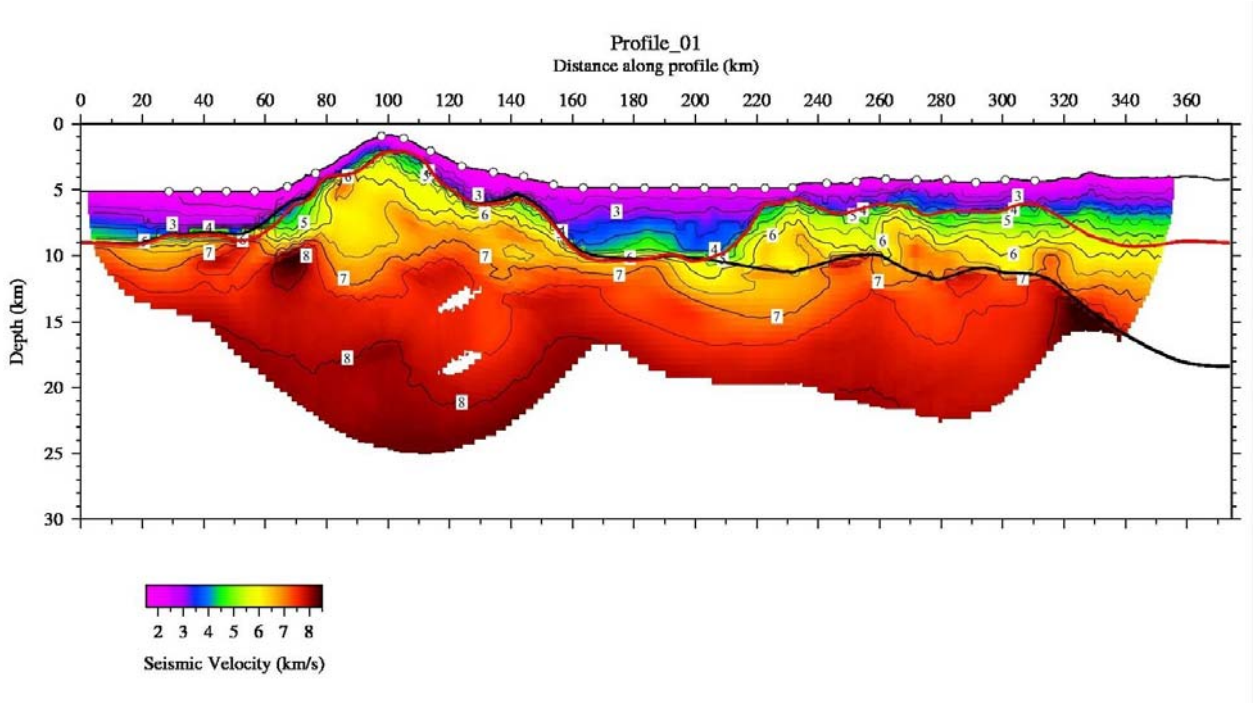


Figure 5 - Velocity model for P-wave propagation obtained by travel-time inversion along P1 This profile runs from the Gorringe Bank towards the Horseshoe Abyssal. See figure 2 for location.

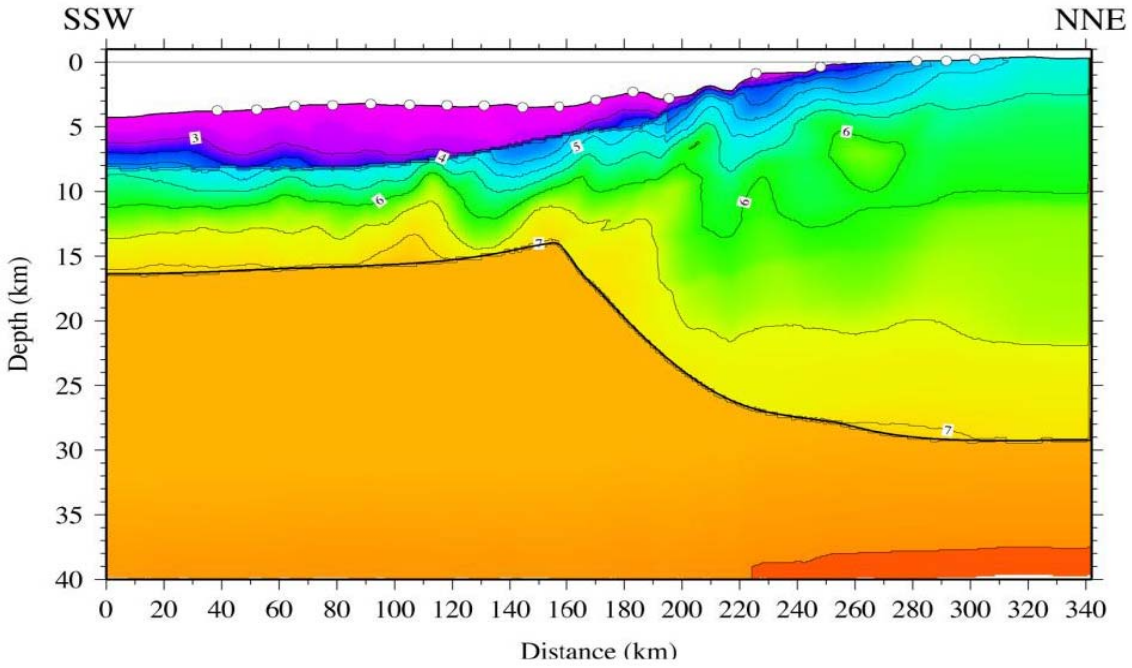


Figure 6 - Velocity model for P-wave propagation obtained by travel-time inversion along P2. The tomography method used is joint travel-time inversion of refracted and reflected seismic phases. See figure 2 for location.

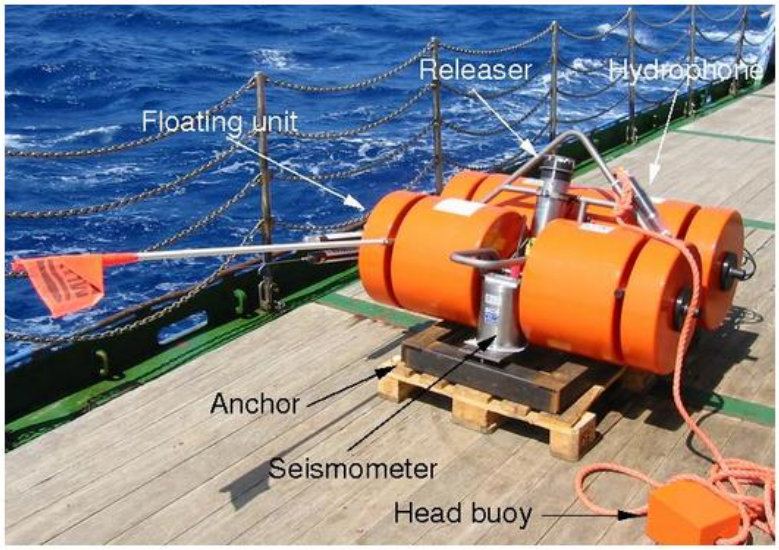


Figure 7 – Photo of one OBS with technical details..

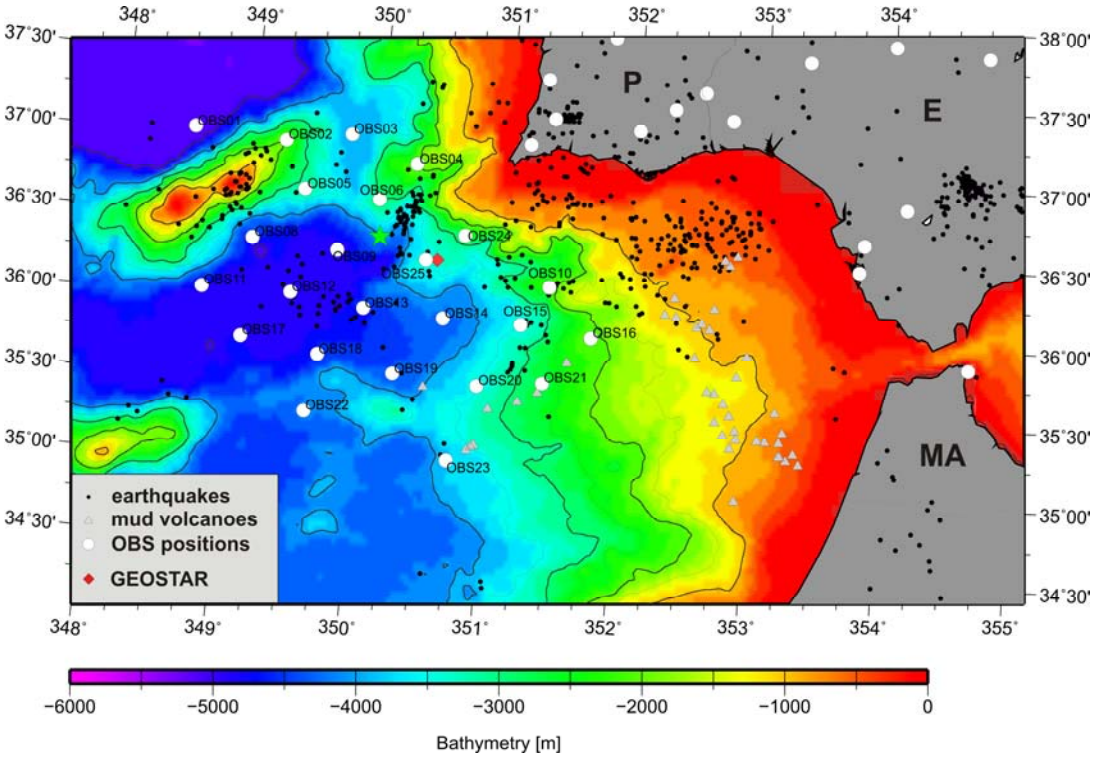


Figure 8 - Location of the OBS network (white circles) and GEOSTAR deep-sea observatory (red diamond), while the white full circles on land represent the location of the seismic station. Depth contours every 1000m. Earthquake epicentres are take from IM bulletin for the period August 2007 to August 2008.

iv) carried out an One-Year Continuous OBS survey in the area on top of the presumed tsunamigenic structures. This was accomplished using 24 OBS (Ocean Bottom Seismometers) provided by AWI (Fig.7) which operated in the Gulf of Cadiz from August 29, 2007 till August 11, 2008 and the GEOSTAR deep-sea observatory (location in Fig. 8). All the 25 observation points were equipped with the same type of broad-band seismometer.
During this one-year experiment the OBS and GEOSTAR recorded the signal of 1354 earthquakes (example in Fig. 9 and Fig. 10), 767 of which occurred in the Gulf of Cadiz. During the same interval of time, the seismic network of the Meteorological Institute of Portugal reported only 422 earthquakes located in the area of the marine network. This means that the

NEAREST marine temporary network recorded and located nearly twice as many earthquakes. At the moment the results are preliminary and regard the analysis of ad subset of the data. A selection of 37 events with the largest magnitude recorded by the land stations of the NEAREST network were compared with the data recorded by the marine network. A local seismic velocity model was used, but soon it will be used the one derived from the refraction experiment. Comparing NEAREST results with the earthquake location carried out by the Instituto de Metereologia of Portugal (IM), which used only land station, we found that the epicentres are generally displaced to SW of their original location and the focal depths (>40 km) are now much deeper than computed by IM (Fig.11). These preliminary results confirm the importance of using dense marine network to fill the gap of exact seismological information in the oceans.

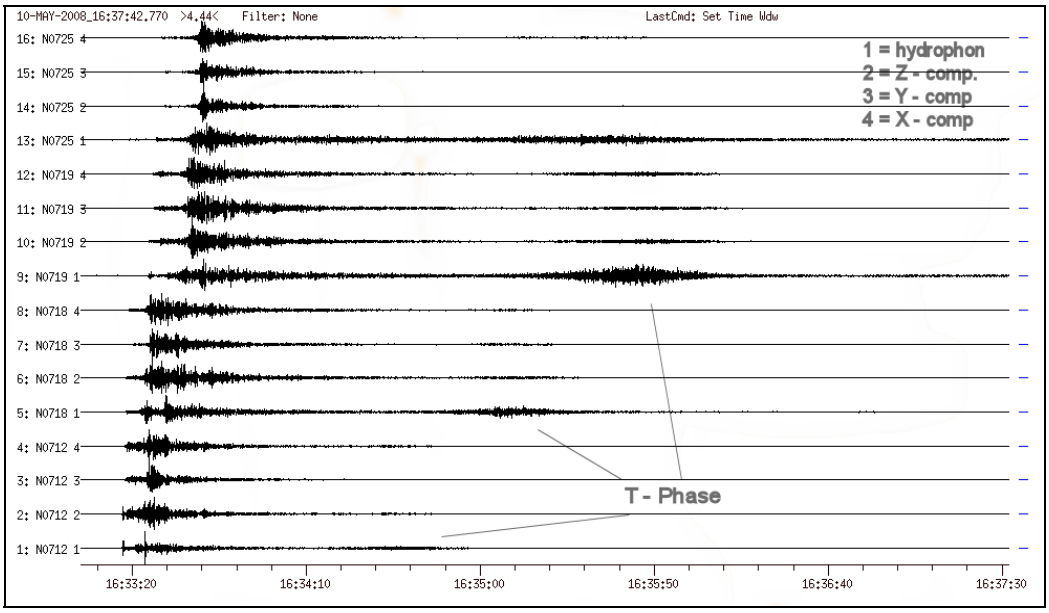


Figure 9 – Seismograms of a local event in the Sea of Morocco, 10.05.2008. 1, hydrophone; 2, vertical component (Z); 3,4, horizontal components (Y,X).

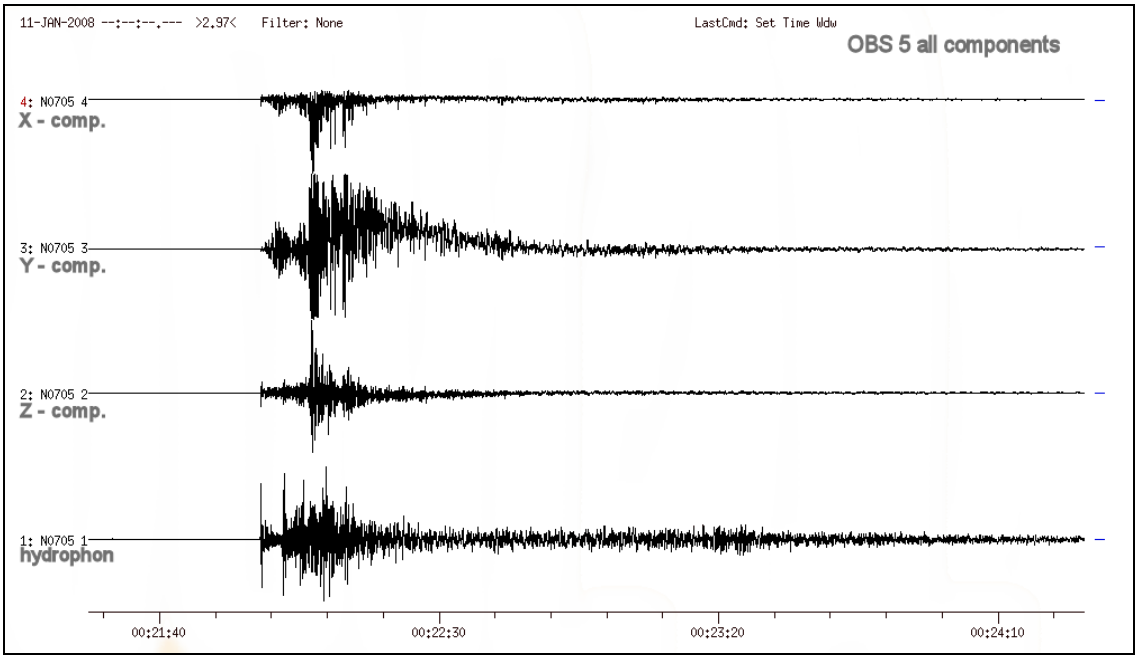


Figure 10 - Seismogram of local earthquake showing the effect of transient signal after arrival of strong signals (S phases) and subsequent clipping. Therefore such waveforms cannot be used for local waveform inversion. Most probably, these signal disturbances are related to the soft basement (sediments) at the seafloor.

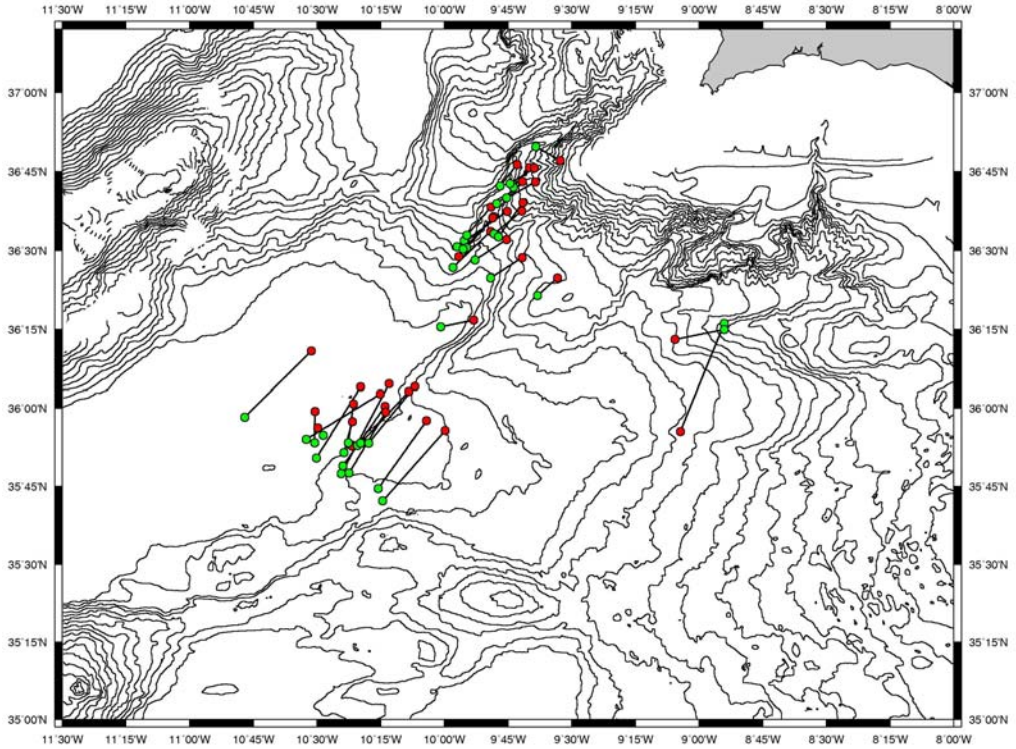


Figure 11 - Comparison between the locations obtained by the NEAREST network (in green) and the locations provided by IM (in red). There is a clear shift in epicentre as well as depth locations (see D9 for details).

2) Development of a Tsunami Early Warning System (TEWS) Prototype based on the direct monitoring of a potential tsunamigenic structure located near the coasts of SW Iberia.

The development of a regional TEWS had, in NEAREST, five main folds: **i**) development and operational set-up, deployment, operation and recovery of a seafloor observatory hosting a prototype for the detection of "near-field tsunami waves" capable of real time communication with land-based seismic centres; **ii**) establishment on an Integrated Tsunami Detection Network based on the three data collectors for real-time automatic processing of data flow (one in Portugal, one in Spain and one in Morocco) in charge of issuing “tsunami alert” at national level; **iii**) feasibility study of the TEWS prototype installed in the Gulf of Cadiz by development of simulators: **1**) by creating synthetic data flows representing seismic waveforms and water level data computed from realistic scenarios to be fed into the monitoring system and test its outcomes; **2**) by providing the Civil Protection Authorities with a simulator that will act as the real one under a simulated crisis; **iv**) Investigations for the comprehension of the tsunami generation mechanisms: the discovery of localized potentially tsunamigenic tectonic structures offered the straightforward opportunity to study the tsunami generating mechanism, at least in the frame of low magnitude events. This information, coupled with the detailed bathymetry knowledge of the area, allowed a finer tuning of the current tsunami generation models providing measured sets of initial conditions for tsunami propagation models; **v)** production of inundation maps for a test area selected in the Algarve coasts, between Lagos and Sagres as input for the local municipalities to implement future mitigation strategies.

To accomplish the tasks summarised above, NEAREST used an abyssal observatory taking advantage of the technology previously developed and validated in the period 1995-2005 in the frame of the EC project GEOSTAR, GEOSTAR-2 and ORION-GEOSTAR-3. In particular NEAREST used GEOSTAR, an already existing multi-parameter seafloor observatory owned by the NEAREST partner INGV which was adapted to NEAREST needs, hosting the tsunameter. This prototype had to be capable either to detect "near-field tsunami waves", as well as communicate in near-real time by underwater acoustics to a surface buoy and by

radio/satellite link from the buoy to shore stations. A specific task was implemented by NEAREST for the definition of sensor requirements and sensor selection; requirements of the detection software as detection algorithm, triggering threshold and messages. The seafloor observatory was then equipped with a specific set of sensors among which a seismometer, a hydrophone, absolute pressure gauge, oceanographic and environmental sensors (See Fig. 12 and associated table, Fig. 13).

The GEOSTAR seafloor observatory on board of the Spanish R/V Sarmiento de Gamboa in November 2009 when the second mission started (left) and the set of scientific sensors installed (right).

Sensor	Sampl. rate	Model
Triaxial broad band seismometer	100Hz	Guralp CMG-40
Triaxial accelerometer	100Hz	Guralp CMG5-T
Hydrophone	100Hz	OAS E-2PD
Absolute pressure gauge	15sec	Paroscientific 8CB4000-1
Triaxial accelerometer + Triaxial Gyro (IMU)	100Hz	Gladiator Technologies Landmark 10
Gravity meter	1Hz	IFSI (INAF) Prototype #2
CTD + Transmissometer	1smp/hour	SeaBird SBE 16 plus Wet Labs ECO-BBRTD 6000m
ADCP	1profile/hour	RDI Workhorse 300 Khz
3D single-point currentmeter	5Hz	Nobska MAVS-3

Figure 12 - sensor package of the GEOSTAR seafloor observatory. The seismometer and the absolute pressure gauge data are real-time analysed on the sea floor by an originally developed processing software for the purpose of tsunami detection.

Figure 13 - The communication buoy just after the re-deployment in November 2009 when the second mission started.

Special attention was given to the 'in situ' automatic data processing procedure and to the message creation, content and emission time. The logical scheme of a Tsunami Detection Algorithm was defined based on the processing of the seismometer, bottom pressure sensor and accelerometer data. The communication path from the seafloor observatory to the shore station through the surface buoy is shown in Figure 14.

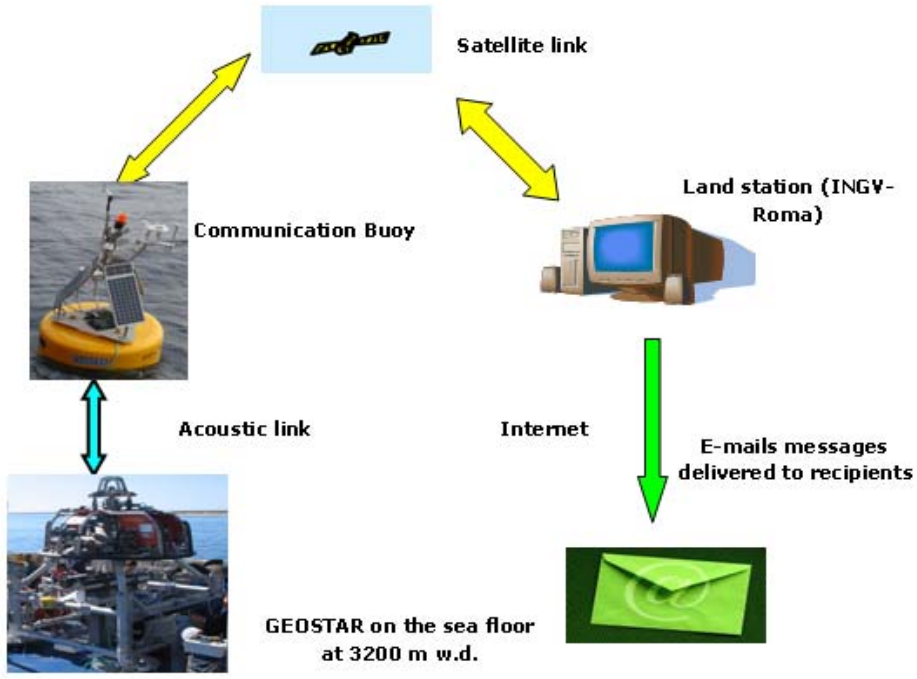


Figure 14 - The communication to/from the seafloor observatory GEOSTAR. Periodic messages (status and data) are sent by the seafloor observatory every 6 hours and event notification are sent in near-real time.

Two types of messages were considered necessary: **i**) periodic messages (status and data) sent by the seafloor observatory every 6 hours to check the good operation of all the devices, **ii**) event messages sent in near-real-time to notify a pressure/seismic event. The distribution of the periodic and event messages by electronic mails from the shore stations was considered the easiest way to integrate the seafloor data with the measurements (seismological, tide-gauges, etc.) available by the partners IM, UGR and CNRST. The abyssal station and the surface buoy were deployed in the Gulf of Cadiz (Fig.15) for one year, from August 2007 to August 2008, contemporary to the experiment done with the 24 OBS deployed for the earthquake monitoring (see above.

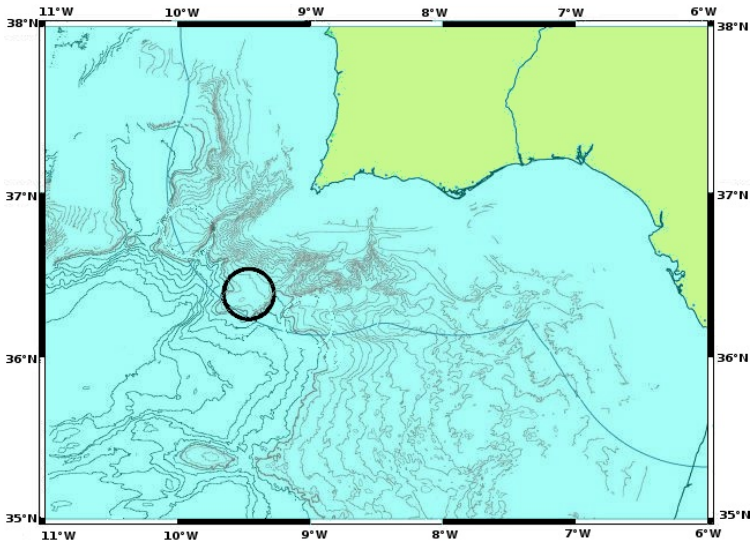


Figure 15 – Location of the the abyssal station and the surface buoy during the experiment in the Gulf of Cadiz.

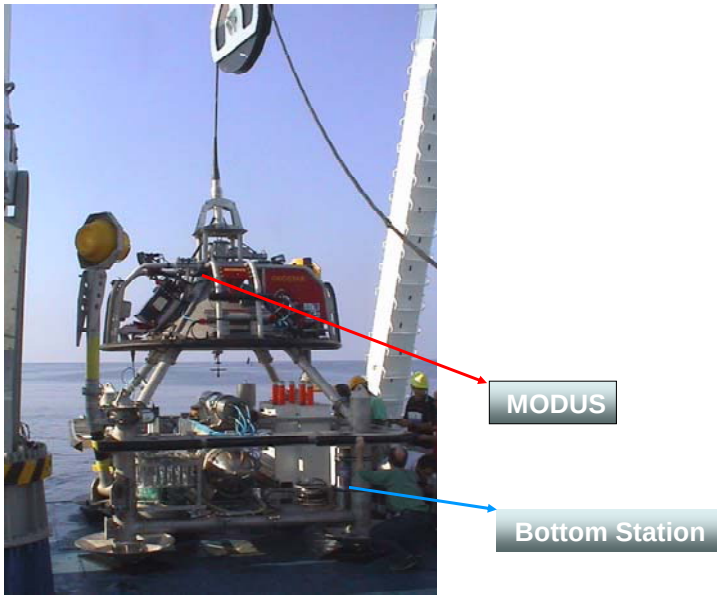


Figure 16 – MODUS vehicle connected to the bottom station before deployment at sea

The observatory deployment and recovery was carried out using a dedicated deployment/recovery vehicle: "MODUS" (Fig.16) operated by the partner TFH, which is able to install an abyssal station in deep water (3200 meters in our case) and recover it with a precision of few meters. These operations were carried out from the R/V Urania. During the first one-year experiment all the sensor and software worked properly with the exception of a malfunctioning of the acoustic communication system located on the surface buoy. Although the acoustic system test corresponds only to a small part of the activity planned within NEAREST, the real-time communications between abyssal station and shore stations represented indeed one of the key qualifying element for the success of the project. For that reason, NEAREST consortium decided to re-install the NEAREST observatory in the same location to complete the tests. The new mission was planned in synergy and taking advantage of a parallel-running activity funded in the frame of the LIDO Demonstration Mission of ESONET NoE project. This was accomplished in November 2009 by R/V Sarmiento de Gamboa (Spanish flag) after the complete refitting of the abyssal station and of the buoy.
In this second experiment the communications via acoustics between seafloor observatory and buoy, and via satellite between buoy and shore worked properly demonstrating the validity of all the system. Messages released by the GEOSTAR abyssal observatory and by the buoy reached the shore according to the scheme already shown in figure 14. An example of these periodic messages is shown in Table 2.

flavio.furlan	NEAREST BUOY STATUS FILE of 20/11/09 ore 00:00:00 - FILE RECEIVED ON 20/11/09 AT 03:42:03 CONVERSION I	20/11/09
flavio.furlan	NEAREST BUOY EVENTS CATALOG FILE of 20/11/09 ore 00:00:00 - FILE RECEIVED ON 20/11/09 AT 02:43:16	20/11/09
flavio.furlan	NEAREST BUOY DATA FILE of 20/11/09 ore 00:00:00 - FILE RECEIVED ON 20/11/09 AT 02:42:13 CONVERSION DO	20/11/09
flavio.furlan	NEAREST GEOS STATUS FILE of 20/11/09 ore 00:00:00 - FILE RECEIVED ON 20/11/09 AT 02:42:01 CONVERSION	20/11/09
flavio.furlan	NEAREST GEOS DATA FILE of 20/11/09 ore 00:00:00 - FILE RECEIVED ON 20/11/09 AT 02:41:50 CONVERSION DC	20/11/09
flavio.furlan	NEAREST BUOY EVENTS CATALOG FILE of 19/11/09 ore 18:00:00 - FILE RECEIVED ON 19/11/09 AT 22:41:42	19/11/09
flavio.furlan	NEAREST BUOY STATUS FILE of 19/11/09 ore 18:00:00 - FILE RECEIVED ON 19/11/09 AT 22:41:34 CONVERSION I	19/11/09
flavio.furlan	NEAREST BUOY DATA FILE of 19/11/09 ore 18:00:00 - FILE RECEIVED ON 19/11/09 AT 22:41:24 CONVERSION DO	19/11/09
flavio.furlan	NEAREST GEOS STATUS FILE of 19/11/09 ore 18:00:00 - FILE RECEIVED ON 19/11/09 AT 22:41:14 CONVERSION	19/11/09
flavio.furlan	NEAREST GEOS DATA FILE of 19/11/09 ore 18:00:00 - FILE RECEIVED ON 19/11/09 AT 22:41:04 CONVERSION DC	19/11/09
flavio.furlan	NEAREST BUOY EVENTS CATALOG FILE of 19/11/09 ore 12:00:00 - FILE RECEIVED ON 19/11/09 AT 16:42:11	19/11/09
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flavio.furlan	NEAREST GEOS STATUS FILE of 19/11/09 ore 12:00:00 - FILE RECEIVED ON 19/11/09 AT 16:41:39 CONVERSION	19/11/09
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flavio.furlan	NEAREST BUOY STATUS FILE of 19/11/09 ore 00:00:00 - FILE RECEIVED ON 19/11/09 AT 04:41:58 CONVERSION I	19/11/09
flavio.furlan	NEAREST BUOY DATA FILE of 19/11/09 ore 00:00:00 - FILE RECEIVED ON 19/11/09 AT 04:41:47 CONVERSION DO	19/11/09
flavio.furlan	NEAREST GEOS STATUS FILE of 19/11/09 ore 00:00:00 - FILE RECEIVED ON 19/11/09 AT 04:41:37 CONVERSION	19/11/09
flavio.furlan	NEAREST GEOS DATA FILE of 19/11/09 ore 00:00:00 - FILE RECEIVED ON 19/11/09 AT 04:41:25 CONVERSION DC	19/11/09

Table 2 – LIST of the periodic messages released by the GEOSTAR abyssal observatory and by the surface buoy and received on land and distributed according to the scheme of figure 14.

The bottom pressure recorded during the first mission were used to compute the sea tide coefficients, that represents a key parameter for the Tsunami Detection Algorithm developed by ISMAR and INGV. These new coefficients were used during the second abyssal station mission (Nov.-Dec. 2009), along with an improved version of the Tsunami Detection Algorithm so that we can now take into account also the basin effects. Figure 17 shows examples of real bottom pressure data acquired during that mission. Figure 18 shows an example of the output of the Tsunami Detection Algorithm during the same mission (red line represents filtered data compared to the blue-line linear prediction obtained starting from the same filtered data: the point to point difference between the two is evaluated against the prescribed threshold to declare the possible event. The algorithm developed by NEAREST allows the evaluation detection of a parent tsunami signal of less than 1-cm amplitude.

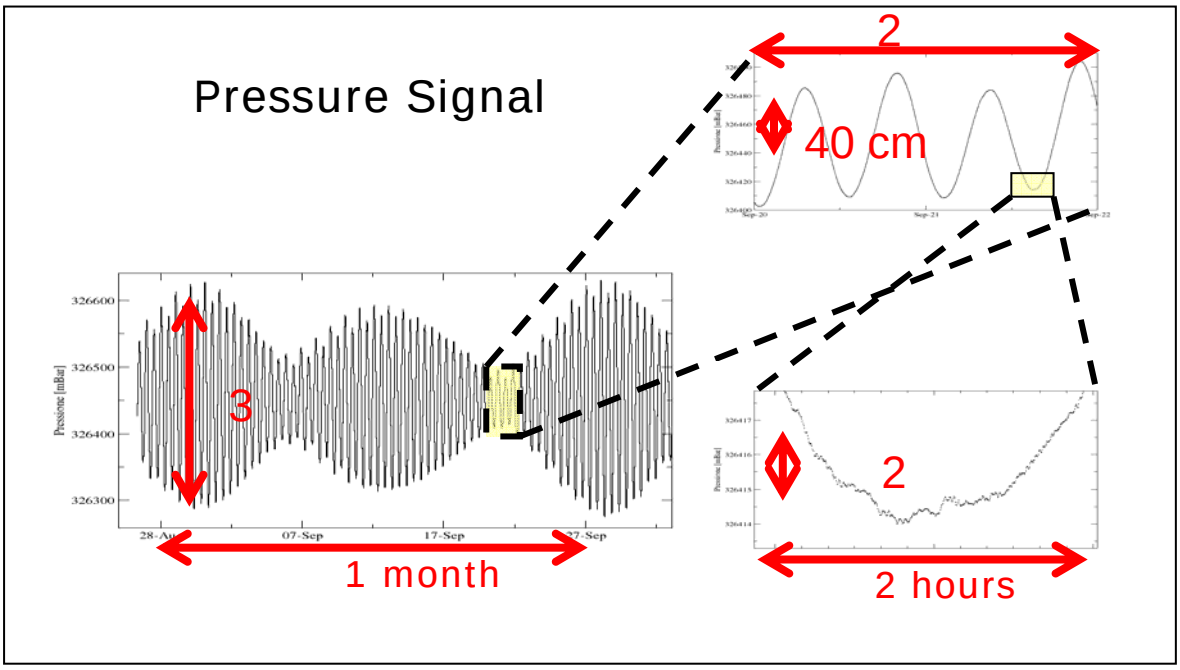

Figure17 - Example of bottom pressure data recorded during the first one-year GEOSTAR mission in the Gulf of Cadiz

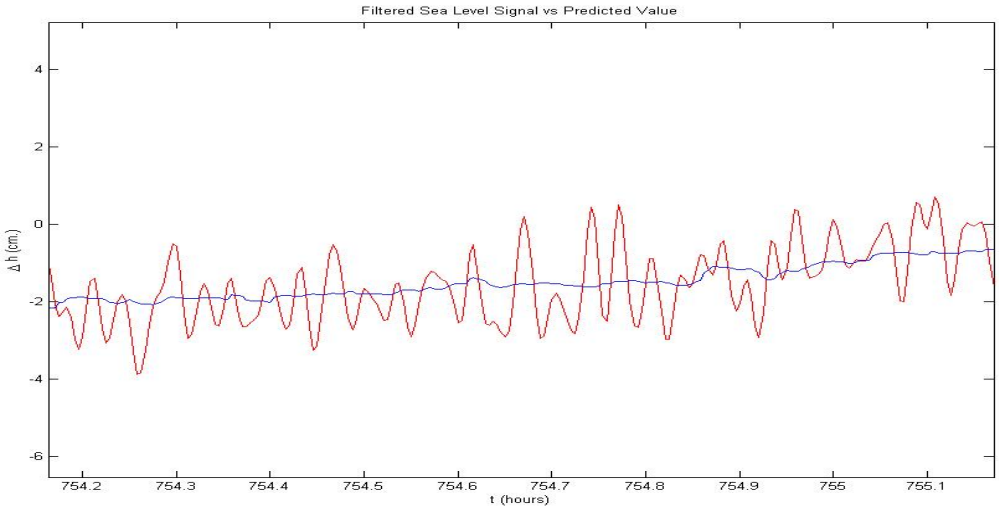

Figure 18 - Example of the output of the Tsunami Detection Algorithm during the first GEOSTAR mission in the Gulf of Cadiz.

During to the Abyssal station preparation and the first one-year experiment at sea, it was carried out the development of a "Integrated Tsunami Detection Network" establishing the three data collectors for real-time automatic processing of the seismic data flow, one in Lisbon (Portugal), one in Granada (Spain) and one in Rabat (Morocco). The contractors involved were UGR, IM and CNRST they represent the national (IM and CNRST) and regional (UGR) data collectors for the three countries listed above. The integration of the data-collectors, the harmonization of the recording and the processing procedures of the seismic data stream coming from different devices as tide gauges, buoys, obs, seismic stations, abyssal station was accomplished. The automatic procedures for rapid determination of seismic parameters and for effective tsunami detection methodology were also refined with further tests (Fig. 19 and Fig. 20).

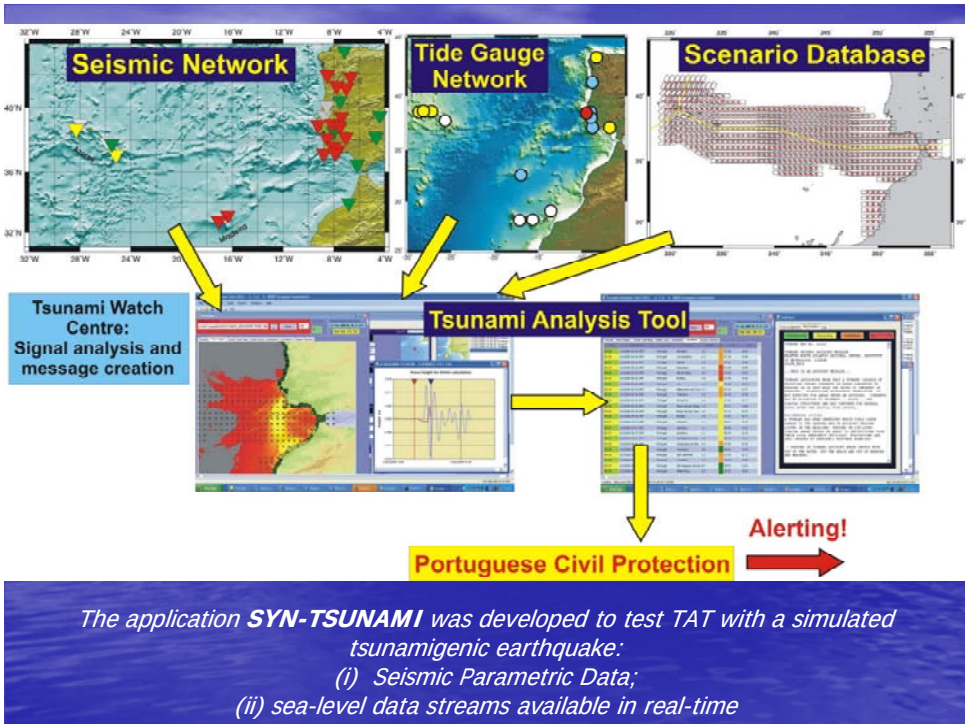

Figure 19 - Prototype for the Portuguese Tsunami Warning System

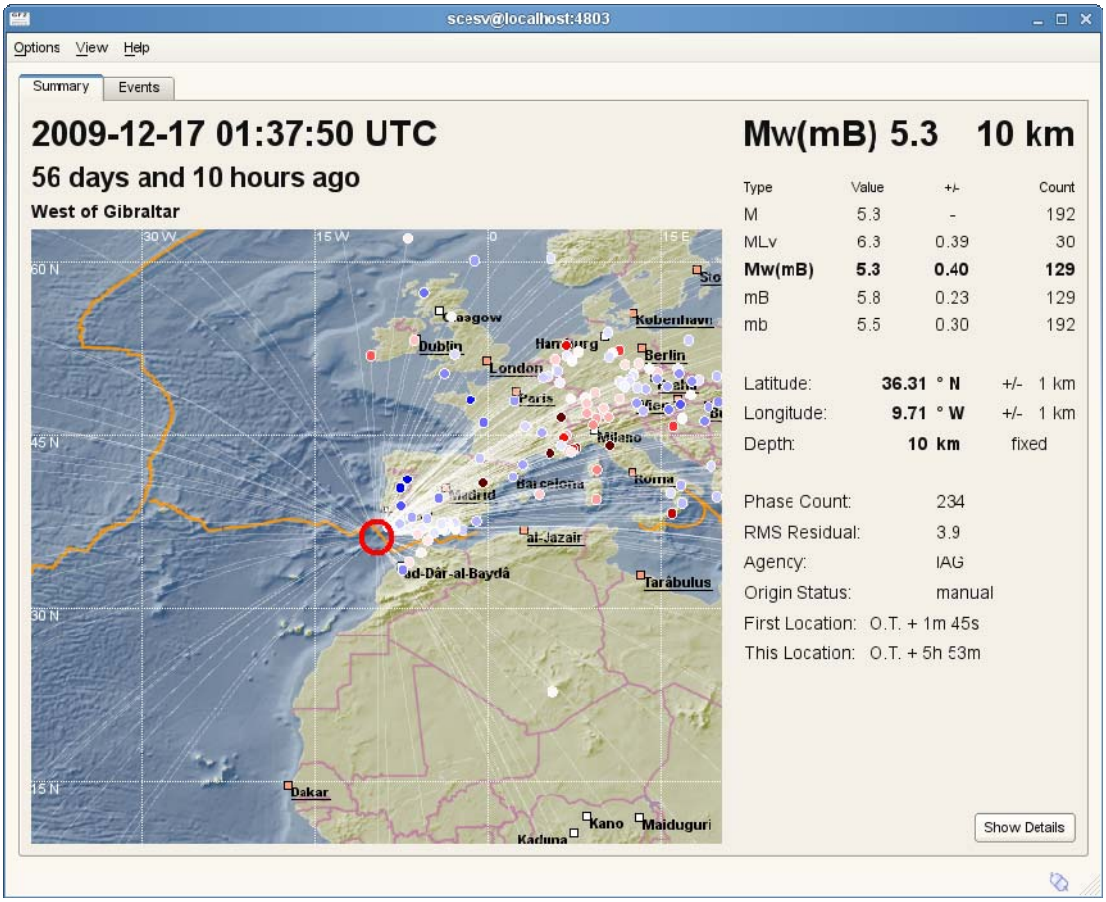

Figure 20 - Example of location and evaluation procedure with the SEISCOMP 3.0 at UGR node in the case of the December 17th, 2009, Mw=5.5 earthquake in the SW margin of Iberia.

An important outcome of this work is a substantial improvement of the seismicity knowledge of the region. It should also be mentioned the fact that the Moroccan partner, taking advantage of the coordination established by NEAREST between Spain and Portugal, could have access to additional national funding allowing them to greatly improve the seismic network by adding several new land seismic station and tide gauges to the Network. At the end of the project the integration of the data-collector for each seismic node was completed and tested by using synthetic data streams. The Integrated Tsunami Detection Network developed within NEAREST was then able to share the data among the seismic node and to apply common procedures for earthquake fast-location (Fig.19). This Network can also easily integrate other external agencies allowing to define a *Virtual Seismic Network* for the Gulf of Cadiz region that could be dedicate to a future Tsunami Early Warning in SW Iberia margin and/or to support other possible focal points dedicated to the surveillance in other regions (Fig.21).

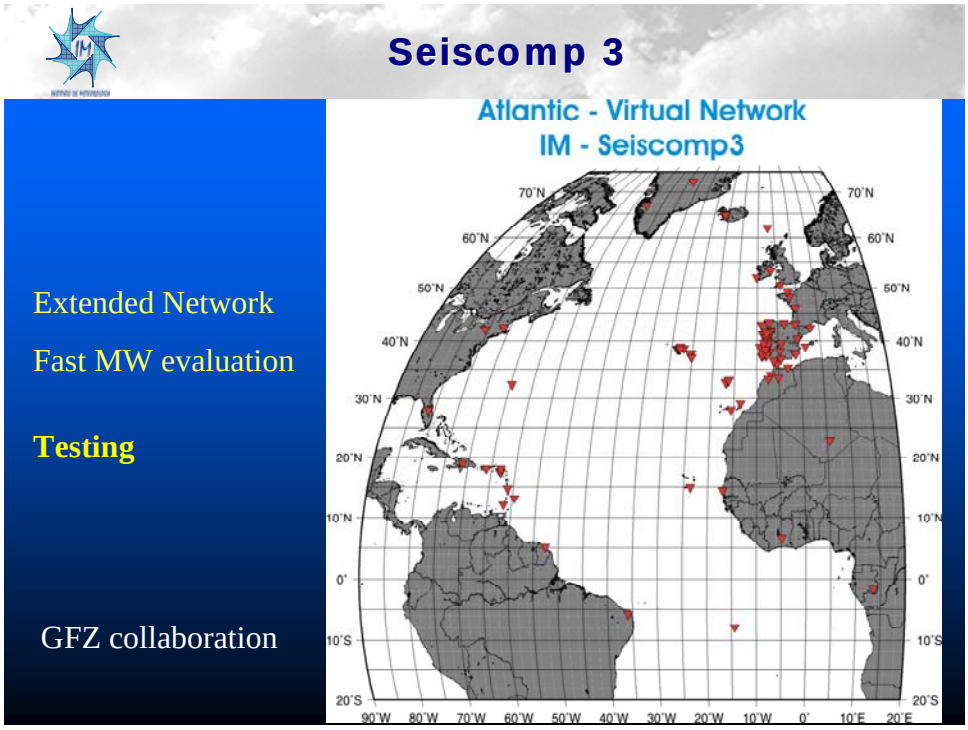

Figure 21 - Atlantic Virtual Network

The *Virtual Seismic Network* could locate and estimate real size of the seismic source in the SW Iberian margin in less than five minutes. To improve the prototype and give more robustness to the system, the experience gained by NEAREST suggests that it would be highly desirable to include in the *Virtual Seismic Network* data from the source region, like the seafloor observatories deployed by NEAREST. By the end of the project, a prototype of Tsunami Early Warning System has been implemented in the Instituto de Meterologia (IM-Lisbon) able to release an alert in case of tsunamigenic seismic events. The Prototype of the Tsunami Warning System is based on the Tsunami Analysis Tool (TAT) developed at the Joint Research Centre of Ispra, Italy.

The Integrated Tsunami Detection Network developed in NEAREST is only a prototype, meaning that it will not be fully operational 24 hours, 7 days a week. Furthermore, the large earthquakes that can trigger such a system, centred in the Gulf of Cadiz, are vey rare and big tsunamigenic events have a return period close to, or larger than 1000 years. This means that, almost for sure, the tsunami monitoring system will not be put to a true operational test for many years. However, the final goal of such a monitoring system is to issue a message to the Civil Protection Authorities in the concerned countries, Portugal, Spain and Morocco, in less than 5 minutes after the occurrence of a seismic event, and a confirmation message in less than 15 minutes. In addition, the tsunami detection must be reliable and effective. To account for these strict demands of a system that will operate only very rarely, NEAREST carried out a feasibility study for a future Early Warning System. For this purpose NEAREST developed two types of simulators. The first simulator was designed by partner FFCUL to create synthetic data flows representing seismic information and water level data computed from realistic scenarios to be fed into the monitoring system and test its outcomes. NEAREST considered that the tsunamis are generated by the surface displacement produced by the movement in rectangular faults at depth (see Fig. 22 and table 2).

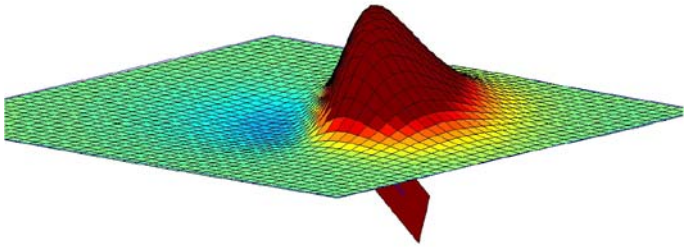

Figure 22 – 3D image of the surface displacement. Vertical displacement is exaggerated 5000x.

M_w	L (km)	W (km)	D (m)
6.50	14	12	0.64
6.75	19	16	0.86
7.00	25	21	1.15
7.25	34	28	1.53
7.50	45	38	2.04
7.75	60	50	2.72
8.00	81	67	3.62
8.25	107	89	6.49
8.50	143	119	7.81
8.75	220	120	9.90

Table 2 – Main parameters to be supplied to the Okada tsunami model of sea bottom displacement as a function of the moment magnitude. L is the length of the rectangular fault and W is its width. D is the average displacement between the two fault blocks during the earthquake.

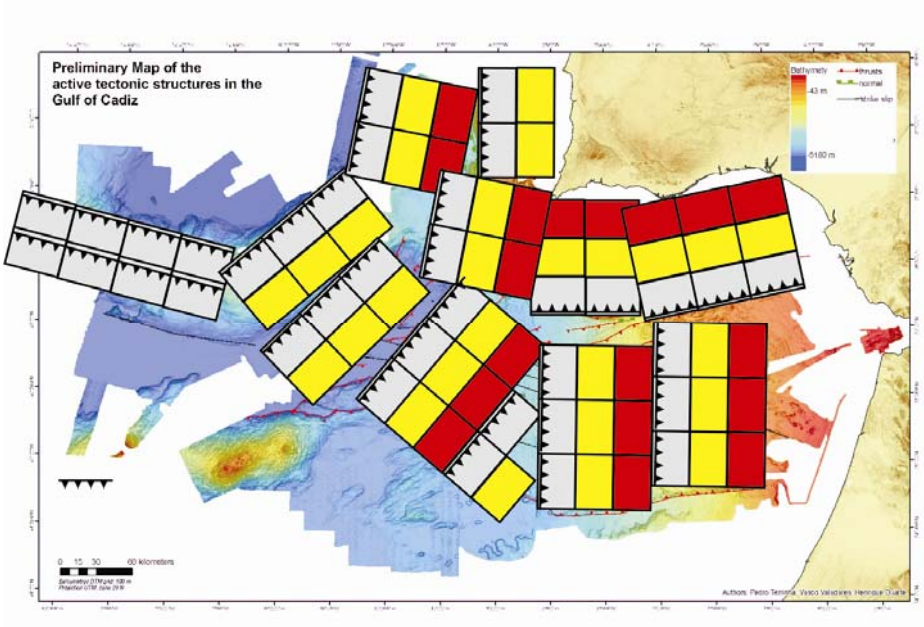

Figure 23 – Proposal for the distribution of tsunamigenic unit sources in the G. Cadiz

This model required the definition, for each magnitude, of a number of geometrical and rheological parameters. Based on the location of the most credible sources for tsunamigenic events in the Gulf of Cadiz made in NEAREST, for each geographical location were associated the earthquake scenario (see Fig. 23).

The database of scenarios was then computed at locations separated by 0.5º in latitude and longitude and for all magnitudes from 6.5 up to the maximum magnitude, at 0.25 intervals. These source parameters, but with a random location and a different depth and fault orientation, were used to create synthetic data streams to feed into the Tsunami Analysis Tool (TAT). In the

simulation mode, the tsunami evaluation begins by the collection of the main earthquake parameters provided by the Seismic Network. Then, synthetic measurements of tide-gauges are collected in real-time by TAT, simulating the operation of the P-TEWS in a real event, to the issuing of the messages to the Civil Protection. In simulation mode these messages are prepared but not sent to the planned recipients. In the simulation mode we can further test any suitable geometry for the tsunami detection system, assessing the performance improvements that deep-see tsunameter provide to the P-TEWS (Fig.23). The second simulator was designed by partner XISTOS to provide the Civil Protection authorities a software to be used either for training either as an operational add-to-decision tool in case of a simulated or true crisis. The partner Xistos, using the help and expertise provided by all the NEAREST partners, developed this simulator which is designated as the NEAREST Simulator. The NEAREST Simulator allows **i**) to model a geomorphologic environment that may generate earthquake and tsunamis like active faults (see Fig. 24) and **ii**) to model the social and urban environment of the areas subject to the earthquake and tsunami (see Fig. 25). The Simulator is a modular and open tool that makes it particularly adequate for three main uses: **1**) as an evaluator of the consequences of an event on the population and on the infrastructures; **2**) as a training tool for the local and regional emergency services. Using the simulator the operators will gain insight on the dimension of the ongoing phenomena (arrival time, water height, evacuation time); **3**) as a decision support and operational tool for he civil protection agencies to model the social and urban environment of the areas subject to the earthquake and tsunami (see Figure 25).

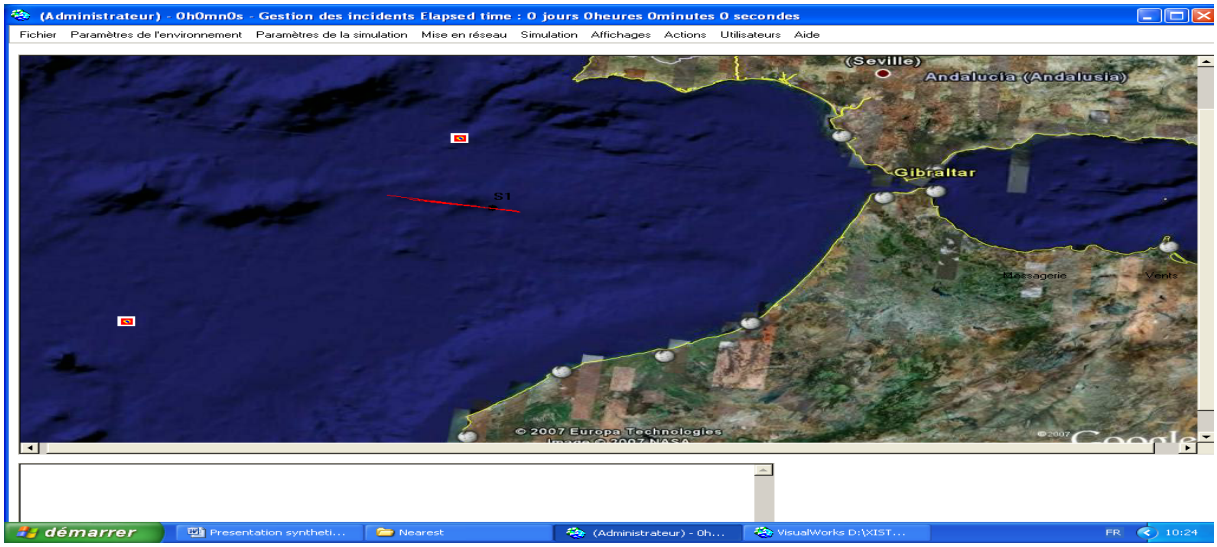

Figure 24 – Example of one model of a tectonic framework in the study area. The red line shows the modelled tsunamigenic fault. The red squares simulate the pressure gauges that are connected to the Regional Tsunami Warning Centre.

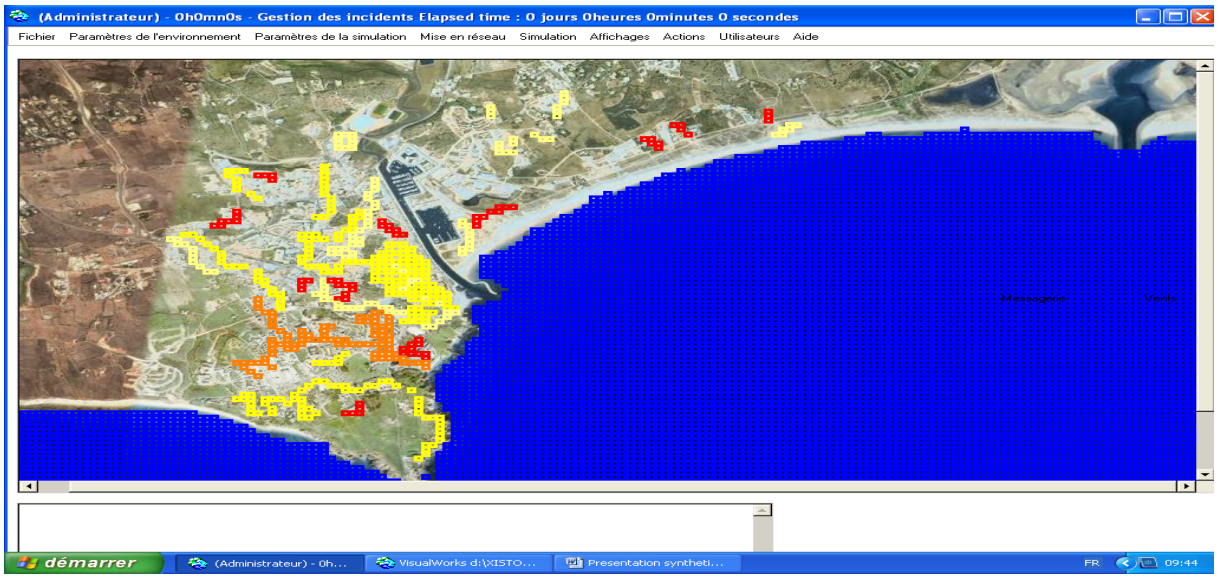

Figure 25 – Partial display of the social and urban model for the Lagos town (Algarve, Portugal)

On top of this, NEAREST, thanks to the FFCUL expertise, computed the inundation maps for a test area located in the Algarve (South Portugal), along the Lagos and Sagres coastal areas. The Digital Terrain Model (bathymetry/topography) connecting the tsunami-source areas and the coast of Sagres-Lagos was generated from a compilation of multisource height/depth data from multibeam surveys, digitized bathymetric charts of 1:150,000 and 1:15,000 scales (Folio 3,132 and 861 of Admiralty Charts and publications) and digital cartographic data of 1:25,000 scale. For Lagos-Sagres area high resolution bathymetry data was acquired, close to the coast, with a dedicated NEAREST cruise, and this data were used in the final dataset. To account for the availably of high-resolution bathymetric data NEAREST implemented the numerical tsunami model and then performed the simulation of the 1755 tsunami in Boca do Rio and computed the inundation maps for Lagos-Sagres areas. Boca do Rio was selected as benchmark for the simulation because of the sedimentary evidence of the 1755 Lisbon tsunami, together with the detailed historical descriptions of the event, make this an unique area to test the numerical model. After this test, NEAREST computed the inundation maps for Lagos and Sagres (Fig. 26 and Fig. 27).using two earthquake scenarios both due to thrusts, considered the most relevant candidate to be tsunamigenic sources: the Marques de Pombal fault (MPF) and Horseshoe Fault (HSF). The influence of bottom friction in the inundation parameters, that is to say run up, maximum inundation distance and current velocity was computed for Lagos area (Fig. 28). The sensitivity of the overland current velocity to the variation of the bottom roughness was investigated. These results present the impact of the MPF scenario at the site of Lagos in terms of overland current speed. We found that the effect of the bottom roughness on the computed flow speed is considerable. For the case with no bottom friction (n=0.000) the maximum current speed exceeds 8 m/s, at some locations. Even if not initially planned, the methodology was extended to Casablanca (Morocco) in order to produce inundation maps for this area.

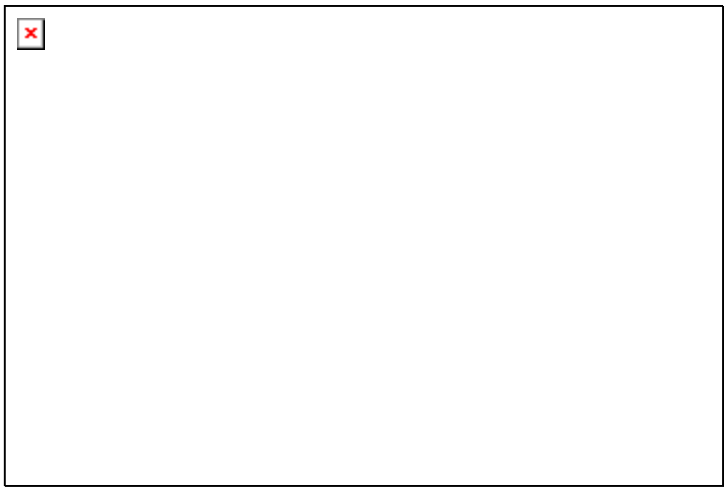

Figure 26 - Example of the propagation modeling for the Marques de Pombal scenario.

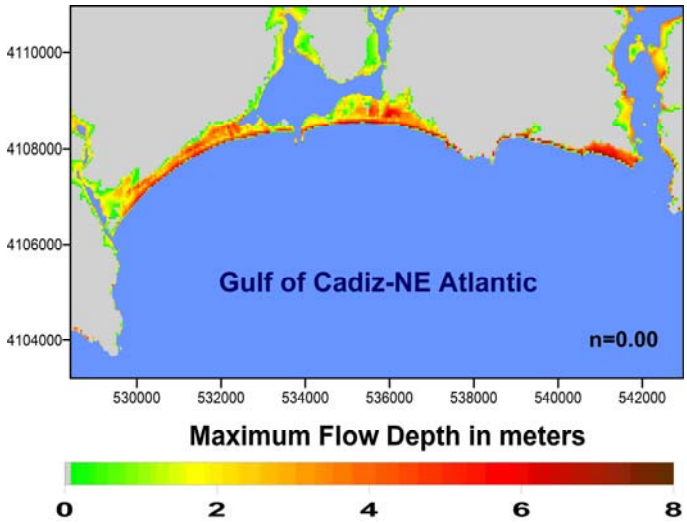

Figure 27 - Inundation Map – Lagos –Portimão area; Marques de Pombal scenario;

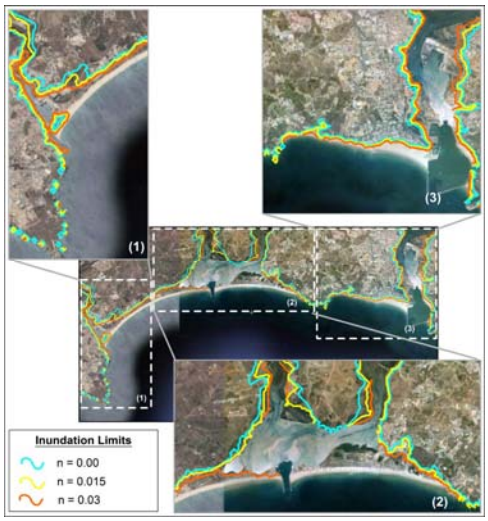

Figure 28 - Influence of bottom friction in maximum inundation distance using MPF scenario.

Another remarkable theoretical work concerning tsunami generation was developed by ISMAR and INGV in order to look for a potential hydro-acoustic precursor. This work is based on a new model that takes into account the water compressibility and the effect of porous compressible seabed. The results of this model showed that modulated hydro-acoustic waves are generated in the water layer by the sea-floor motion. The main and surprising feature of these waves is their modulation, which carries information on the seafloor motion and source parameters. These acoustic waves travel with speed at least seven times greater than the tsunami wave, well preceding its arrival. The modulation of these acoustic waves might be used as a “hydro-acoustic tsunami precursor” and could be integrated in a new generation of Tsunami Early Warning System. Figure 29 shows an example of this hydro-acoustic signal, obtained using the model developed by ISMAR and INGV. The upper inset represents the water surface disturbance for a fixed observation point at 100 km distance from the source. The lower inset shows the hydro-acoustic precursors and its modulation characterised by its pulses. These results were published in the international magazine JGR by Chierici et al. on March 2010, "Modelling of the hydro-acoustic signal and tsunami wave generated by seafloor motion including a porous seabed".

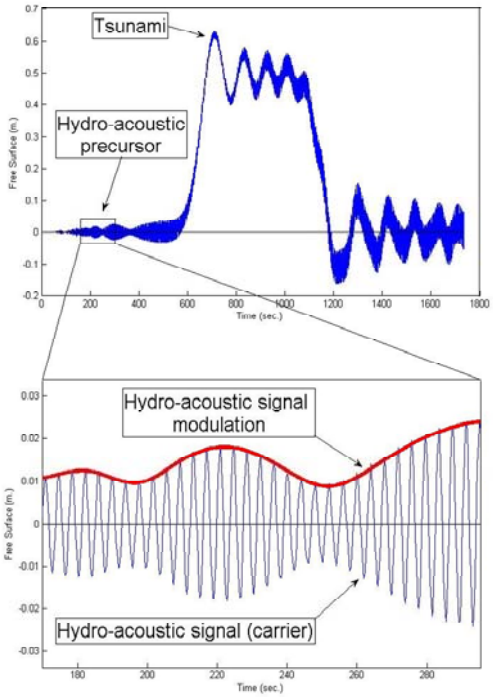

Figure 29 - example of the hydro-acoustic signal at 100 km distance from the source.

3) Sedimentological evidence of paleo-tsunamis and paleo-earthquakes.

As far as we know the recurrence time for a big, potentially tsunamigenic earthquake is in the order of 2000-3000 years for each single tectonic structure. Because we found at least 4 potential source areas, the frequency of a tsunamigenic event may be on the order of 500 years or less. To elucidate this very important aspect, NEAREST carried out an exhaustive recognition of the tsunami deposits, searching for records of paleo-tsunamis that flooded coastal areas and wetlands of South Portugal, Spain and North Morocco. This study was mainly carried out by Partners, CSIC and FFCUL and included the link of paleo-tsunami deposits to source mechanisms, estimating run-up height from tsunami deposits and mechanisms of deposition. In addition, NEAREST tried to identify, sample and analyse also the marine records that could be related to paleo-seismic events as submarine slides with the aim to correlate the occurrence of onshore/offshore tsunami deposits to paleo-seismicity (see example in Fig. 30).

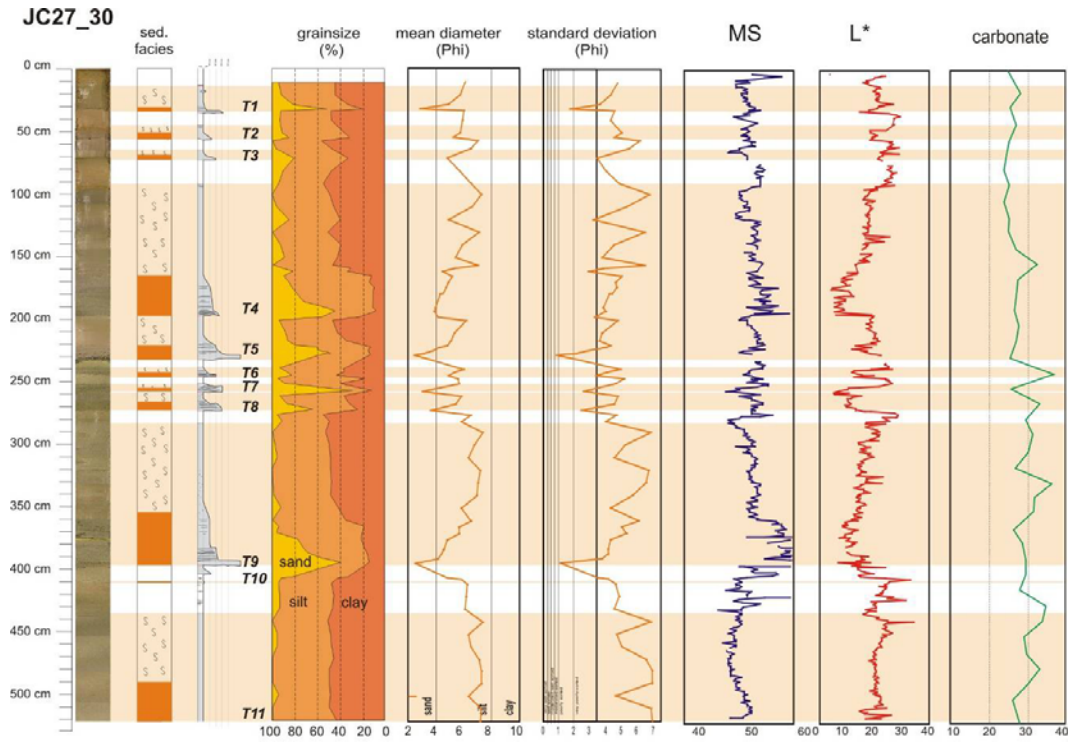

Figure 30 - Image, lithological description, grain-size distribution, mean grain-size, standard deviation, magnetic susceptibility, lightness and $CaCO_3$ content of core JC27-30.

The work carried out by NEAREST was quite complex because it involved field work both at sea and on land; it required the use of different sampling strategies in relation to the analysis to be performed on the sediments cored. It needed many different laboratory analyses accompanied by several meeting to discuss the data and their interpretation. NEAREST carried out sampling of paleo-tsunami deposits at several site locations: Boca do Rio and Salgados Lagoon in Algarve; Moulay Bousselham Lagoon and Loukos estuary in Morocco; Arade Estuary; Alcantarillha lowland; Rio Piedras plus a sampling survey at sea by R/V James Cook. To characterize the tsunami and turbidite deposits related to 1755 AD and previous events NEAREST team adopted several procedures: sedimentology (texture and facies), geochemistry (XRD, XRF, major trace elements), physical properties (magnetic susceptibility, P-wave velocities, density) and paleontological contents (foraminifera, ostracods, nannoplankton, and pollen). In addition NEARESTv team tested field techniques adequate to the description of internal structure of deposits, such as Ground Penetration Radar. To constrain the age of the tsunami and earthquake episodes recorded on sedimentary deposits NEAREST used radiometric (14C, 137Cs and 210Pb), luminescence (TL, OSL) and paleomagnetics dating methods(see example in Fig. 31 and Fig. 32). This work is still in progress and the samples are, at the moment, not completely analysed. Nevertheless, NEAREST can already list important results. NEAREST prepared the first complete compilation of available records on sedimentary deposits of the whole Algarve, focused on features favoring/constraining tsunamigenic inundation and the possibility of preservation of tsunami sediment. NEAREST completed the first compilation map integrating all marine sediment cores acquired so far in the Gulf of Cadiz . NEAREST elaborated a sedimentological and paleogeographical model of Rio Piedras estuary (Fig. 33 and Fig. 34) for the Holocene along with an exhaustive study distinguishing EWE (Extreme Wave Events) in Rio Piedras as well as in the rest of studied areas of the Gulf of Cadiz to differentiate between tsunamis or storms surges.

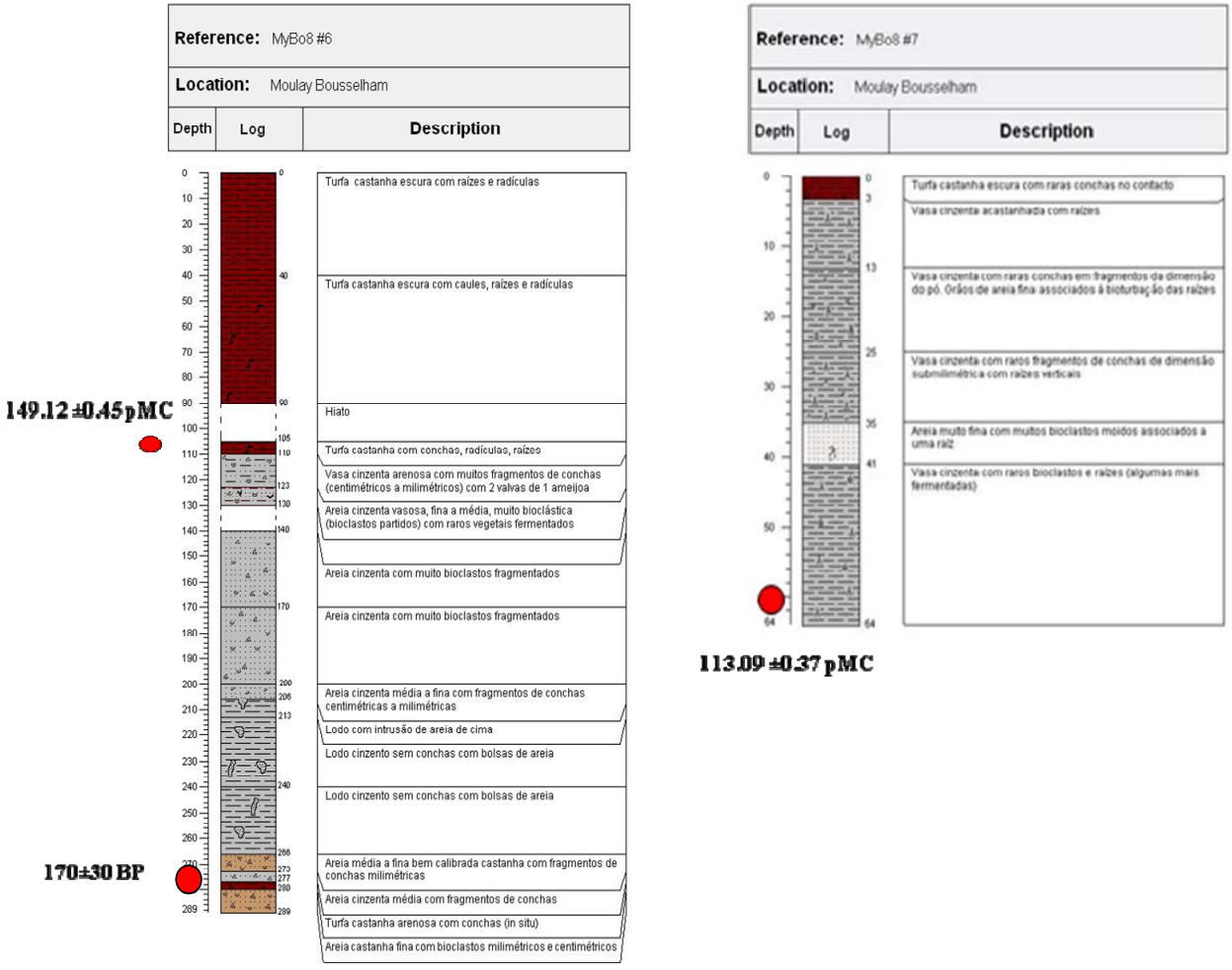

Figure 31 - Logs of sedimentary infill in Moulay Bousselham showing radiocarbon dates.

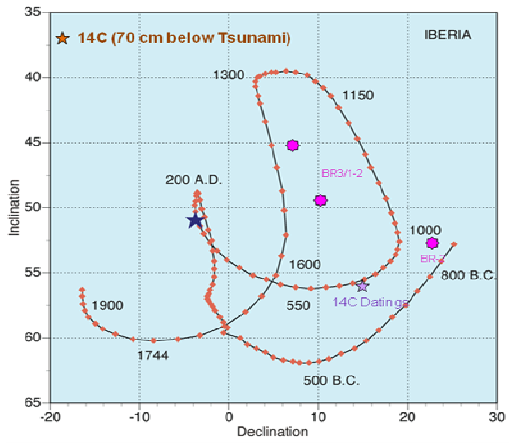

Figure 32- Plot of inclination versus declination of magnetic field in Iberia with results obtained from magnetic studies of sediment deposited at Boca do Rio.

NEAREST data set can now show that near 2800-3000 calBP, a high energy event, probably a tsunami, affected the entire estuary and that some geomorphologic changes can be interpreted as a result from this sea water ingression, which is in agreement with an event reported elesewhere (Punta Umbria, Doñana, Valdelagrana) along the Spanish section of the Gulf of Cadiz. In addition, paleoecological changes found in ostracod assemblages, in the top of the sequence representing the infill of a tidal channel, may be related with massive marine

flood of the Lisbon 1755 tsunami. In concerning the recurrence of EWE (Extreme Wave Events) in the Gulf of Cadiz, all the bibliography about tsunami deposits in the Spanish coast of SW Iberia has been reviewed in order to use the data to calculate recurrence periods of large tsunami events (Table 3).

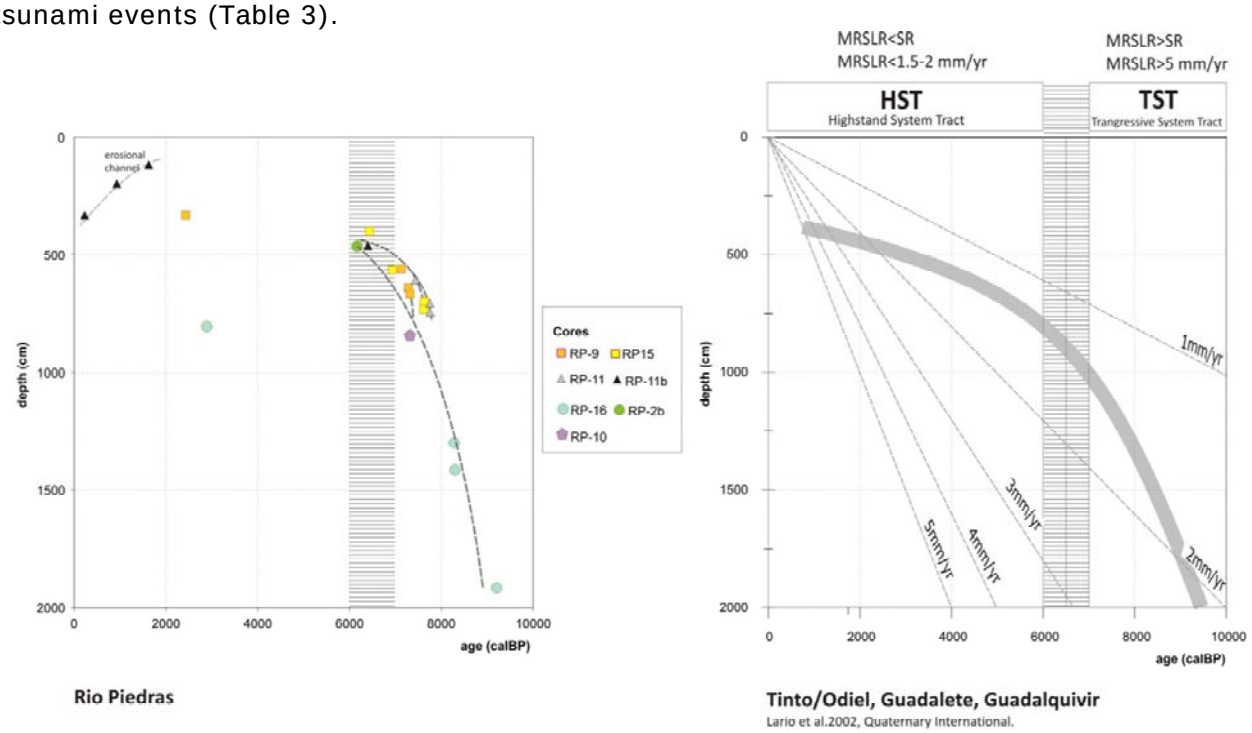

Figure 33 - Depth-age model and sedimentation rates obtained from the Rio Piedras region.

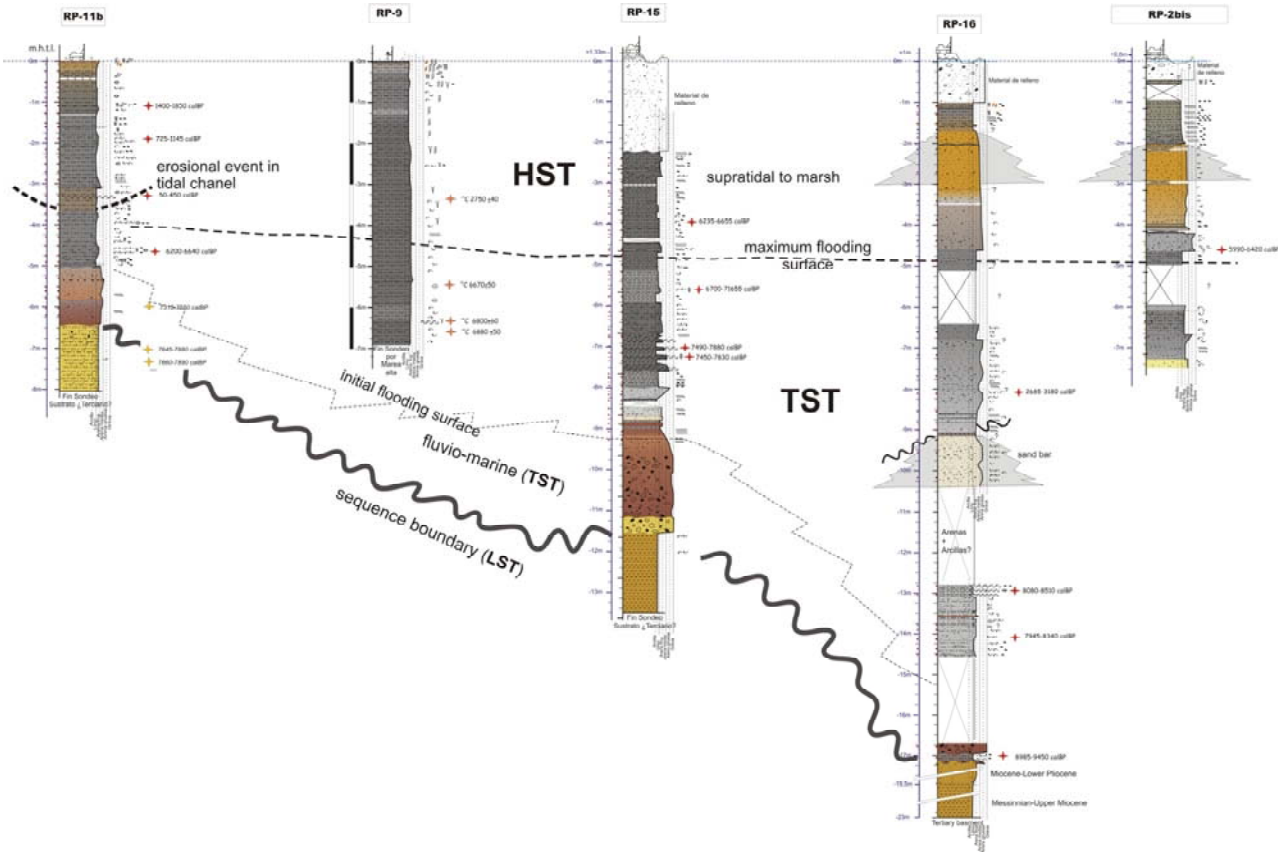

Figure 34.- Summary cross section illustrating facies changes in Rio Piedras sediment infill.

Table 3
Largest instrumental earthquakes, historical seismic record, historical tsunamis and tsunami deposits (tsunamites) from the SW iberian margin.

Age	Name	Source location / Location of tsunamites	Magnitude M*	Intensity (MSK)	Type of record	References
AD 2007	São Vicente Earthquake	Horseshoe Fault	6.0		Instrumental EQ	Stich et al. (2007)
AD 1969	Horseshoe Earthquake and Tsunami	Horseshoe Abyssal Plain	8.0	VII	Instrumental EQ and tsunami	Fukao (1973); Baptista and Miranda (2009)
AD 1964	Guadalquivir Bank	Gulf of Cadiz	6.1–6.6		Instrumental EQ	Buforn et al. (2004); Stich et al. (2005a)
AD 1960		Atlantic Morocco	6.2		Instrumental EQ	Buforn et al. (2004)
AD 1909	Benavente Earthquake	Lower Tagus Valley	(6.0)	IX–X	Historical EQ	Moreira (1984); Mezcua et al. (2004); Stich et al. (2005b)
AD 1858	Setúbal Earthquake	Lower Tagus Valley	(7.1)	IX	Historical EQ	Mezcua and Martínez Solares (1983); Moreira (1984)
AD 1761	North Atlantic	Gloria Fault zone	(6.7)	VI–VII	Historical EQ and tsunami	Mezcua and Martínez Solares (1983); Baptista and Miranda (2009)
AD 1755	Lisbon Earthquake and Tsunami	SW Iberian margin	(8.5–8.7)	X–XI	Historical EQ, tsunami and tsunamites	Andrade et al. (1994); Dawson et al. (1995); Baptista et al. (1998); Luque et al. (2001); Martínez Solares and López Arroyo (2004); Lario et al. (in press)
AD 1722	Tavira Earthquake	Offshore Algarve	(6.5)	VIII	Historical EQ and tsunami	Galbis (1932); Moreira (1984); Martins and Mendes Victor (2001); Baptista and Miranda (2009)
AD 1531	Vila Franca de Xira Earthquake	Tagus Estuary		IX–X	Historical EQ and tsunami	Galbis (1932); Justo and Salwa (1998); Baptista and Miranda (2009)
AD 881		Cádiz		X–XI	Historical EQ and tsunami	Galbis (1932); Mezcua and Martínez Solares (1983)
AD 382	Cape São Vicente	SW Iberian margin		VII–X?	Historical EQ and tsunami	Galbis (1932); Martins and Mendes Victor (2001); Baptista and Miranda (2009)
60 BC	Portugal and Galicia	W Iberian margin		IX?	Historical EQ and tsunami	Galbis (1932); Martins and Mendes Victor (2001); Baptista and Miranda (2009)
2200–2300 yr BP	218 BC Earthquake and Tsunami	Gulf of Cadiz			Historical EQ, tsunami and tsunamites	Galbis (1932); Luque et al. (2002); Ruiz et al. (2008); Lario et al. (in press)
3700–3900 yr BP		Doñana marshlands			EWE (local tsunamite?)	Ruiz et al. (2005, 2008); Lario et al. (in press)
4100–4500 yr BP		Doñana marshlands			EWE (tsunamite?)	Ruiz et al. (2005); Lario et al. (in press)
5300–5500 yr BP	5310 yr BP Tsunami	Gulf of Cadiz			Tsunamites	Ruiz et al. (2005, 2008); Baptista and Miranda (2009); Lario et al. (in press)
6000–7000 yr BP		Guincho Beach, NW Lisbon			Tsunamites (giant boulders and cobbles)	Ruiz et al. (2005); Scheffers and Kelletat (2005); Baptista and Miranda (2009); Lario et al. (in press)

M* = In brackets, estimated magnitude; EQ = earthquake; EWE = extreme wave event.

Table 3. Instrumental earthquakes, historical seismic record, historical tsunamis and tsunami deposits (tsunamites) in the SW Iberian Margin (from Gràcia et al., 2010).

NEAREST reached the main conclusion that most likely not all the events cited as tsunamis have enough data to support this assumption. Then, a new catalogue of EWE (Extreme Wave Events) in the Gulf of Cadiz has been compiled. NEAREST carried out the turbidite event chronology for the offshore of the SW Iberian Margin (Fig. 35).

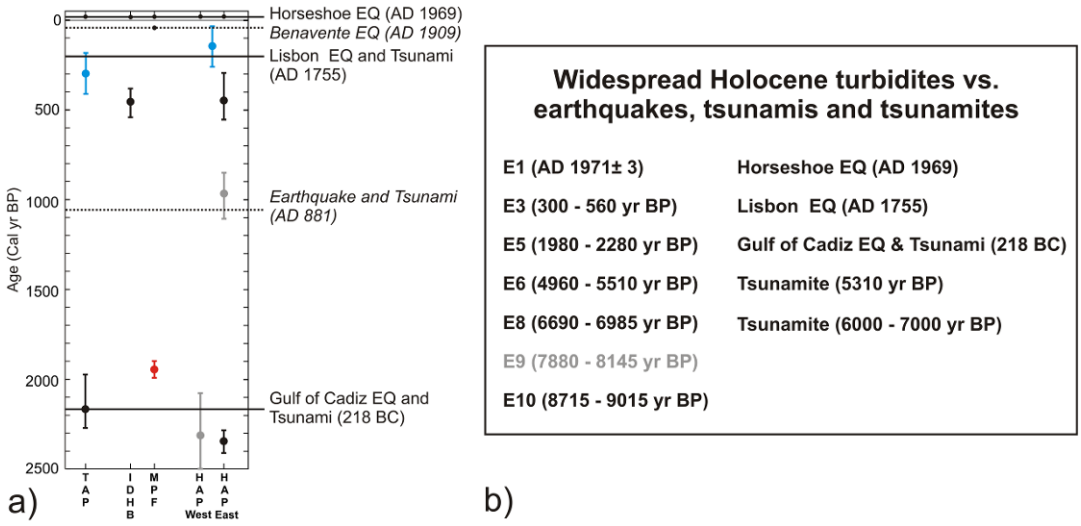

Fig. 35. a) Turbidite ages identified in study areas for the last 2500 years. a)

In accordance with this chronology, NEAREST recognized a total of 14 turbidite events in the last 16.5 kyr (E1 to E14), 11 of which occurred during the Holocene. NEAREST found that widespread turbidite events E1 (AD 1971 ± 3), E3 (300 – 560 yr BP) and E5 (1980 – 2280 yr BP) can be correlated with instrumental and historical earthquakes that occurred during the last 2500 years, such as the AD 1969 Horseshoe Earthquake, the AD 1755 Lisbon Earthquake and Tsunami, and the 218 BC Earthquake and Tsunami, respectively. Older widespread Holocene events E6 (4960 – 5510 yr BP) and E8 (6690 – 6985 yr BP) can be correlated with tsunami deposits that occurred around 5310 yr BP and 6000 - 7000 yr BP, respectively. The relevant conclusion of this work is that if we regard the 6 Holocene widespread turbidite deposits as seismically triggered, the recurrence interval for great earthquakes is determined as approximately 1800 years with implications for the assessment of seismic and tsunami

hazards in the SW Iberian Margin. The first results started already to be presented in several national and international congresses and start to be published. Among them is the synthesis made by the paper of Grazia et al., (2010) “Holocene record of earthquake events offshore Portugal (SW Iberia): Testing turbidite paleoseismology in a slow-convergence margin” published in Quaternary Science Reviews. This important result is also accompanied by the organization of the Research Conference "Submarine Paleoseismology: The Offshore Search of Large Holocene Earthquakes" funded by ESF, Austria, 11-16 September 2010 co-chaired by CSIC.

4) Circulation of project information

The project involves tsunami hazards and the risk posed to populations in the region surrounding the Gulf of Cadiz. For these reasons the diffusion of the project results was not addressed only toward the scientific community but also at the level of the general public and to the relevant national institutions. During the 3,5 years of activity, NEAREST continuously promoted the spread of project information to the general public, local communities, relevant regional and national institutions, civil protection agencies. These actions were accompanied by presentations of NEAREST results to international congresses and publications on scientific magazines. This was accomplished throughout the creation, upgrading and maintenance of the project web site; the continuous upgrading of the database of target persons, communities, institutions and authorities both at local and regional levels (See Table 4).

YEAR		PAPERS on scientific journals	ABSTRACTS from scientific conferences	TALKS (presentations in Museums, Schools, etc)	POSTERS	THESES	MEDIA (Radio, TV, WEB, newspapers, magazines)	FESTIVALS (lessons workshops, open houses)
	Type of audience and language	Scientific, English	Scientific, English and/or local language	General audience, English and/or local language	English	Local language	General audience, English and/or local language	General audience, English and/or local language
2006				**1**			**2**	
2007			**2**	**3**			**36**	**1**
2008		**11**	**9**	**3**	**1**		**8**	**3**
2009		**14**	**23**	**20**	**12**	**2**	**49**	**5**
2010		**5**		**3**		**3**	**16**	**3**
	Total	**30**	**34**	**30**	**13**	**5**	**111**	**12**

Table 4 – Synthesis of activities 2006 - 2010

The significant results reached by NEAREST is the diffusion of the project outcomes at the level of the general public throughout press, TV, radio and webs which was very successful as depicted in Table 4. For example, NEAREST partners CSIC and UBO were involved in the production of a docu-drama jointly produced by ZDF and Discovery Channel on the Lisbon 1755 earthquake and tsunami (produced by A. Solomon, H. Stein, script by H. Nelsen-Minkenberg) with the participation of a TV team of three journalists of German ZDF Station to the Nearest-Seis cruise carried out in Nov. 2008.

5) Conclusive remarks

The NEAREST results were far beyond the expectations!
The major goals of the project were the identification and characterisation of large potential tsunami sources located near shore in the Gulf of Cadiz; the improvement of near real-time detection of signals by a prototype of tsunameter installed on multi-parameter seafloor observatory for the characterisation of potential tsunamigenic sources to be used in the development of a Tsunami Early Warning System (TEWS) prototype; the improvement of integrated numerical models enabling more accurate scenarios of tsunami impact and the

production of accurate inundation maps in selected areas of the Algarve (SW Portugal), highly hit by the 1755 tsunamis.

- NEAREST fully completed the identification of the potential tsunami sources giving and important contribution for the understanding of the geodynamics of the area with the discovery of the WNW-ESE, 600 km long, SWIM lineaments, expression of the Eurasia-Africa plate boundary.
- NEREST completely mapped the offshore sediment instabilities.
- NEAREST provided for the first time the crustal velocity of the offshore of SW Iberia by carrying out a successful refraction experiment.
- NEAREST performed one-year natural seismicity monitoring with 24 OBS and with the GEOSTAR deep-sea observatory in the Gulf of Cadiz. This experiment allowed to detect for the first time the low-magnitude earthquake-events of the area. Thanks to the crustal velocity knowledge acquired by the refraction experiment, the earthquake-ipocentres of these events could now be located very precisely and be related to the main active tectonic structures.
- NEAREST not only carried out the improvement of near real-time detection of signals by a tsunameter installed on a multi-parameter seafloor to be "*used in the development of an Tsunami Early Warning System (TEWS) Prototype*", but fully developed the prototype.
- NEAREST installed at > 3.200 meter depth, and operated for one year GEOSTAR seafloor observatory and the surface buoy for the communications (first experiment) equipped with the sensor and the software for tsunami detection, and re-deployed the system (GEOSTASR and buoy) for the second experiment in synergy with the LIDO Demonstration Mission funded by the EC project, ESONET NoE.
- NEAREST developed a Tsunami Detection Algorithm that, taking into account the basin effects, allows the detection of a parent tsunami signal of less than 1-cm amplitude. The sea-floor observatory was connected in near-real time with the seismic station network implemented by NEAREST partners IM, UGR and CNRST, and successfully tested all the components of the chain.
- NEAREST carried out the integration of the three seismic centres of IM (Portugal), UGR (Spain) and CNRST (Morocco) for real time acquisition, sharing and processing of seismic, tide gauges and abyssal station data. This work allowed to define a *Virtual Seismic Network* for the target region that could be dedicated to a future Tsunami Early Warning in SW Iberia margin and/or to support other possible focal points dedicated to the surveillance in other Regions. The *Virtual Seismic Network* developed by NEAREST could now locate and estimate real size of the seismic source in the SW Iberian margin in less than five minutes. As matter of fact, the Prototype of the Tsunami Early Warning System (P-TEWS) developed in NEAREST, is currently implemented at NEAREST partner IM (Instituto de Meteorologia, Portugal).
- In addition, since tsunami monitoring system will not be put to a true operational test for many years, NEAREST performed a true feasibility study of Early Warning System by simulating a seismic and tsunami event. This was accomplished by developing two simulators.
    1. One simulator that creates synthetic data flows representing seismic information and water level data computed from realistic scenarios to be fed into the monitoring system and test its outcomes.
    2. One simulator that evaluates the consequences of an event seismic and tsunami, being able to figure its environmental impacts to provide the Civil Protection authorities an operational add-to-decision tool in case of a simulated or true crisis.
- NEAREST computed the inundation maps for a test area located in the Algarve (South Portugal), along the Lagos and Sagres coastal areas based on very high-resolution bathymetric data which were, in part, acquired by the project partners.
- NEAREST faced also the "tsunami generation problem" giving new answers. NEAREST developed a theoretical work which found the theoretical existence of hydro-acoustic signal and tsunami wave generated by seafloor motion that may be used as a "hydro-acoustic tsunami precursor" and could be integrated in a new generation of Tsunami Early Warning System.

- NEAREST carried out an exhaustive recognition of the records of paleo-tsunamis that flooded coastal areas and wetlands of South Portugal, Spain and North Morocco and located and sampled the marine records that could be related to paleo-seismic events as submarine slides.
- NEAREST correlated the occurrence of onshore/offshore tsunami deposits to paleo-seismicity and prepared the first complete compilation of available records on sedimentary deposits of the whole Algarve.
- Finally NEAREST, considering the small number of the consortium's partners, had a very positive diffusion results, totalling more than 200 activities among scientific papers, presentation at conferences, radio, TV, newspapers, magazine, scientific festival, etc.

As sketched very briefly above, the project was very complex with a lot of different expertise and work package nested one in the other. NEAREST could reach these results manly thanks to the professionalism and dedications of its partners.

Annex – Plan for using and disseminating the knowledge

Exploitable knowledge and its use

The results of the project are currently far from industrialization or commercialization. Nevertheless the tsunami-detector developed under the Nearest project is in a prototype stage and could be engineered in the next future (see Deliverable D38 for details).

Dissemination of knowledge

The following Table (colors distinguish the type) summarizes the dissemination activities related to the NEAREST project realized during the whole duration of the project (3 years + six months).

Synthetic table of activities 2006 - 2010

YEAR		PAPERS on scientific journals	ABSTRACTS from scientific conferences	TALKS (presentations in Museums, Schools, etc)	POSTERS	THESES	MEDIA (Radio, TV, WEB, newspapers, magazines…)	FESTIVALS (lessons workshops, open houses)
	Type of audience and language	Scientific, English	Scientific, English and/or local language	General audience, English and/or local language	English	Local language	General audience, English and/or local language	General audience, English and/or local language
2006				1			2	
2007			2	3			36	1
2008		11	9	3	1		8	3
2009		14	23	20	12	2	49	5
2010		5		3		3	16	3
	Total	30	34	30	13	5	114	12

The following table illustrates, with a short description, each major activity. The colours have the same meaning of the previous table

Overview Table 2006				
date	**type**	**audience**	**country addressed/ language**	**partners involved**
Aug-Sept 2006	film/video	non specialized	Italy	INGV
9-11 October 2006.	Kick-off **meeting**	specialized	Italy/English	All partners
October 2006	project web site	non specialized	Italy/English	ISMAR

Overview Table 2007				
date	**type**	**audience**	**country addressed/ language**	**partners involved**
17-18/08/2007	Press release (press/radio/tv)	non specialized	Italy, Portugal/ Italian, Portuguese	ISMAR, FFCUL
April 2007	EUG Conference research	specialized	International/English	ISMAR,FFCUL,INGV, TFH, AWI, CNRST, UBO
July 2007	IUGG Conference research	non specialized	International/English	ISMAR,FFCUL,INGV, TFH, AWI, CNRST, UBO
19/01/2007	**Workshop** “Onshore Sedimentological Evidence of Tsunami Deposits”,	specialized	Spain/English	CSIC, FFCUL, ISMAR
10-14/12/2007	NEAREST project; first tsunami underwater observatory in the Gulf of CadizZitellini, N; Eos, Transactions, American Geophysical Union, vol. 88, no. 52, Suppl., **Abstract S53A-1030, Dec 2007**EC	specialized	International/English	
10-14/12/2007	San Francisco - Chierici. et Al - An innovative tsunami detector operating in tsunami generation environment. AGU Fall **Meeting**,	specialized	International/English	
4/10/2007	**Radio** Maroc, Casablanca, (interview by telephone) Reseau d’alerte au tsunami au Maroc et le projet Européen Nearest.	non specialized	Morocco/French	CNRST
3/09/2007	Gazzetta di Parma <<Tsunamometro>> italiano	non specialized	Italy/Italian	ISMAR
31/08/2007	LA VOCE REPUBBLICANA Contro lo tsunami al via un'invenzione del nostro Cnr	non specialized	Italy/Italian	ISMAR
31/08/2007	Brasciaoggi Geostar, lo strumento a caccia di tsunami	non specialized	Italy/Italian	ISMAR
31/08/2007	Il Giornale di Vicenza Geostar, lo strumento a caccia di tsunami	non specialized	Italy/Italian	ISMAR
31/08/2007	L'Arena Geostar, lo strumento a caccia di tsunami	non specialized	Italy/Italian	ISMAR
30/08/2007	La Voce di Romagna "Tsunamometro" made in Italy	non specialized	Italy/Italian	ISMAR
30/08/2007	Il Cittadino Geostar,è tutto made in Italy il sistema <<prevedi tsunami>>	non specialized	Italy/Italian	ISMAR
30/08/2007	Avvenire Una stazione sottomarina per rilevare i maremoti	non specialized	Italy/Italian	ISMAR

29/08/2007	The euro weekly news Tsunamy early warning system installed off Algarve coast	non specialized	Portugal/Poruguese	FFCUL
17/08/2007	Publico Estação de alerta de tsunamis vai ser colocada ao largo de Algarve	non specialized	Portugal/Poruguese	FFCUL
16/08/2007	Diario de Noticias Europa vigia tsunamis	non specialized	Portugal/Poruguese	FFCUL
29/08/2007	CNR news Il nuovo tsunamometro è made in Italy	non specialized	Italy/Italian	ISMAR
31/08/2007	Le Scienze uno 'tsunamometro' per l'Europa	non specialized	Italy/Italian	ISMAR
30/08/2007	SCIENZAESALUTE Nasce Geostar, lo Tsunamometro italiano	non specialized	Italy/Italian	ISMAR
2007	LA STAMPA.it Geostar, lo "tsunamometro" made in Italy	non specialized	Italy/Italian	ISMAR
31/08/2007	Barimia Ecco Geostar, tsunamometro del Cnr	non specialized	Italy/Italian	ISMAR
4/09/2007	torinoscienza.it Ecco Geostar, il primo "tsunamometro"	non specialized	Italy/Italian	ISMAR
5/09/2007	immediapress GEOSTAR, il nuovo "tsunamometro" made in Italy	non specialized	Italy/Italian	ISMAR
4/09/2007	marketpress GEOSTAR, IL NUOVO 'TSUNAMOMETRO' MADE IN ITALY….	non specialized	Italy/Italian	ISMAR
2007	Globalpress GEOSTAR, IL NUOVO 'TSUNAMOMETRO' MADE IN ITALY	non specialized	Italy/Italian	ISMAR
09/ 2007	Villaggio Globale Geostar dà l'allarme tsunami	non specialized	Italy/Italian	ISMAR
5/09/2007	innovations-report.de Innovative Tiefseestation warnt vor Tsunami	non specialized	Germany/German	AWI
5/09/2007	Taucher.net Neuartige Tiefseestation warnt vor Tsunami	non specialized	German	
5/09/2007	presstext.austria Neuartige Tiefseestation warnt vor Tsunami	non specialized	Austria/German	
20/08/2007	CNA - Central de Noticias do Algarve Focus on tsunamis in the Algarve	non specialized	Portugal/Portuguese	FFCUL
6/09/2007	businessportal24.com Innovative Tiefseestation warnt vor Tsunami	non specialized	de-ch/German	AWI
2007	AlgarveMais ALGARVE COM TSUNAMIS "DEBAIXO DE OLHO"	non specialized	Portugal/Portuguese	FFCUL
7/09/2007	Rügenbote Innovative Tiefseestation warnt vor Tsunami	non specialized	Germany/German	AWI

31/08/2007	Moebius Geostar, lo "tsunamometro" made in Italy	non specialized	Italy/Italian	ISMAR
30/08/2007	Jugo Geostar: è italiano il primo tsunamometro	non specialized	Italy/Italian	ISMAR
03/09/2007	Municipi di Roma Geostar, il nuovo "tsunamometro" made in Italy	non specialized	Italy/Italian	ISMAR
30/08/2007	canali.libero.it Tsunami/ ecco geostar la macchina che rileva i maremoti	non specialized	Italy/Italian	ISMAR
29/08/2007	Galileo Geostar, l'anti tsunami	non specialized	Italy/Italian	ISMAR
29/08/2007	.Iswn.it GEOSTAR, il nuovo 'tsunamometro' made in Italy	non specialized	Italy/Italian	ISMAR
1-3 /10/2007	Lo Iacono, C., Gràcia, E., Diez, S., Vizcaino, A., Asioli, A., Bartolomé, R., Martínez, S., Dañobeitia, J.J., Terrinha, P., Zitellini, N. (2007). Overview of submarine mass-movements in the Gulf of Cadiz: Relationship with tectonic activity. 3rd **International Conference** on Submarine Mass Movements and their Consequences, Santorini	specialized	Greece/English	CSIC, FFCUL, ISMAR

Overview Table 2008				
date	**type**	**audience**	**country addressed/ language**	**partners involved**
26-31/03/2008	**Workshop**/Specific NEAREST **Meeting** "Tsunami Hazard on Moroccan coasts: multidisciplinary approach", Institut National de Géophysique, Centre National pour la Recherche Scientifique et Technique	specialized	Morocco/English	CNRST, FFCUL, ISMAR, UBO
8-9/05/2008	Intermediate 18 month Project **meeting** in Barcelona	specialized	Spain/English	CSIC, FFCUL, CNRST
13-18/04/2008	F.Chierici, et Al. - An innovative tsunami detector operating on a multiparameter seafloor observatory. **EGU General assembly**	specialized	International/ English	ISMAR, INGV
17/09/2008	Chierici F., Zitellini N., Favali P., Beranzoli L., Pignagnoli L., Embriaco D., Carrara G., Marinaro G., Lo Bue N., Monna S., Gasparoni F., Furlan F., Bruni F. - Tsunami Warning prototype in the frame of the EC NEAREST project. **SGI Annual assembly**,	specialized	Italy/English	ISMAR, INGV,
6-14/08/2008	**Leaflet**, made by INGV and ISMAR, distributed at the International Geological Conference,	Non specialized	Norway/english	INGV, ISMAR
13/11/2008	University of Granada, **talk**	specialized	Spain/English	UBO
2008	http://www.observatoriodoalgarve.com/cna/noticias_ver.asp?noticia=17511 http://jn.sapo.pt/PaginaInicial/Nacional/Interior.aspx?content_id=980502 http://diario.iol.pt/tecnologia/algarve-tsunami-estacao-de-alerta-sagres-equipamento-tecnologia/981944-4069.html http://www.barlavento.online.pt/index.php/noticia?id=26408	non specialized	Portugal/ Portuguese	FFCUL
2008	A **TV** team of three journalists of German ZDF Station participated in the Nearest-Seis cruise in the framework of a docu-drama jointly produced by ZDF and Discovery Channel on the Lisbon 1755 earthquake and tsunami (produced by A. Solomon, H. Stein, script by H. Nelsen-Minkenberg).	non specialized	Germany/ English	AWI, CSIC
2008	AWI established contacts with German **TV** teams which documented the OBS/GEOSTAR recovering August 2008 and will participate in the NEAREST-Seis cruise in October 2008.	non specialized	Germany/ English	AWI
2008	**TV** - The History Channel, filmed in the studio in Köln Germany	non specialized	Germany/ English	AWI
2008	ZDF/3sat 2008 : **TV** production, hitec: Angst vor der Riesenwelle – Tsunamis im Mittelmeer"	non specialized	Germany/ English	AWI
12/07/2008	ZDF (**German television**), filmed onboard the vessel Hesperides in the Gulf of Cadiz, Nov. 2008	non specialized	Germany/ English	AWI, UBO
2008	"Gefahr für Lissabon" (Lisbonne 1755), **Docu-Drama** (produced by A. Solomon, and written by H. Schmidt)	non specialized	Germany/ English	CSIC, UBO
11/ 2008	The History Channel (**US Cable television**), filmed onboard the vessel Hesperides in the Gulf of Cadiz	non specialized	USA/ English	CSIC, UBO

date	type	audience	country addressed/ language	partners involved
11/ 2008	**Science Festival**: Fete de la Science Nov. 2008, Place de Strasbourg, Brest.	non specialized	France/ French	UBO
12/ 2008	**Conference abstracts:** Omira R., M. A. Baptista, J. M.Miranda, C. Catita. Tsunami Vulnerabilità Assessment of Casablanca – Morocco, pilot study. AGU Fall Meeting, San Francisco 10 – 14 December 2008.	specialized	USA/ English	FFCUL
12/2008	Favali, P., EMSO - European Multidisciplinary Seafloor Observatory, **ECRI**	specialized	France/ French	INGV
2008	Gutscher, M.-A., Baptista, M.A., Miranda, J.M., Omara, R., and Marcaillou, B., 2008. Long term hazard from Atlantic subduction zones (Antilles and Cadiz/Gibraltar) and the example of the Great Lisbon earthquake and tsunami of 1755. **Proceedings AGU Fall Meeting**, San Francisco, 2008, EOS suppl., v. 89.	specialized	International/ English	UBO, FFCUL
4-6/11/2008	Le Roy, P., M Sahabi, N Maad, MA Gutscher, M. Dakki, M. Hssain, B. Van Vliet-Lanoë, L. Ait Brahim, N. M'Hammdi, A. Trenteseaux, N. Babonneau, M. Rabineau, JP Réhault. 2008. High-Resolution seismic stratigraphy of the Neogene and Quaternary deposits of the North-western Atlantic Moroccan margin. 22nd Colloquium Of African Geology, 13th **Conference Of The Geological Society Of Africa**, Hammamet (**Oral Presentation**).	specialized	International/ English	UBO, CNRST
4-6/11/2008	Maad N,, M Sahabi, P Le Roy, M. Dakki, M. Hssain, MA Gutscher, N. M'Hammdi, K. Mehdi , K. El Archi, B. Zourarah, JA Malod, JP Réhault, B. Van Vliet-Lanoë 2008. Quaternary Deformation in the Context of the Rharb Foredeep Basin (NorthWestern Atlantic Moroccan Margin) 22nd Colloquium of African Geology, 13th **Conference of The Geological Society of Africa**, Hammamet	specialized	International/ English	UBO, CNRST
2008	Marcaillou, B., Gutscher, M.-A., and Westbrook, G., 2008. Great earthquakes hazard in slow subduction zones. **AGU Fall Meeting**, San Francisco, 2008, EOS suppl., v. 89.	specialized	International/ English	UBO
16-18/10/2008.	Oliveira, M. A., Andrade, C., Freitas, M.C. & Costa, P. (2008) - Geomorfologia litoral e preservação de assinaturas sedimentares de eventos de alta energia: exemplos do Algarve ocidental. Abstract, submitted to GEOMORFOLOGIA 2008, 2nd National Congress on Geomorphology, Braga	specialized	International/ English	FFCUL
1/10/2008	**Conference** at the Faculty of Sciences, Lisbon (Portugal): Quines estructures generen tsunamis al Golf de Cadis? Falles actives vs. esllavissades submarines.(E. Gràcia)	specialized	International/ English	CSIC, FFCUL
2008	**Paper**: Abrantes F., U. Alt-Epping, S. Lebreiro, A. Voelker, R. Schneider (2008) Sedimentological record of tsunamis on shallow-shelf areas: The case of the 1969 AD and 1755 AD tsunamis on the Portuguese Shelf off Lisbon. Marine Geology 249,283–293.	specialized	International/ English	FFCUL
2008	**Paper**: Buontempo, L., G.H.R. Bokelmann, G. Barruol and J. Morales (2008) "Seismic anisotropy beneath southern Iberia from SKS Splitting" Earth Planetary Science Letters vol 273: 237-250.	specialized	International/ English	FFCUL
2008	**Paper**: Geissler, W., Jokat, W., Schmidt-Aursch, M., Erfolgreiche Bergung von 24 Ozeanbodenseismometern im Golf von Cadiz", GMIT, 24, 21-22, 2008.	specialized	International/ English	AWI

date	type	audience	country addressed/ language	partners involved
2008	**Paper**: Gailler., A., Gutscher, M.-A., Graindorge, D., Sallares, V., Bartolome, R., Gracia, E., Diaz, J., Seismic evidence for Mesozoic oceanic crust in the Gulf of Cadiz. (in prep. for EPSL).	specialized	International/ English	UBO, CSIC
2008	**Paper**: Gutscher, M.-A., and Westbrook, G., (in press). Great earthquakes in slow-subduction low-taper margins. in Sp. Vol. Subduction Zones Geodynamics, (eds. S. Lallemand, F. Funiciello) Springer, Berlin.	specialized	International/ English	UBO
2008	**Paper**: Gutscher, M.-A., Dominguez, S., Westbrook, G., and Le Roy, P., (accepted). Deep structure, recent deformation and analog modeling of the Gulf of Cadiz accretionary wedge: implications for the 1755 Lisbon earthquake. Tectonophysics Sp. Vol., Proc. of the MAPG Meeting Marrakech Morocco (guest editor D. Frizon de Lamotte	specialized	International/ English	UBO
2008	**Paper**: Lima, V.; Miranda, J. ; Baptista, M.; Catalão, J.; Gonzalez, M.; Soares, P. (2008) Spatial distribution of tsunami height and the extent inundation along the southeastern Iberian coast for the 1755 event . EGU2008-A-00822; NH6.1-1TH1O-002	specialized	International/ English	FFCUL
2008	**Paper**: Maad, N., LeRoy, P., Sahabi, M., Gutscher, M.-A., (in review) Seismic stratigraphy of the NW Moroccan Atlantic shelf and Quaternary deformation at the offshore termination of the southern Rif front. Comptes Rendus Geoscience	specialized	International/ English	FFCUL, UBO
2008	**Paper**: Martinez-Loriente, S., Gràcia, E., Bartolomé, R., Sallarès, V., Dañobeitia, JJ., And Swim-06 Cruise Party (2008). Pre-stack depth migration seismic imaging of the Coral Patch Ridge and adjacent Horseshoe and Seine Abyssal Plains (Gulf of Cadiz): Tectonic implications. Trabajos de Geología, ISSN: 0474-9588.	specialized	International/ English	CSIC
2008	**Paper**: Ventosa, S., Simon, C., Schimmel, M., Dañobeitia, J.J., adn A. Manuel. The S-Transform from a wavelet point of view. IEEE transctions, Processing, Vol.56, No7, 2771-2780, 2008.	specialized	International/ English	CSIC
2008	**Paper**: Costa, P., C. Andrade, M. C. Freitas, M. A. Oliveira, R. Taborda and C. M. da Silva. High energy boulder deposition in Barranco and Furnas lowlands, western Algarve (south Portugal). Submitted to the 2nd International Tsunami Field Symposium, Puglia - Ionian Islands, 2008.	specialized	International/ English	FFCUL
2008	**Paper**: Oliveira, M. A., C. Andrade, M. C. Freitas and P. Costa. Using the historical record and geomorphological setting to identify tsunami deposits in the southwestern coast of Algarve (Portugal). Submitted to the 2nd International Tsunami Field Symposium, Puglia - Ionian Islands, 2008.	specialized	International/ English	FFCUL

Overview Table 2009				
date	**type**	**audience**	**country addressed/ language**	**partners involved**
2009	**Class lessons** and workshop within the “Il linguaggio della ricerca”, dissemination project of CNR in Bologna	High school students	Italy/Italian	ISMAR
17/03/2009	**Presentation** at Commisariat à l’Energie Atomique (CEA)	non specialized	France/ French	UBO
9/09/2009	**Poster** presented at GEOITALIA **meeting**, September 9-11, 2009	specialized	International/ English	ISMAR
20/10/2009	Participation to the “il linguaggio della ricerca” **exhibition** in Bologna	High school students	Italy/Italian	ISMAR
27/11/2009	Geosciences Montpellier, Univ. Montpellier II, **talk**	specialized	France/ French	UBO
26-27/10/2009	2 **Workshops** presented, within the “Il linguaggio della ricerca”, at “FESTIVAL DELLA SCIENZA”, Genoa, Italy, October 23rd – November 1st, 2009.	High school students	Italy/Italian	ISMAR
18/05/2009	Il sussidiario.net http://www.ilsussidiario.net/articolo.aspx?articolo=20953 A 3000 metri sotto il mare l'osservatorio "anti Tsunami"	non specialized	Italy/Italian	ISMAR
12/10/2009	E-GAZETTE.IT http://e-gazette.it/index.htm Il nuovo "tsunamometro" è made in Italy	non specialized	Italy/Italian	ISMAR
2/10/2009	www.heos.it/ http://www.heos.it/index.htm Il nuovo "tsunamometro" è made in Italy	non specialized	Italy/Italian	ISMAR
30/09/2009	agadarco.it http://infoshare.agadarco.it/ lo tsunami nel pacifico	non specialized	Italy/Italian	ISMAR
1/10/2009	AFFARITALIANI.it http://www.affaritaliani.it/cronache/scienza_ intervita_a_neccil_tsunamometro_made_in_italy011009.html Scienza/L'Intervista a Nevio Zitellini: "Il nuovo tsunamometro è made in Italy"	non specialized	Italy/Italian	ISMAR
1/10/2009	Il Sussidiario.net http://www.ilsussidiario.net/articolo.aspx?articolo=39799 TSUNAMI/L'esperto: le isole di Samoa a rischio, non sappiamo se il fenomeno si ripeterà	non specialized	Italy/Italian	ISMAR
1/10/2009	www.ecoblog.it http://www.ecoblog.it/post/9046/tsunami-e-possibile-prevederli Tsunami, è possibile prevederli?	non specialized	Italy/Italian	ISMAR

date	type	audience	country addressed/ language	partners involved
30/09/2009	www.dire.it http://www.dire.it/terremoto_in.php?menu=3&cont=24795&lingua=it Terremoto, in Italia si studia lo 'tsunamometro': 'Per prevenire i disastri' Progetto Cnr, Ingv e Inaf perminstallare una stazione di rilevamentoa 3200 metri di profondità nel golfo di Cadice	non specialized	Italy/ Italian	ISMAR
30/09/2009	la Repubblica.it http://www.repubblica.it/2009/09/sezioni/esteri/terremoto-samoa/prevenzione-tsunami-cnr/prevenzione-tsunami-cnr.html?ref=search Lo "tsunamometro" italiano nel golfo di Cadice controlla i movimenti del fondo del mare	non specialized	Italy/ Italian	ISMAR
5/09/2009	la Repubblica.it http://ricerca.repubblica.it/repubblica/archivio/repubblica/2009/10/05/cnr-il-momento-del-venture-capital.html Cnr, è il momento del venture capital	non specialized	Italy/ Italian	ISMAR
30/09/2009	www.adnkronos.com http://www.adnkronos.com/IGN/News/Cronaca/Il-Cnr-in-campo-con-uno-tsunamometro-nel-Golfo-di-Cadice-per-prevedere-i-maremoti_3830184322.html Il Cnr in campo con uno 'tdunamometro' nel Golfo di Cadice per prevedere i terremoti	non specialized	Italy/ Italian	ISMAR
30/09/2009	http://www.italynews.it http://www.italynews.it/scienze-tecnologia/2009/09/30/il-nuovo-%E2%80%98tsunamometro%E2%80%99-e-made-in-italy-11552.html Il nuovo "tsunamometro" è made in Italy	non specialized	Italy/ Italian	ISMAR
30/09/2009	www.italianinnovation.it http://www.italianinnovation.it/html/modules/article/view.article.php?article=14045 Tsunami: Il nuovo "tsunamometro" è made in Italy	non specialized	Italy/ Italian	ISMAR
30/09/2009	Diario del Web http://www.diariodelweb.it/Articolo/?d=20090930&id=106405 Tsunami: Il nuovo "tsunamometro" è made in Italy	non specialized	Italy/ Italian	ISMAR
04/09/2009	Expresso Also in: http://aeiou.expresso.pt/e-possivel-prever-tremores-de-terra=508166	non specialized	Portugal/ Portuguese	FFCUL
22/05/2009	Expresso Also in: http://aeiou.expresso.pt/portugal-com-alerta-de-itsunamisi=f515811	non specialized	Portugal/ Portuguese	FFCUL
10/2009	National Japanese **Television** Network	non specialized	Japan/J apanese	FFCUL
17/12/2009	Expresso Also in: http://aeiou.expresso.pt/o-misterio-do-epicentro=f553562	non specialized	Portugal/ Portuguese	FFCUL
18/12/2009	TVI (**tv Channel**)	non specialized	Portugal/ Portuguese	FFCUL

date	type	audience	country addressed/ language	partners involved
19/12/2009	SIC Notícias (**tv Channel**)	non specialized	Portugal/ Portuguese	FFCUL
6/05/2009	OGGI, **Magazine** Una faglia nell'Atlantico	non specialized	Italy/ Italian	ISMAR
5/10/2009	la Repubblica, **newspaper** Cnr, è il momento del venture capital	non specialized	Italy/Italian	ISMAR
1/10/2010	Corriere nazionale, **newspaper** Un radar negli abissi per prevedere il disastro	non specialized	Italy/Italian	ISMAR
1/10/2010	LA VOCE di Romagna, Rimini, **newspaper** Tsunamometro nel Golfo di Cadice	non specialized	Italy/Italian	ISMAR
1/10/2010	il Domani, Calabria, **newspaper** Monitorando gli abissi si prevedono i disastri	non specialized	Italy/Italian	ISMAR
1/10/2010	la Repubblica, **newspaper** La raffica di scosse che assedia il Pacifico	non specialized	Italy/Italian	ISMAR
1/10/2010	Il Sole24ORE, **newspaper** Devastato il sud-est del mondo	non specialized	Italy/Italian	ISMAR
1/10/2010	IL GIORNALE DI VICENZA L'ARENA, **newspaper** Presto disponibile lo tsunamometro made in italy	non specialized	Italy/Italian	ISMAR
1/10/2010	QN (Il giorno, il resto del Carlino, la Nazione) , **newspapers** Il rilevatore made in Italy	non specialized	Italy/Italian	ISMAR
1/10/2010	l'Unità, **newspaper** Cnr, uno <<tsunamometro>> nel golfo di Cadice	non specialized	Italy/Italian	ISMAR
1/10/2010	La Padania , **newspaper** "Tsunamometro" nel Golfo di Cadice	non specialized	Italy/Italian	ISMAR
30/09/2009	Adnkronos, **press agency** **Samoa: Presto Attivo Tsunamometro Cnr, Puo' Prevedere Maremoti 1 =** E' La Stazioni 'Geostar' Allestita A 3mila Mt Profondita' Nel Golfo Di Cadice	non specialized	Italy/Italian	ISMAR
30/09/2009	Adnkronos, **press agency** **Samoa: Presto Attivo Tsunamometro Cnr, Puo' Prevedere Maremoti 2 =** Installato Su Una Gigantesca Struttura Geologica Fuori Dalle Colonne D'ercole	non specialized	Italy/Italian	ISMAR
30/09/2009	Adnkronos, **press agency** **Samoa: Presto Attivo Tsunamometro Cnr, Puo' Prevedere Maremoti 3 =** Una Boa Di Superficie Per Inviare L'allerta A Terra In Tempi Brevi	non specialized	Italy/Italian	ISMAR
30/09/2009	Adnkronos, **press agency** **Samoa: Presto Attivo Tsunamometro Cnr, Puo' Prevedere Maremoti 4 =** Alla Fine Della Missione L'osservatorio Sara' Recuperato Da Un Robot Marino Tedesco	non specialized	Italy/Italian	ISMAR

date	type	audience	country addressed/ language	partners involved
30/09/2009	Ansa, **press agency** **Ambiente: da cnr lo 'tunamometro' per vedere i maremoti** stazione di rilevamento installata a 3000 metri profondita'	non specialized	Italy/Italian	ISMAR
30/09/2009	REUTERS, **press agency** Made in Italy nuovo prototipo "tsunamometro", dice il Cnr	non specialized	Italy/Italian	ISMAR
30/09/2009	Dire, **press agency** **Terremoto. Da cnr, ingv e inaf studio su prevenzione tsunami** 'tsunamometro' in stazione a 3000 mt profondita' golfo cadice	non specialized	Italy/Italian	ISMAR
30/09/2009	Agra Press, **press agency** Cnr installa nel golfo di cadice stazione di rilevamento a 3mila metri di profondita'	non specialized	Italy/Italian	ISMAR
11/12/2009	**Press release**: El CSIC instala GEOSTAR, un laboratory submarino para la alerta temprana de tsunamis, http://www.csic.es/prensa	non specialized	Spain/ Spanish	CSIC
13/11/2009	**Publico** - Una sonda marina alertará a España de posibles tsunamis. - El laboratorio sumergido en el golfo de Cádiz buscará el origen del maremoto que asoló Europa en 1755.	non specialized	Spain/ Spanish	CSIC
2/10/2009	**RADIO** 101 GR News - interview to Zitellini	non specialized	Italy/Italian	ISMAR
30/09/2009	RAI **TV**3 TG3 Linea Notte- interview to Zitellini	non specialized	Italy/Italian	ISMAR
30/09/2009	RAI **RADIO** 3 GR 3- interview to Zitellini	non specialized	Italy/Italian	ISMAR
30/09/2009	**RADIO** 24 GR 24- interview to Zitellini	non specialized	Italy/Italian	ISMAR
1/10/2009	SKY TG24- interview to Zitellini, **TV**	non specialized	Italy/Italian	ISMAR
09/2009	"Los Ecos del Mar": http://www.utm.csic.es/ecos/ **Web site**	non specialized	Spain/ Spanish	CSIC
03/2009	Posters, 3-D images (anaglyphs) and analog models illustrating research done in the Gulf of Cadiz on the 1755 Lisbon earthquake and tsunami were shown at the "**open house**" day: Portes Ouvertes IUEM/UBO	non specialized	France/ French	UBO
20/01/2009	**Dissemination**: ZDF and Discovery Channel. CMIMA, Barcelona, January 20th, 2009.	non specialized	Spain/English	CSIC
11/2009	**Invited talk** to Civil Defense emergency planners: Baptista, M A: Tsunamis –Sistemas de Alerta no Atlântico. V DEFENCIL	non specialized	São Paulo, Brasil/ Portuguese	FFCUL
7/11/2009	**Invited Talk:** Andrade C. "Sedimentary record of tsunami impacts on the Portuguese coast", Lisbon. Padrão dos Descobrimentos, organization of Lisbon Municipality (Following the conference and	non specialized	Portugal/ Portuguese	FFCUL

	interview to the national press agency, several news-blocks were broadcasted on national TV channels and two national newspapers dedicated one-page articles to tsunami research and risk in Portugal.			
25/9/2009	Antenne 3 (**French television**), (interview filmed in Brest, June 2009). Thalassa: Reportage - à la recherché de l'Atlantide (produced par V. Perazio)	non specialized	France/ French	UBO
2009	**Talk**. IM presented the Nearest project in a number of national and international workshops, particularly on the 1^st Meeting of the Task Team for the Establishment of the Regional Tsunami Warning Centres for the Northeast Atlantic.	specialized	Portugal/ English	IM
12/2009	**Lesson** on "Seismic Monitoring and Surveillance in Portugal and the Tsunamis Watch System", curso de Licenciatura em Protecção Civil, ISEC, Dezembro de 2009, Lisboa.	specialized	Portugal/ Portuguese	IM
2/2009	Participation on the 3^rd **Meeting** of the Task Team for the Establishment of the Regional Tsunami Warning Centers for the Northeast Atlantic and Mediterranean Tsunami Warning System, Paris,	specialized	France/ English	IM
2009	**conferences** of the German Geophysical Society and German Society of Geosciences 2009	specialized	Germany/ German	AWI
5-9/10/2009	Ait Brahim L., Sossey alaoui F., Mastere M., Abdelouafi A., Sahabi M., Mhammdi N., Le Roy P., Van Vliet Lanoë B., Gutscher M.A. & Maad N. 2009. Analyse de la fracturation issue des données satellitaires optiques (Landsat ETM+ et SPOT XS) et Radar (ERS-1) du domaine atlantique de la péninsule de Tanger (Tanger-Larache). 2009. Third Annual Conference IGCP n°526, Rabat, **poster**.	specialized	Morocco/ French	CNRST, UBO
October 2009	Baptista M.A. On the Implementation of the PtTWS (Portuguese Tsunami Warning system. RELEMR - **Workshop** on Seismicity and Earthquake Engineering in the Extended Mediterranean Region, Fundação Luso-Americana para o Desenvolvimento,Lisboa,Outubro,2009	specialized	Portugal/ English	FFCUL
2009	Baptista, M.A., R Omira, L Matias, C Catita, F Carrilho, and E A Toto (2009). Optimal Design of a Tsunami Detection Network in the Gulf of Cadiz - A Contribution to the NEAMTWS of IOC-UNESCO, **Geophysical Research Abstracts**, Vol. 11, **EGU2009**-3197.	specialized	International/ English	FFCUL
July 2009	**Conference abstract**: Baptista, MA, R. Omira, L Matias, J. M. Miranda, C. Catita, E. A. Toto. Early Detection of Tsunamis in the North East Atlantic region. Tsunami - 2009, 24th International Tsunami Symposium, Novosibirsk, Russia.	specialized	International/ English	FFCUL
2009	**Conference abstract:** Costa, P., Andrade, C., Freitas, M.C., Oliveira, M.A. & Jouanneau, J.-M. (2009) - Preliminary results of exoscopic analysis of quartz grains deposited by a palaeotsunami in Salgados lowland (Algarve, Portugal). International Coastal Symposium - ICS 2009, Lisboa, Portugal.	specialized	International/ English	FFCUL
2009	Cunha, T., L.M. Matias, P. Terrinha, A.M. Negredo, F. Rosas, R.M.S. Fernandes, and L.M. Pinheiro (2009). Assessing the recurrence period of large earthquakes and tsunami in the Gulf of Cadiz and SW Iberia margin using thin-sheet neotectonic modelling, **Geophysical Research Abstracts**, Vol. 11, **EGU 2009**-10542.	specialized	International/ English	FFCUL
March 2009	Domingos, M., A. Afilhado, L. Matias, A. Hirn, M. Moulin, P. Terrinha, L. Baptista, T. Alves and T. Cunha (2009). Deep Structure of the South Portuguese Zone From Coincident MCS and Wide-Angle Data: Arrábida to Cape San Vincent, AMPG 2009-6º **Simpósio** de Meteorologia e Geofísica da APMG, 16-18 Março, Caparica.	specialized	Portugal/ English	FFCUL
Dec. 2009	Gailler, A., Gutscher, M.-A., Graindorge, D., Sallares, V., Bartolome, R., and Gracia, E., 2009.	specialized	International/	UBO, CSIC

	Results from the NEAREST-SEIS deep seismic cruise across the Gulf of Cadiz accretionary wedge. **AGU Fall Meeting, San Francisco**, Dec. 2009, EOS, suppl., v. 90.		English	
2009	Geissler, W.H., L.M. Matias, S. Monna, D. Stich, A. Iben Brahim, F. Mancilla, N. Zitellini, and NEAREST Working Group (2009). Sub-crustal earthquakes beneath the Gulf of Cadiz - First results from seismological observations with the NEAREST OBS network, **Geophysical Research Abstracts, Vol. 11, EGU2009**-5641-3.	specialized	International/ English	AWI, FFCUL, CNRST, ISMAR
2009	Geissler, W.H., L.M. Matias, S. Monna, D. Stich, A. Iben Brahim, F. Mancilla, N. Zitellini, and NEAREST Working Group (2009). From Tides to Whale calls - Broadband ocean-bottom recordings from the Gulf of Cadiz, **Geophysical Research Abstracts**, Vol. 11, **EGU2009**-5613-3.	specialized	International/ English	UBO, FFCUL, UGR, INGV, ISMAR
26 March 2009	Gutscher, M.-A., 2009. Slow subduction systems in the Western Mediterranean (Gibraltar – Calabria) : active deformation and long-term seismic hazard. **Proceedings Offshore Mediterranean Conference**	specialized	Italy/English	UBO
2009	**Conference abstract**: Le Roy P., Maad N., Sahabi M., Gutscher M.A., Dakki M., Hssain M., Ait Brahim L., Babonneau N., Mhammdi N., Trenteseaux A., Rabineau M., Rehault J.P. & Van Vliet Lanoë B. 2009. Seismic stratigraphy of the Neogene and Quaternary deposits of the NW Moroccan continental margin. **12ème Congrès Français de Sédimentologie**, Rennes 2009, Livre des résumés, Publ. ASF, 64, p. 207.	specialized	France/ English	UBO, CNRST
October 5th - 9th, 2009	Maad N., Sahabi M., Le Roy P., Gutscher M.A., Ait Brahim L., Babonneau N., Dakki M., Hssain M., Mhammdi N., Rabineau M., Réhault JP, Trenteseaux A. & Van Vliet Lanoë B. 2009. Protit and Nomads oceanographic programs (North Western Atlantic Moroccan Margin) : Pleistocence deformations of the offshore Rharb Foredeep Basin. . Third Annual Conference IGCP n°526, 5th to 9th of October 2009, Rabat, **poster**.	specialized	International/ English	UBO, CNRST
October 5th - 9th, 2009	Maad N., Van Vliet-Lanoe B., Le Roy P., Sahabi. M., Mhammdi N. & Mastere M. 2009. Middle Eemian tectonic event : offshore and onshore evidences of the Rharb and Mamora coast Morroco. Third Annual Conference IGCP n°526, 5th to 9th of October 2009, Rabat, **oral presentation**.	specialized	International/ English	UBO
April 2009	Maad, N., Sahabi, M., Le Roy P., Gutscher, M.-A., Dakki, M., Hssain, M., van Vliet-Lanoe, B., Ait-Brahim, L., M'Haamdi, N., Trenteseaux, A., and the Rharb foredeep Team, 2009. Pleistocene deformations in the contexte of the Rharb foredeep basin (north western Atlantic Moroccan margin). **EGU Meeting**, Vienna, April 2009, Geophysical Research Abstracts, v. 11, **CD-ROM**.	specialized	International/ English	UBO, CNRST
2009	**Conference abstract**: Matias, L., Annunziato, A., Carrilho, F., Baptista, M.A. (2009). Towards a Regional Tsunami Early Warning in the Gulf of Cadiz, **IASPEI2009**,	specialized	International/ English	FFCUL
March, 16 - 18	Matias, L., F. Carrilho, M. A. Baptista, A. Annunziato, R. Omira and J. Luis (2009). O Protótipo do Centro de Alerta Contra Tsunamis em Portugal, **AMPG2009**-6º Simpósio de Meteorologia e Geofísica da APMG, 16-18 Março, Caparica.	specialized	Portugal/ Portuguese	FFCUL
March, 16 - 18	Matias, L., W. Geissler, S. Monna, D. Stich, A. Ibenbrahim, F. Carrilho and the NEAREST Working Group (2009). Sismicidade de Profundidade Intermédia no Golfo de Cadiz - Resultados Preliminares da Campanha de OBS's do Projecto NEAREST, **AMPG2009**-6º Simpósio de Meteorologia e Geofísica da APMG, 16-18 Março, Caparica.	specialized	Portugal/ Portuguese	FFCUL, INGV, CNRST
29-30 April, 2009	Matias, L., W. Geissler, S. Monna, D. Stich, A. Ibenbrahim, F. Carrilho and the NEAREST Working Group (2009). Relationship between seismicity and crustal faults in the Gulf of Cadiz – first results	specialized	Portugal/ English	FFCUL, INGV, CNRST, AWI

	from the NEAREST OBS network, Second International **Seminar** on Prediction of Earthquakes, Lisbon, Portugal,			
March, 16 - 18	Matias, L., W. Geissler, S. Monna, D. Stich, A. Ibenbrahim, F. Carrilho and the NEAREST Working Group (2009). Registos de OBS de Banda Larga no Golfo De Cádiz – Das Baleias às Marés, AMPG2009-6º **Simpósio de Meteorologia e Geofísica da APMG**, 16-18 Março, Caparica.	specialized	Portugal/ Portuguese	FFCUL, INGV, CNRST, AWI
March 2009	Mhammdi N., Trentesaux A. , L. Allousi , L. El Jorfi , M. Ramdani , A. Filali , M. Sahabi , P. Le Roy, B.N. Maad ,B. Van Vliet Lanoe 2009 A Synthesis of Marine Sedimentological Data on Moroccan Continental Margin. **Hermes Project Congrès** Mars 2009.	specialized	France/ English	UBO
Dec.1 – 5, 2009	Moulin, M., Afilhado, A., Domingos, M., Matias, L., Hirn, A., Terrinha, P., Baptista, L., Alves, T. & Cunha, T. (2009). Deep structure of the south segment of the continental Iberia margin: the proximal margin from coincident MCS and wide angle data, **6th Symposium on the Atlantic Iberian Margin,** Oviedo**,**	specialized	Portugal/ Portuguese	FFCUL
16-18/03/2009	Neves, C., F. Rosas, P. Terrinha, L. Matias (2009). Modelação Multi-Escala da Deformação no Golfo de Cádis, AMPG2009-**6º Simpósio de Meteorologia e Geofísica da APMG**,Caparica.	specialized	Portugal/ Portuguese	FFCUL
2009	Oliveira, M.A., Andrade, C., Freitas, M.C. & Costa, P. (2009) - Modeling volume transfer between beach-foredune and the backshore by the 1755 Lisbon tsunami at Boca do Rio lowland, Algarve (Portugal). **International Coastal Symposium - ICS** 2009, Lisboa	specialized	Portugal/ Portuguese	FFCUL
12/2009	Omira, R., Baptista M.A., Miranda J.M., Catita, C., Toto, E.A. : Evaluating Tsunami Hazard and Vulnerability Along the Gulf of Cadiz, North East Atlantic., Cite abstracts as Author(s) (2009), Title, Eos Trans. **AGU,** 90(52), Fall Meet. Suppl., **Abstract**,OS43A-1379	specialized	International/ English	FFCUL
12/2009	Viana Baptista, M.A., Roger, J., Hebert, H. Far-Field Simulations of Tele-tsunami Observed in the Atlantic Ocean: Impact on the Lesser Antilles, Eos Trans. **AGU**, 90(52), Fall Meet. Suppl., **Abstract** OS32A-04	specialized	International/ English	FFCUL
26/3/2009	**Conference** at the Faculty of Sciences, Lisbon (Portugal): Rock-magnetic parameters as environmental and climatic indicators: examples from marine and lacustrine records. 26 March 2009 (L. Vigliotti, ISMAR-CNR).	specialized	Portugal/ English	ISMAR, FFCUL
21/01/2009	**Conference** at the Faculty of Sciences, Lisbon (Portugal): Integración de nuevas tecnologías en paleosismología marina: el proyecto EVENT y la campaña EVENT-SHELF. (E. Gràcia, R. Bartolomé, C. Lo Iacono).	specialized	Portugal/ English	CSIC, FFCUL
25/02/2009	**Presentation** of the project, ROTARY-Club Pirna,	non specialized	Germany/ German	AWI
23.-26/3/2009	69th annual meeting of the German Geophysical Society (**oral presentation**)	specialized	Germany/German	AWI
2009	**Paper**: Annunziato, A., F. Carrilho, L. Matias, M.A. Baptista, R. Omira (2009). Progresses in the Establishment of the Portuguese Tsunami Warning System, EMSC Newsletter, April 2009, pp.10-12.	specialized	International/ English	IM, FFCUL
2009	**Paper**: Baptista, MA; Miranda JM; Mendes-Victor, L. A; et al. (2009). Evaluation of the 1755 Earthquake Source Using Tsunami Modeling. "1755 LISBON EARTHQUAKE: REVISITED" Volume: 7 Pages: 425-432.	specialized	International/ English	FFCUL
2009	**Paper**: Baptista, MA; Miranda JM. (2009). Revision of the Portuguese catalog of tsunamis .Natural Hazards and earth Systems Science,Volume: 9 Issue: 1 Pages:25-42.	specialized	International/ English	FFCUL

2009	**Paper**: Costa, P., Andrade, C., Freitas, M.C., Oliveira, M.A. & Jouanneau, J.-M. 2009, Preliminary results of exoscopic analysis of quartz grains deposited by a palaeotsunami in Salgados lowland (Algarve, Portugal). Journal of Coastal Research, SI 56 (1), pp. 39-43.	specialized	International/ English	FFCUL
2009	Embriaco, D., F Chierici, and L. Pignagnoli: A new real time tsunami detection algorithm for bottom pressure measurements in open ocean: characterization and benchmarks, EGU April 21st, 2009	specialized	International/ English	INGV, ISMAR
2009	Favali, P. and EMSO Partnership, EMSO: European Multidisciplinary Seafloor Observatory, IASPEI January 2009	specialized	International/ English	INGV
2009	Favali, P., and L. Beranzoli, Seafloor observatories, benefits for the Marine and Earth Sciences	specialized	International/ English	INGV
2009	Geissler, W.H., Matias, L., Jokat, W., Monna, S., Stich, D., Iben Brahim, A., Mancilla, F., Zitellini, N., NEAREST Working Group, 2009. Von Gezeitensignalen zu Walgesängen – Breitband-Seismologische Auszeichnungen aus dem Golf von Cadiz, Ostatlantik, 69. Jahrestagung der Deutschen Geophysikalischen Gesellschaft, 23.-26.März 2009, Kiel, SO36, 265.	specialized	German/Germany	AWI, FFCUL, INGV, UGR, CNRST, ISMAR
2009	Geissler, W.H., Matias, L., Jokat, W., Monna, S., Stich, D., Iben Brahim, A., Mancilla, F., Zitellini, N., NEAREST Working Group, 2009. Erdbeben im oberen Erdmantel unter dem Golf von Cadiz – Erste Ergebnisse seismologischer Beobachtungen mit dem NEAREST OBS-Netzwerk, 69. Jahrestagung der Deutschen Geophysikalischen Gesellschaft, 23.-26.März 2009, Kiel, SO37, 266.	specialized	German/German	AWI, FFCUL, INGV, UGR, CNRST, ISMAR
2009	Geissler, W.H., Matias, L., Monna, S., Stich, D., Iben Brahim, A., Mancilla, F., Zitellini, N., NEAREST Working Group, 2009. Sub-crustal earthquakes beneath the Gulf of Cadiz – First results from seismological observations with the NEAREST OBS network, Geophysical Res. Abstracts, Vol. 11, EGU2009-5641, EGU General Assembly 2009.	specialized	International/ English	AWI, FFCUL, INGV, UGR, CNRST, ISMAR
2009	Geissler, W.H., Matias, L., Monna, S., Stich, D., Iben Brahim, A., Mancilla, F., Zitellini, N., NEAREST Working Group, 2009. From Tides to Whale calls – Broadband ocean-bottom recordings from the Gulf of Cadiz, Geophysical Res. Abstracts, Vol. 11, EGU2009-5613, EGU General Assembly 2009. (Poster)	specialized	International/ English	AWI, FFCUL, INGV, UGR, CNRST, ISMAR
2009	**Paper**: Jaffal, M., Frauke Klingelhoefer, Luis Matias, Fernando Teixeira, Mostafa Amrhar (2009). Crustal structure of the NW Moroccan margin from deep seismic data (SISMAR Cruise), C. R. Geoscience, 341, pp 495–503.	specialized	International/ English	UBO, FFCUL
2009	**Paper**: Kaabouben F, Baptista M.A., Iben Brahim A., El Mouraouah A, and Toto A (2009) On the Moroccan tsunami catalogue. Nat. Hazards Earth Syst. Sci., 9.	specialized	International/ English	FFCUL, CNRST
2009	**Paper**: Neves, M.C., P. Terrinha, A. Afilhado, M. Moulin, L. Matias, F. Rosas (2009). Response of a multi-domain continental margin to compression: Study from seismic reflection-refraction and numerical modelling in the Tagus Abyssal Plain, Tectonophysics, 468, 113-130.	specialized	International/ English	FFCUL
2009	**Paper**: Oliveira, M.A., Andrade, C., Freitas, M.C. & Costa, P. Modeling volume transfer between beach-foredune and the backshore by the 1755 Lisbon tsunami at Boca do Rio lowland, Algarve (Portugal). Journal of Coastal Research, SI 56 (2), pp.1547-1551.	specialized	International/ English	FFCUL
2009	**Paper**: Omira, R., Baptista MA, Matias L, Miranda JM, Catita C, Carrilho F and Toto E (2009). Design of a Sea-level Tsunami Detection Network for the Gulf of Cadiz. Nat. Hazards Earth Syst. Sci., 9, 13271338, 2009.	specialized	International/ English	FFCUL, IM
2009	**Paper**: Omira, R., M. A. Baptista, J. M. Miranda,E. A. Toto, C. Catita, J. Catalao. Tsunami	specialized	International/	FFCUL

	vulnerability assessment of Casablanca-Morocco using numerical modelling and GIS tools. Natural Hazards. DOI 10.1007/s11069-009-9454-4		English	
2009	**Paper**: Ribeiro, A., Mendes-Victor, L.A., Matias, L., Terrinha, P., Cabral, J. and Zitellini, N. (2009). The 1755 Lisbon Earthquake: A Review and the Proposal for a Tsunami Early Warning System in the Gulf of Cadiz, in: L.A. Mendes-Victor et al. (eds.), The 1755 Lisbon Earthquake: Revisited, Geotechnical, Geological and Earthquake Engineering 7, Springer, pp 411-423.	specialized	International/ English	FFCUL, ISMAR
2009	**Paper**: Rosas,FM; Duarte, JC; Terrinha, P; Valadares, V; Matias, L - Morphotectonic characterization of major bathymetric lineaments in Gulf of Cadiz (Africa-Iberia plate boundary): Insights from analogue modelling experiments Marine Geology, Vol. 261, no. 1-4, pp. 33-47.	specialized	International/ English	FFCUL
2009	**Paper**: Terrinha P., L. Matias, J. Vicente, J. Duarte, J. Luís, L. Pinheiro, N. Lourenço, S. Diez, F. Rosas, V. Magalhães, V. Valadares, N. Zitellini, C. Roque, L. Mendes Víctor and MATESPRO Team Morphotectonics and strain partitioning at the Iberia–Africa plate boundary from multibeam and seismic reflection, Marine Geology, Vol. 267, pp. 156-174.	specialized	International/ English	FFCUL, CSIC, ISMAR
2009	**Paper**: Terrinha, P., João Duarte, Vasco Valadares, Luis Batista, Nevio Zitellini, Eulalia Gràcia, Nuno Lourenço, Filipe Rosas, Cristina Roque (2009), Seafloor morphology of the Eurasia-Nubia (Africa) plate boundary between the Tore-Madeira Rise and the Straits of Gibraltar: a case of coexistent Mesozoic through Present day features of tectonic, oceanographic and sedimentary origin	specialized	International/ English	FFCUL, ISMAR, CSIC
2009	Vigliotti L., Gallerani A., Andrade C. and Freitas M.C. (2009). Paleomagnetic and rock magnetic study of sediments from Boca do Rio (Algarve, Portugal): inference for the emplacement of the 1755 tsunamigenic layer. European Geosciences Union (EGU)-09, Vienna (Austria), 19-24 April.	specialized	International/ English	ISMAR, FFCUL
2009	Zitellini, N., Gràcia, E., Matias, L., Terrinha, P., Abreu, M.A., Dealteriis, G., Henriet, J.P., Dañobeitia, J.J., Masson, D.G., Mulder, T., Ramella, R., Somoza, L., Diez, S., 2009. The Quest for the Africa-Eurasia plate boundary West of the Strait of Gibraltar. European Geosciences Union (EGU)-09, Vienna (Austria), 19-24 April.	specialized	International/ English	ISMAR, CSIC, FFCUL
2009	**Poster**: Bartolome R.; E. Gràcia; D. Stich; S. Martinez –Loriente ; D. Klaeschen; E. Masana;// S. Diez; C. Lo Iacono; X. Moreno; N. Zitellini; A. Manuel; J. Dañobeitia: Poster presented on Dec. 17th at the 2009 AGU Fall meeting entitled: *T21D-1852*. Seismic evidence of active strike-slip faulting in the external Gulf of Cadiz (SW Iberian Margin).	specialized	International/ English	CSIC, UGR, ISMAR
2009	**Poster**: Geissler and NEAREST Working Group. 2009. Seismological studies within the frame of the EU project NEAREST . EGU Meeting, Vienna, Apr. 2009. (**poster + oral presentation**)	specialized	International/ English	AWI
2009	**Poster**: Mastere M., Aït Brahim L, Abdelouafi A., Fahchouch A.N., Sahabi N., Mhammdi N., Le Roy P., Van Vliet Lanoë, Gutscher M.A. & Maad N. 2009. Mapping geological accidents from airborne and satellite imagery and analysis of fractures networks of the NorthWest of the coastal area between Rabat and Larache. . Third Annual Conference IGCP n°526, 5th to 9th of October 2009, Rabat, poster	specialized	International/ English	CNRST
2009	**Poster**: Morales, J.; Alguacil G.; Martos A. and Martín J.B. (2009) “Andalusian Seismic Network: A real time network for fast earthquake evaluation” 8ThInternational Workshop on Seismic Microzoning and Risk Reduction 15-18 March 2009. Almería	specialized	Spain/English	FFCUL
2009	**Poster**: Riccioni, Rita-Maria, Lucilla Capotondi, Nevio Zitellini, “Science and prevention of natural risk: the example of the project NEAREST (Near ShorE Sources of Tsunamis)“, Poster presented at	specialized	Italy/English	ISMAR

	GEOITALIA meeting, September 9th, 2009, Rimini			
2009	**Poster**: Romsdorf, M., Geissler, W.H., Matias, L., Jokat, W., Monna, S., Stich, D., Iben Brahim, A., Mancilla, F., Zitellini, N., NEAREST Working Group, 2009. Erdbeben im oberen Erdmantel unter dem Golf von Cadiz – Ergebnisse seismologischer Beobachtungen mit dem NEAREST OBS-Netzwerk, GeoDresden 2009, 30.09.-02.10.2009, Schriftenreihe der Dt. Ges. f. Geowiss., 63, 299.	specialized	Germany/ German	AWI, FFCUL, INGV, UGR, CNRST, ISMAR
30.09-02.10/ 2009	**Poster**: GeoDresden 2009, Annual Meeting of the German Society of Geosciences, Dresden	specialized	Germany/ German	AWI
12/2010	**Poster**: D'Oriano, F., Angeletti, L., Captondi, L., Laurenzi, M., Taviani, M., Torelli, L., Trua, T., Zitellini, N.: *New evidence of the Monchique-Madeira hot spot volcanism at the Coral Patch Seamount, Central Eastern atlantic Sea.,* AGU meeting.	specialized	International/ English	ISMAR
2009	**Thesis**: Feld, C., 2009. Seismological monitoring of the 1755 tsunami source area offshore SW Iberia by ocean bottom seismometers, Bachelor thesis, Freie Universität Berlin, 82 pp		Germany/ German	AWI
2009	**Thesis**: Vizcaino i Martì, Alexis, Tesi Doctoral, 2009: Processos sedimentaris d'edat Holocena al marge sud-oest de la penìnsula Ibèrica: aplicaciò a paleosismologia marina.		Spain/ Spanish	CSIC

Overview Table 2010

date	type	audience	country addressed/ language	partners involved
11-12/2/2010	NERIES – ESONET OBS Marine Seismology Workshop, IPG (Institut de Physique du Globe) Paris (**oral presentations**)	specialized	France/English	AWI
01/2010 03/2010	**Class lessons** and workshops within the “Il linguaggio della ricerca”	High school students	Italy/Italian	ISMAR
18/01/2010	SIC (**tv channel**)	non specialized	Portuga/ Portuguese	FFCUL
08/02/20010	**TVI channel** http://www.tvi24.iol.pt/galeria_nova.html?mul_id=13217144	non specialized	Portuga/ Portuguese	FFCUL
27/02/2010	**Publico**	non specialized	Portuga/ Portuguese	FFCUL
01/03/2010	http://maputo.co.mz/noticias/tsunami_fez_alguns_mortos_e_...	non specialized	Portuga/ Portuguese	FFCUL
08/02/2010	**TVI channel** http://www.tvi24.iol.pt/galeria_nova.html?mul_id=13217144	non specialized	Portuga/ Portuguese	FFCUL
17/03/2010	**Metro**	non specialized	Portuga/ Portuguese	FFCUL
28/02/2010	**TVI24 channel** – Jornal da noite	non specialized	Portuga/ Portuguese	FFCUL
03-04/2010	In Camper, **Magazine** Il nuovo "tsunamometro" è made in Italy	non specialized	Italy/Italian	ISMAR
27/02/2010	**TV**: TG2 http://www.tg2.rai.it/dl/RaiTV/programmi/media/ContentItem-f795bb83-beb9-44b0-9ad9-b32c134ba74a-tg2.html?p=0	non specialized	Italy/Italian	ISMAR
27/02/2010	**TV**: TG2 http://www.tg2.rai.it/dl/RaiTV/programmi/media/ContentItem-f795bb83-beb9-44b0-9ad9-b32c134ba74a-tg2.html?p=0	non specialized	Italy/Italian	ISMAR
27/02/2010	**TV**: TG2 http://www.tg2.rai.it/dl/RaiTV/programmi/media/ContentItem-f795bb83-beb9-44b0-9ad9-b32c134ba74a-tg2.html?p=0	non specialized	Italy/Italian	ISMAR
27/02/2010	**Press agency**: ANSA	non specialized	Italy/Italian	ISMAR
27/02/2010	**Web**: www.ilsussidiario.net http://www.ilsussidiario.net/News/Scienze/	non specialized	Italy/Italian	ISMAR

date	type	audience	country addressed/ language	partners involved
27/02/2010	**TV**: TG1 http://www.rai.tv/dl/RaiTV/programmi/media/ContentItem-05848bb4-92d6-4379-a5a6-125670cff685.html?p=7	non specialized	Italy/Italian	ISMAR
2010	"Marine Sciences for Society" Ocean **Lectures** Gutscher 2010, Titre - Séismes et tsunamis dans la region Mediterranéenne (8 min) (in French) http://www.youtube.com/watch?v=acsMd8pPUB4	non specialized	France/French	UBO
2010	**Documentary film** (1h long) entitled "The Lisbon Earthquake". Produced for History Channel (in English) and ZDF TV channel (in German).	non specialized	Germany/English	AWI, CSIC, UBO
2010	Production of tsunami awareness materials in Portuguese to be used in Mozambique-collaboration between the India Ocean Tsunami Early Warning System and (IOTWS) and the North east Atlantic and Mediterranean Tsunami Early Warning System (NEAMTWS); these materials are implemented in the TSUNAMI INFO webpage of IDL http://www.idl.ul.pt	non specialized	Portugal/Portuguese	FFCUL
03/2010,	Participation on the 5^rd **Meeting** of the Task Team for the Establishment of the Regional Tsunami Warning Centers for the Northeast Atlantic and Mediterranean Tsunami Warning System, Paris.	specialized	France/English	IM
14-16/01/2010	Terrinha, P., Matias, L., Noiva, J., Vicente, J., Silva, S., Batista, L., Lourenço, N., Carrara, G., Cunha, T., Duarte, J., Rosas, F., Valadares, V., Gràcia, E., Zitellini, N. (2010). Active Faults between the Gibraltar Straits and the Tore-Madeira Rise. **Project SHARE workshop**, Moncarapacho.	specialized	Portugal/English	FFCUL, ISMAR, CNRST
2010	Chierici, F., L. Pignagnoli, and D. Embriaco (2010), Modeling of the hydroacoustic signal and tsunami wave generated by seafloor motion including a porous seabed, J. Geophys. Res., 115, C03015, doi:10.1029/2009JC005522.	specialized	International/English	ISMAR, INGV
2010	Cunha, P., Buylaert, J., Murray, A., Andrade, C. Freitas, M.C., Fatela, F.,Munhá, J., Martins, A. & Sugisaki, S. - Optical dating of clastic deposits generated by an extreme marine coastal flood: the 1755 tsunami deposits in Algarve (Portugal). Quaternary Geochronology, vol.5 (2010) 329 - 335.	specialized	International/English	FFCUL
2010	Gràcia, Eulàlia; Vizcaino, Alexis; Escutia, Carlota; Asioli, Alessandra; Rodés, Ángel; et. al., May, 2010 - Holocene earthquake record offshore Portugal (SW Iberia): testing turbidite paleoseismology in a slow-convergence margin, Quaternary Science Reviews Volume: 29, Issue: 9-10, pp. 1156-1172	specialized	International/English	CSIC
2010	Pignagnoli Luca, F. Chierici, P. Favali, L. Beranzoli, D. Embriaco, S. Monna, F. D'Oriano and N. Zitellini, 2010, Tsunami Early Warning System: deep sea measurements in the source area. Submitted to volume MARE, "Dipartimento Terra e Ambiente del CNR" editor, 2010.	specialized	International/English	ISMAR. INGV

date	type	audience	country addressed/ language	partners involved
2010	**Paper:** Zitellini Nevio, Maria Ana Baptista, Juanjo Dañobeitia, Wilfried Jokat, Marc-Andre Gutscher, Paolo Favali, Hans W. Gerber, Jose Morales, Fernando Carrilho and Azelarab El Mouraquah, Integrated observations from Near Shore Sources of Tsunamis in the Gulf of Cadiz, Geophysical Research Abstracts, Vol. 12, EGU2010-PREVIEW, 2010, EGU General Assembly.	specialized	International/English	ISMAR, FFCUL, CSIC, AWI, UBO
2010	Romsdorf, M., 2010 (in prep.), Diploma **thesis**, TU Bergakademie Freiberg.	specialized	Germany/German	AWI
2010	**Thesis:** Sergi Ventosa: *Multidimensional techniques of signal processing applied to seismic data.* Juanjo Danobeitia is one of the supervisors. March 1st, 2010	specialized	Spain/English	CSIC
9/04/2010	**Thesis defense:** D'Oriano Filippo, *Geological and Structural evolution of the Eurasia Africa plate boundary in the Gulf of Cadiz Central Eastern Atlantic Sea.* Supervisors Rossella Capozzi and Nevio Zitellini, University of Bologna, School of Earth Sciences, XXII Cycle.	specialized	Italy/English	ISMAR

After the end of the project, the following activities have been already foreseen:

Date	type	Typeof audience	Country addressed	Partner responsible/involved
October 2010- June 2011	School lessons	Non specialistic	Italy	ISMAR
Dec. 2010 AGU Conference	Research conference	Specilaistic-	International	All partners
April 2011 EGU Conference	Research conference	Specilaistic-	International	All partners

In addition, our plan of dissemination after the end of the project foresees the following activities:

1) editing a special volume on the geology/geophysics of the Gulf of Cadiz
2) submitting a paper to an international magazine that summarize the activities carried out by NEAREST project
3) Participation in the Italian CNR events for the dissemination of the NEAREST scientific activities in the schools.

Publishable results

The following list summarizes the publishable results related to the Nearest project with reference to the work performed during the whole project.

no.	Deliverable name
D3	report on site characterisation and selection for the deployment of the deep sea platform
D5	wide angle seismic cruise report
D7	deployment cruise of broad band OBS and cruise report
D8b	cruise report
D14	deployment cruise of the deep-sea platform and cruise report
D15b	cruise report
D22b	high-resolution seismics and core sampling cruise report
D24b	cruise report
D30	simulator for the decision-maker authorities
D31	project brochure
D32	web site
D34a D34b	project information materials (initial, updates and final) current situation and know-how on tsunami and EWS
D35	periodical management reports
D36	minutes of meetings and workshops
D37	final Report
D38	technological implementation plan