



The 12/02/2007 SW Cape San Vicente Earthquake: SFS (San Fernando SP) and WM (Western Mediterranean) networks preliminary report

J. Martín-Davila (1), A. Pazos (1), E. Buforn (2), A. Udías (2), M. Bezzeghoud (3), B. Caldeira (3), A. Rimi (4), M. Harnafi (4), W. Hanka (5), A. Nadji (6)

1. Real Instituto y Observatorio de la Armada, San Fernando, Spain (mdavila@roa.es and pazos@roa.es)
2. Departamento de Geofísica y Meteorología, Universidad Complutense, Madrid, Spain (ebufornp@fis.ucm.es)
3. CGE and Physics Department., Universidad de Evora, Evora, Portugal (mourad@uevora.pt)
4. Institut Scientifique, Université Mohammed V Agdal Rabat, Morocco (harnafi@israbat.ac.ma)
5. GeoforschungsZentrum, Potsdam, Germany (hanka@gfz-potsdam.de)
6. Université d'Oran – Es Sénia, Oran, Algeria (amansour.l@yahoo.fr)

Introduction

The western part of the Eurasia-Africa plate boundary crosses the Gulf of Cadiz at about 36°N latitude, without a well defined boundary line. The plate convergence, at a rate of a few mm/year in a NNW/SSE to NW/SE direction (Buforn et al 2004), induces a moderate magnitude and shallow depth seismicity, but a clear intermediate activity (figure 1) is also present at the area and large magnitude historical events have been documented since the roman times (Martín-Davila and Pazos, 2003), among them the 1755 Lisbon earthquake, with an estimated magnitude of 9.0. This event, with an epicentre located SW of Cape San Vicente, caused around 20000 casualties. More recently, on February 28, 1969, an 8.1 magnitude event was located in the same area. Both shocks induced a tsunami, with a measured wave height at Cadiz Bay of about ten meters for the 1755 event and one meter for the 1969.

Seismicity 1985-2005 (Magnitud>3.0)

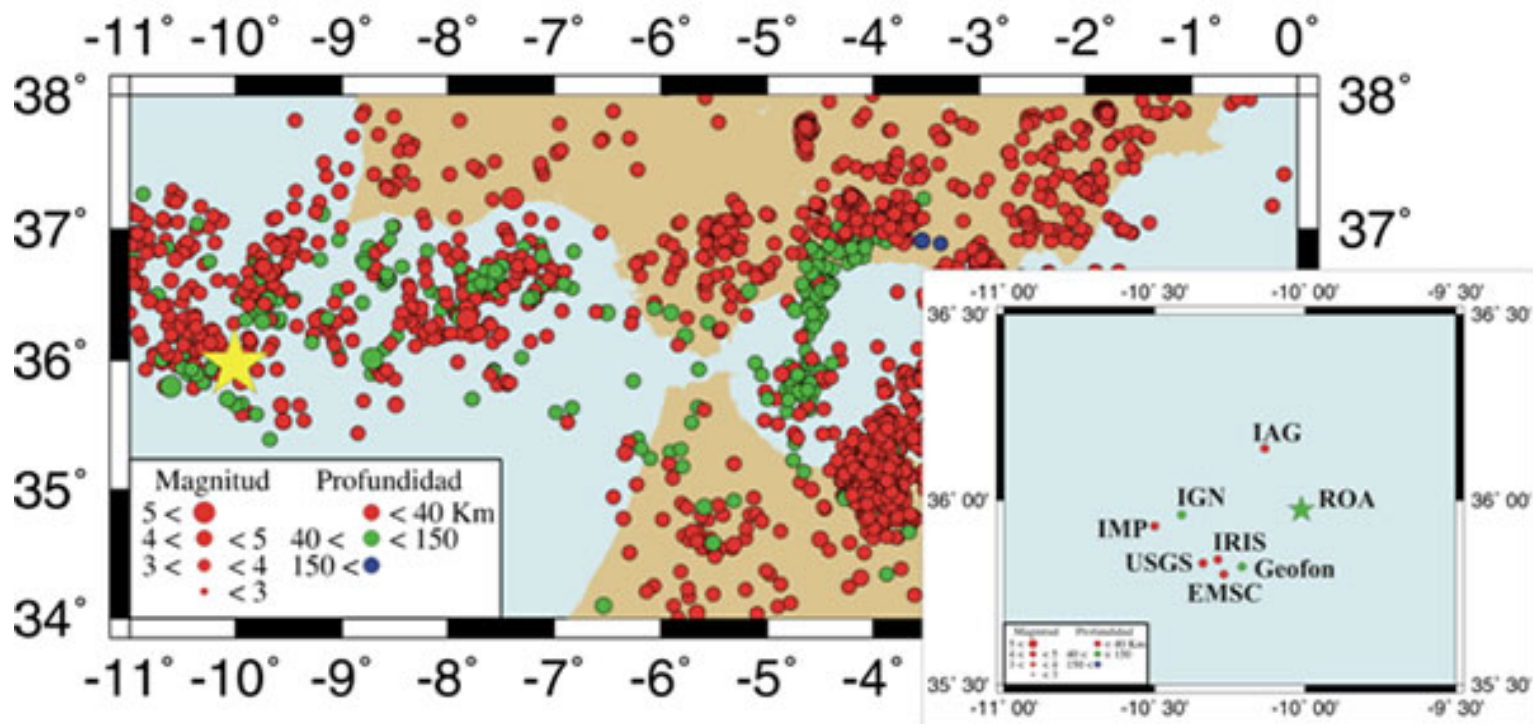


Figure 1. - Distribution of epicenters at the Ibero-Maghrebian region for magnitude greater than 3.0 (IGN and ROA catalogues). The 12/02/2007 SW San Vicente Cape earthquake location is shown (yellow star). The different epicentral locations provided by several agencies are also plotted (right box).

On February, 12, 2007, at 10h 35m 25s UTC, a large earthquake, felt with Intensity IV (IGN) in the SW of Iberian Peninsula and NW Morocco, occurred in the same area. The preliminary parameters, provided by several agencies, estimated a magnitude close to 6.0 and located the epicentre in the vicinities of the 1755 and February 1969 events (figure 1). In this work we will describe briefly the seismological networks installed in the area by ROA (Real Instituto y Observatorio de la Armada) in collaboration with several Institutions, especially UCM (Universidad Complutense de Madrid), show some broad band stations records and provide the determined hypocentral parameters.

ROA short period seismic network

In order to study the viability of a tunnel or bridge between Spain and Morocco through the Gibraltar Strait, from a seismological point of view, a short period network (SFS Network) has been installed in that area by ROA in 1986 (figure 2), in collaboration with IGN (Instituto Geografico Nacional) and SECEGSA (Sociedad Española de estudios para la Comunicación fija a traves del Estrecho de Gibraltar). At present the network is operated by ROA and consists of eight vertical component analogue stations linked to ROA headquarters via radio UHF/VHF. These stations are presently being upgraded (Pazos et al 2005).

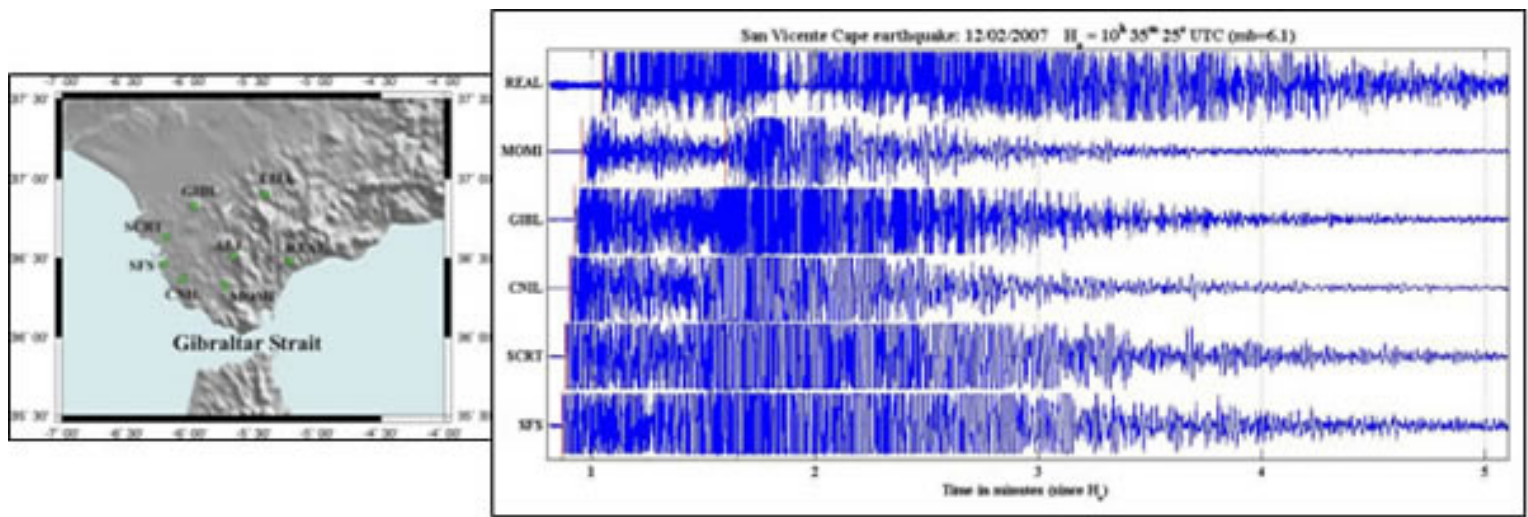


Figure 2, Left: ROA Short Period seismic network (SFS network). **Right:** February 12, 2007, San Vicente Cape earthquake records (P and S waves arrivals are picked with a red line).

Due to the characteristics of these stations and the relative short distance to February 12, 2007 earthquake epicentral location, the records are saturated. Some of them are shown on figure 2, where a clear impulsive P arrival has been marked, but only for MOMI station the S wave could be picked.

Western Mediterranean (WM) broad-band seismological network

To avoid the problems associated to the short period instruments, like those mentioned above, ROA and UCM, with the support of GFZ (Geoforschung Zentrum, Potsdam), have installed a broad band seismological network in Southern Spain and Spanish sites in Northern Africa. Since 2005, and because of the extension of the network outside Spain, the network code is WM (Western Mediterranean, FDSN), replacing the ROA/UCM initial one (Bufoin et al 2002). At present nine stations are in operation (figure 3): three on the Spanish mainland (SFS, EMAL and CART), one on the Balearic Islands (MAHO), three stations at Spanish sites at Northern Africa: MELI, PVLZ, and CEU, one in SW Portugal (EVO, Evora University), and, one in Morocco (AVE, Institut Scientifique of Rabat, ISRABAT), with headquarters and data center at ROA. All stations have Streckeisen STS-2 sensors, Quanterra or Earth Data digitizers, and a Seiscomp acquisition system. Most data are available in near-real time (phone line or Internet) except for PVLZ, CEU and AVE, which will be available in the near future.

Two more stations are planned for the near future, at Ifrane Observatory, Morocco (ISRABAT), and Oran, Algeria (Université d'Oran), both of them in collaboration with ROA and UCM. A deployment of Ocean Bottom Seismometers ("ALBORAN" permanent OBS and "Red FOMAR" temporal network), funded by Spanish Education and Research Ministry (MEC), with the collaboration of Spanish Navy, is planned to be carried out within 2007.

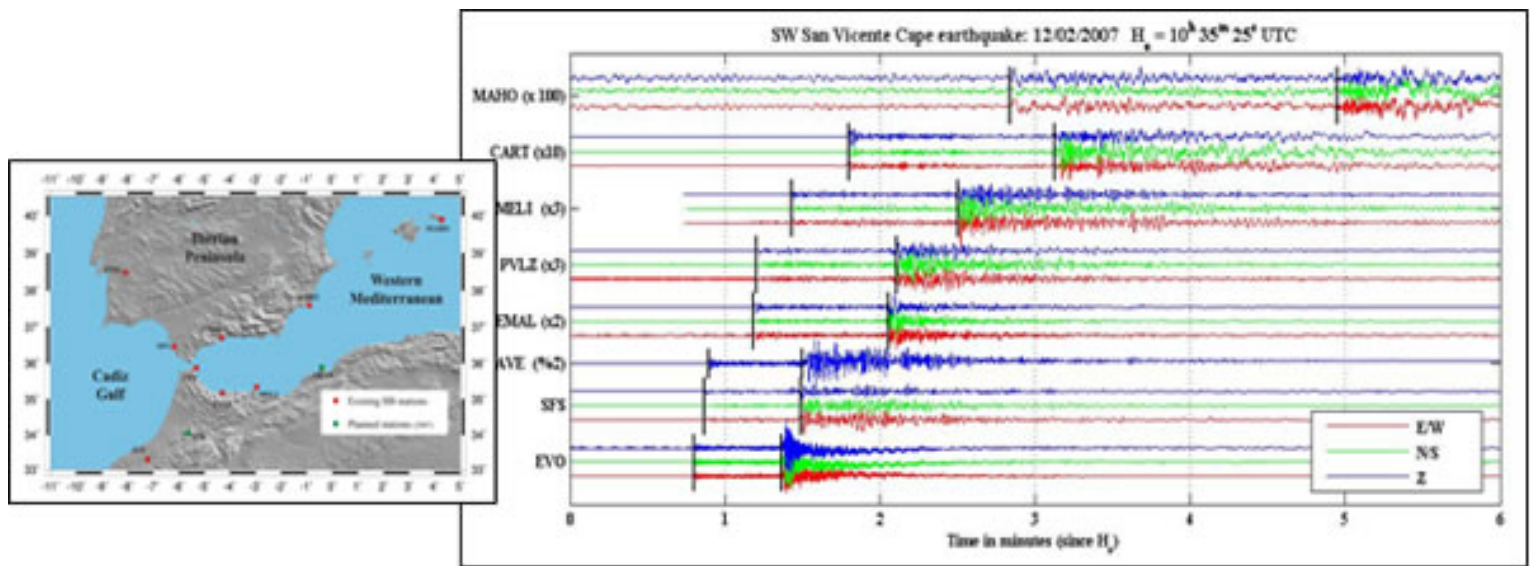


Figure 3, Left: Western Mediterranean (WM) BB seismic network. **Right:** February 12, 2007, San Vicente Cape earthquake records (P and S waves arrivals are picked with a black line).

Some broad band records of the February, 12, 2007 San Vicente earthquake from WM stations are shown in figure 3. Data plotted correspond to BH (20 sps), SH (50 sps) or HH (100 sps) channels.

Earthquake parameters

To determine the earthquake parameters we have used the HYPOCENTER 71 programme (Peters and Crosson, 1972), using all phases picked from SFS and WM network stations. Two more P phases from TAF and RBA analog stations (ISRABAT, Morocco) were also used (Ramdami, F. personal communication). As shown in figure 1, different epicentral locations have been given and the calculated hypocentral depth also shows large differences, from 10 km (IRIS, USGS) to 65 km (IGN). We have calculated the location by fixing the depth between 10 and 80 km. The best solution obtained from our data gives very similar solution residuals for a hypocentre located between 45 and 60 km depth:

Date: 12/02/2007
 Ho: 10:35:26.80 UTC
 Lat: 35.9740 N
 Long: 10.0131 W
 Depth: 45.0 km.
 Mag.: 6.07

Acknowledgements

This preliminary report has been partly funded by the Spanish Ministry of Education and Science (MEC) through the projects: REN2006-10311-C03-01/02 (RISTE), RIOA05-23-002 (OBS ALBORAN) and CGL2005-24194-E (RED FOMAR).

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