Improving the detectability of seismic events in Greece: The rapid deployment of NOA's portable seismographic network

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Abstract

A increase in the rate of the seismic activity production has been observed since the beginning of 2009 to the south – southeast of Zakynthos island, in the Hellenic Arc. Three strong (Ms=6.1, 6.0 and 5.8) crustal earthquakes and thousands of smaller events have been recorded by the Hellenic National Seismographic Network which is coordinated by the Institute of Geodynamics of the National Observatory of Athens (NOA).

In addition to these observations, NOA installed a newly acquired portable seismographic network in the region surrounding the seismic activity for a two month period. During this period real time data flow from the portable seismographic network to NOA's central data base in Athens was accomplished using GPRS/3G lines.

In this study we show that the rapid employment of NOA's newly acquired portable seismographic network significantly improves the real-time detectability of seismic events and the assessment of seismic hazard in Greece.
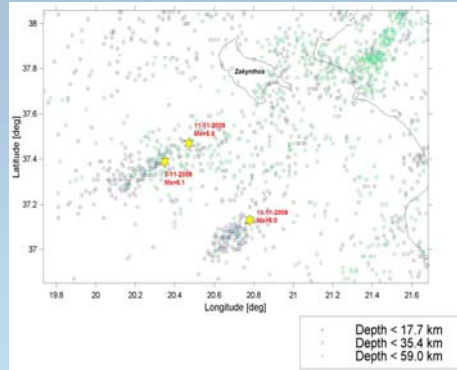
Network instrumentation

NOA's portable seismographic network is a combination of a base station located at the Geodynamic Institute in Athens and the remote stations adequately installed in the area under investigation.

In this specific field campaign each of the 5 remote stations uses a Lennarts (LE 3D/20s) seismometer [1] which is connected to a Geotech - Smart 24 digitizer/recorder [2]. The digital signal from the remote station sampled at 100 Hz is recorded locally in the HDD of the Smart24 and simultaneously it is broadcasted via the Internet to the base station in Athens, with a combination of a Vigor router[3] and 3G/GPRS - USB modem. NOA's Athens base station configuration consists of a Linux - PC running the Seedlink/Seiscomp[4] software. This allows the near real-time data aquisition from the remote stations which are subsequently stored on a Nanometrics[5]NAQS server.

The five remote stations for this campaign were tranported more than 250 km from Athens and were rapidly installed in Zakynthos and Western Peloponesus within 48 hours. Special attention was given to the local geological settings and the GPRS signal quality.
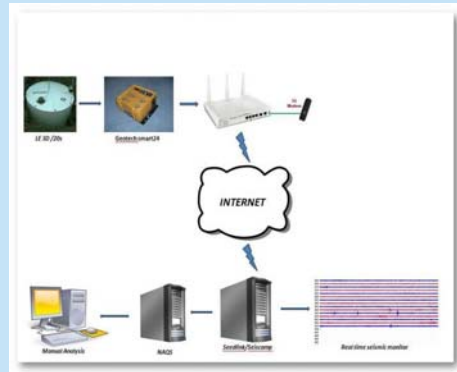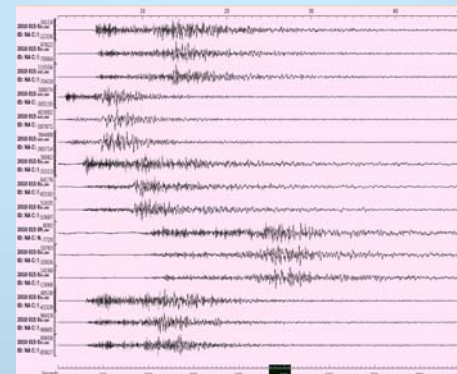
Results and Conclusions

NOA's portable seismographic network operated from December 17th, 2009 untill February 7th, 2010. During this period 148 seismic events were registered in the region under investigation by the portable network. For the same time period and in the same area only 73 events were registered by the national seismographic network operated by NOA[5]. The magnitude range of these events are from M=1.9 - 3.2 and the depths between 2 and 58 km.

The installation of 5 portable seismographic stations clearly enhanced the detectability of the National seismographic network and nearly doubled the amount of registered events in the investigated region.

The magnitude of completeness (Mc=lowest magnitude at which 100% of the events are detected) as a function of space is influenced by the seismological network configuration in Greece[7]. In earthquake hazard assesment studies[8] it is crucial to examine the Mc variation of the data set both in space and time.

The results from this study show that the complementary employment of NOA's portable seismographic network valuably impoves the detectability of NOA's National seismographic network and effectively lowers the magnitude of completeness.

References

1-http://www.lennartz-electronic.de (Lennartz 3D/20s)
2-http://www.geoinstr.com (Geotech Smart24)
3-http://www.draytek.com (Vigor modem/router)
4-http://geofon.gfz-potsdam.de (Seiscomp/Seedlink)
5-http://www.nanometrics.ca (Naqs Server)
6-http://www.gein.noa.gr
7-G. Chouliaras, Nat. Hazards Earth Syst. Sci., 9, 905-912 (2009).
8-K.Makropoulos, V. Kouskouna, G. Kaviris, ESC 32nd General Assembly, SD4/P1/ID61, (2010).

Seismicity near Zakynthos island during 2009

Depth < 17.7 km
Depth < 35.4 km
Depth < 59.0 km

The Seismological Network of the National Observatory of Athens

NOA's Portable Seismographic network

Portable station sites from 17-12-2009 untill 7-2-2010

M=3.2, January 15th, 2010, 09:37 GMT

Seismic events from 17-12-2009 untill 7-2-2010

Comparison of the magnitude of completeness maps before and after the portable network installation

Magnitude of Completeness - National Network

Magnitude of Completeness - Portable Network