Acquiring, archiving, analyzing and exchanging seismic data in real time at the Seismological Research Center of the OGS in Italy: an updated view
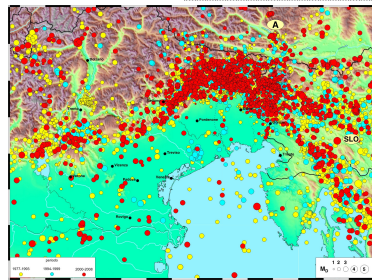
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ISTITUTO NAZIONALE
di OCEANOGRAFIA e di
GEOFISICA SPERIMENTALE

CRS Centro di
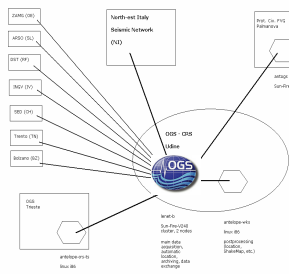Ricerche Sismologiche

SUMMARY

Seismicity of North-East Italy during 1977-2008 (courtesy of S. Urban). The 1976 Ms=6.4 was the last severe earthquake.
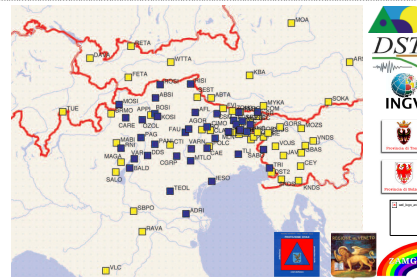
Seismic stations acquired in real-time at OGS-CRS: 42 stations directly managed by OGS-CRS (35 OGS-CRS + 7 Rete del Trentino, blue squares) and 48 stations contributed by other institutions (indicated in the right in the figure, yellow squares). The total number of seismic stations acquired in real-time at OGS-CRS is 90.
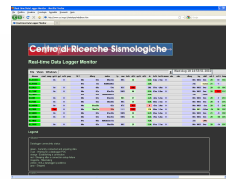
The Centro di Ricerche Sismologiche (CRS, Seismological Research Center) of the Istituto Nazionale di Oceanografia e di Geofisica Sperimentale (OGS, Italian National Institute for Oceanography and Experimental Geophysics) in Udine (Italy) after the strong earthquake (magnitude M=6.4) occurred in 1976 in the Italian Friuli-Venezia Giulia region, started to operate the North-east Italy (NI) seismic network: it currently consists of 14 very sensitive broad band and 21 more simple short period seismic stations, all telemetered to and acquired in real time at the OGS-CRS data center in Udine. Real time data exchange agreements in place with other Italian, Slovenian, Austrian and Swiss seismological institutes lead to a total number of 90 seismic stations acquired in real time, which makes the OGS the reference institute for seismic monitoring of Northeastern Italy.
Since 2002 OGS-CRS is using the Antelope software suite as the main tool for collecting, analyzing, archiving and exchanging seismic data in the framework of the EU Interreg IIIA project "Trans-national seismological networks in the South-Eastern Alps". SeisComP is also used as a real time data exchange server tool. At OGS-CRS we then adapted existing programs and created new ones like: a customized web-accessible server to manually relocate earthquakes, a script for automatic moment tensor determination, scripts for web publishing of earthquake parametric data, waveforms, state of health parameters and shaking maps, noise characterization by means of automatic spectra analysis, plus scripts for email/SMS/fax alerting. A new OGS-CRS real time web site (http://rts.crs.inogs.it) has also been recently designed and made operative in the framework of the Italian P C-INGV S3 Project.

DATA MANAGEMENT

Antelope @ OGS

BB stations State Of Health monitor

Daily plot of the power supply voltage of seismic stations and their radio link devices

Waveform data drumplots refreshed every 5 minutes

The data quality check of the broadband seismic stations is performed through the PQLX software (McNamara & Boaz. 2005) that computes power spectral density (PSD) for frequencies ranging from ~0.01 to 16 Hz. A comparison of day and night PDFs and an examination of artifacts related to station operation and episodic cultural noise allow us to estimate both the overall station quality and the level of Earth noise at each site.

We implemented the TDMT_INV code (e.g. Dreger, 2003) for moment tensor computation. The automatic procedures is activate for earthquakes ML>3.6 located in NE Italy and surroundings.

Moment tensors computed using OGS data.
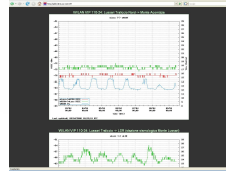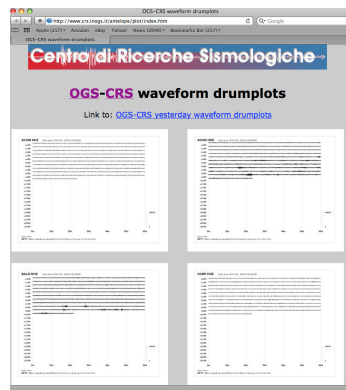
The Antelope software suite is used at OGS - CRS as the main data acquisition tool by the Northeast Italy (NI) Seismic Network run by OGS. The main OGS-CRS Antelope server is running in Udine on a 2 nodes SUN-Fire-V240 cluster: the main module takes care of data acquisition, automatic location determination, data archiving and exchange, plus the alert system via Short Message Service (SMS), email, fax and web. For Antelope users, real time data from the NI Seismic Network is now available at address antelope.crs.inogs.it:51558. Another Linux workstation running Antelope (antelope-wks) at the OGS-CRS headquarters in Udine is used for post-processing including ShakeMaps and manual relocation determinations. Data is also forwarded for redundancy to a SUN-Fire-V245 Antelope machine (antogs) at Protezione Civile della Regione Friuli-Venezia Giulia (Civil Protection of the Friuli-Venezia Giulia region) headquarters in Palmanova and for convenience to a Linux Antelope machine (antelope-crsts) at OGS headquarters in Trieste. Data from the Antelope SUN-Fire-V240 cluster at OGS-CRS headquarters in Udine are also forwarded to the OGS-CRS SeisComP exchange server on the same machine: here data is also available on request.
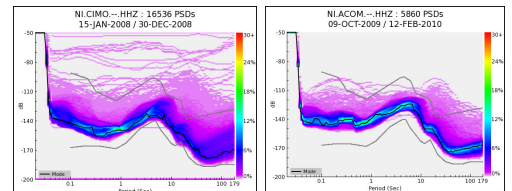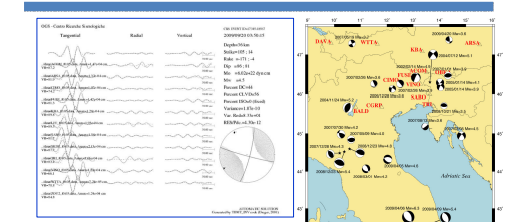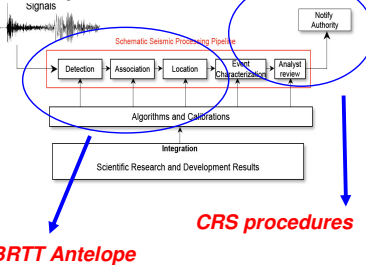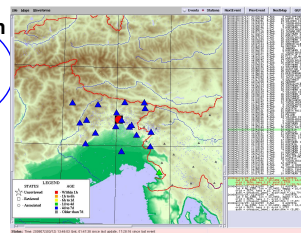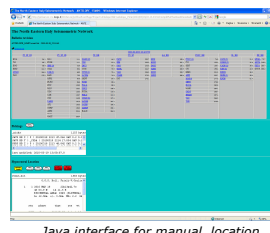
## Earthquake detection and notification

BRTT Antelope

CRS procedures

The standard Antelope program dbevents that plots the locations on a map showing also the contributing seismic stations.

Java interface for manual location revision.

Since 2004 for bulletin production we use the SeisGram2K software (A. Lomax) for quick visualization and signal processing. Such program reads picks and waveforms from the Antelope system through an ad-hoc Java interface created at our department.

Web   Fax
SMS   E-mail
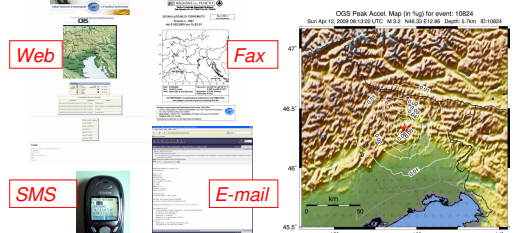
Alarm procedures in case of earthquake.

Earthquake location and magnitude are automatically notified via multiple means to governmental institutions.

Example of PGA map by Shakemap

The ShakeMap software (Wald et al., 2006) customized for Italy by INGV automatically runs at OGS as earthquakes are located.

ACKNOWLEDGMENTS

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