Improving CTBTO monitoring capabilities: the Italian proposal for a CNF

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ABSTRACT. The Centro di Ricerche Sismologiche (CRS, Seismological Research Center) in Udine (Italy) of the OGS (Istituto Nazionale di Oceanografia e di Geofisica Sperimentale), the Italian National Institute for Oceanography and Experimental Geophysics, after the M=6.4 earthquake occurred in 1976 in the Friuli-Venezia Giulia region, started to operate the Northeastern Italy Seismic Network: it currently consists of 18 very sensitive broad band and 20 simpler short period seismic stations, all telemetered to and acquired in real time at the OGS-CRS data center. OGS is officially part of the Central and Eastern European Earthquake Research Network CE3RN (http://www.CE3RN.eu/; Bragato et al., 2014). Real time data exchange agreements in place with CE3RN and other Italian and Swiss seismological institutes lead to a total number of about 100 seismic stations acquired in real time by the CRS, which makes the OGS the reference institute for seismic monitoring of Northeastern Italy (Bragato et al., 2011).

To further support CTBTO activities (Pesaresi and Horn, 2004), OGS proposes with the support of the Italian CTBTO National Authority one of its stations of the Northeast Italy Seismic Network as a Cooperating National Facility (CNF) to the CTBTO. A description of the Cludinico (CLUD) station proposed as CNF, together with results of CTBTO monitoring improvements simulations will be here illustrated.

OGS CLUD seismic station. Anti-clockwise: the satellite data link antenna, the entrance of the mining tunnel, sensors installation (Nanometrics Trillium 120 seismometer left and accelerometer right), Power Spectral Density plot close to Low Noise Model (green line). The Data logger is a 26 bit Quanterra Q330 High Resolution. The installed instrumentation is “substantially meeting” CTBTO specifications.

ANALYSIS METHODOLOGY. We downloaded from the CTBTO IDC SEL3 and REB arrivals from all the IMS network for about 1 year of data, from 06/07/2014 to 30/05/2015. We added to these 2 datasets arrivals from CLUD stations for the same time period: the automatic ones to SEL3 dataset, the manually reviewed ones to REB dataset. For both datasets we computed a very basic but very fast automatic grid search location using the standard Antelope routines (Pesaresi and Horn, 2004) and then refining the location with the generic Gauss-Newton algorithm of the genloc family of location programs (Pavlis et al., 2004). Resulting datasets contain more than 300,000 phases of data. For both datasets we computed azimuth gap and error ellipse area. We then evaluated results in the Europe/Middle East area box with 25° < latitude < 70° and −9° < longitude < 63°.

RESULTS. The full worldwide REB dataset contains 15,618 events: CLUD stations contributed to 97% of them, 15,143. Azimuth gap in the Europe/Middle East area basically remains unchanged at an average of 107°.

Error ellipse area to the contrary clearly improved with the usage of CLUD station: from an average of 5.94 km² down to 4.72 km², with a decrease of 26%.

The full worldwide SEL3 dataset contains 9,275 events: CLUD stations contributed to 96% of them, 8,863. Azimuth gap in the Europe/Middle East area basically remains unchanged at an average of 120°.

Error ellipse area to the contrary clearly improved with the usage of CLUD station: from an average of 6.53 km² down to 6.35 km², with a decrease of 26%.

CONCLUSIONS.

Even with this very simple analysis, it is evident the improvement of the CTBTO location capabilities in the Europe/Middle East area.

More extensive and deep analysis is though needed, perhaps using CTBTO location algorithms and station specific corrections.

REFERENCES.


