Geophysical Research Abstracts
Vol. 14, EGU2012-7915, 2012
EGU General Assembly 2012

Analysis of the October-November 2010 seismic swarm in the Sampeyre area (Piedmont, Italy)

S. Barani, D. Spallarossa, D. Scafidi, G. Ferretti, R. De Ferrari, and M. Pasta
University of Genoa, DipTeris, Genoa, Italy (barani@dipteris.unige.it)

During the period October-November 2010, the area surrounding Sampeyre (Piedmont, Italy) was affected by an intense seismic activity, which evolved into an earthquake swarm. The whole seismic crisis lasted approximately one month, from October 13 to November 12, 2010. During this period, approximately 550 earthquakes were recorded and localized by the Regional Seismic network of Northwestern Italy – RSNI (http://www.dipteris.unige.it/geofisica/) in the study area. However, including the micro seismicity (i.e. earthquakes with negative magnitude) detected by the nearest stations, the number of events goes up to approximately 3800. Among these events, 179 exceeded a local magnitude (Ml) of 1.0 but only two exceeded Ml = 3.0 (the major event has a magnitude of 3.2). Of note, these two earthquakes occurred close to each other on two consecutive days, precisely on October 23 and 24.
The Sampeyre area is located in the inner part of the Dora Maira crystalline massif, which corresponds to the northern Tethyan margin (part of the stretched European continental crust) exhumed during the collision of the Eurasia and Africa plates. The Dora Maira massif consists of three main geological units of high-grade metamorphic rocks (gneiss, schists, eclogites): the Sanfront-Pinerolo unit, the Vanesca unit, and the Dronero-Sampeyre unit. The earthquake swarm took place in this area, more likely in the continental crust (bulk crust) at a depth comprised between 5 km and 20 km. Analyzing various seismic sections, however, clearly indicates that higher magnitude events were confined between of 10 km and 15 km.
Focusing on the temporal evolution of the Sampeyre swarm reveals that most of the earthquakes occurred during the first 15 days since the beginning of the crisis. This period of intense activity was followed by an evident decay in the occurrence rate. A subsequent peak of activity was recorded on November 11, when more than 40 events were generated in the area. In order to find possible correlations or similarities with previous earthquake activity, we analyzed the seismic history of the last 30 years. It reveals that the investigated area never experienced events comparable to that under study. Only in 1989, an intense aftershock sequence, but of shorter duration, took place in the Sampeyre area (approximately a tenth of events were recorded in two days). The strongest instrumental earthquakes, which occurred in January 1994 (Melle earthquake) and April 1998 (Oncino Earthquake) with magnitude 4.3 and 4.1, were neither preceded nor followed by intense activity. Concerning historical seismicity, the area shows a generally infrequent activity characterized by low-magnitude events. The major shocks felt in Sampeyre were the 1905 Alta Savoia (Io = VIII-VIII MCS) and the 1914 Tavernette (Io = VIII MCS) earthquakes but they did not produce any damage.
Previous observation points out the uniqueness of the 2010 swarm which, therefore, deserves special attention. Following a general description of the swarm evolution and the performances of the RSNI network, the study will present the results of a waveform similarity analysis, aimed to indentify families of earthquakes belonging to common genetic sources. Results of a strain rate analysis will be also discussed, focusing on the release of seismic energy with time. Finally, the analysis of the micro-seismicity detected through an STA/LTA- (short-time average/long-time average) based algorithm is presented, revealing a b-value of around unity. The similarity between this value and that calculated accounting for the regional seismicity is a hints that the causative process of micro-earthquakes is of the same nature as that generating larger events.