Geophysical Research Abstracts
Vol. 18, EGU2016-8723, 2016
EGU General Assembly 2016
© Author(s) 2016. CC Attribution 3.0 License.

Earthquakes in Barcelonnette (western French Alps, 2003-2015): where are the faults?

Edouard Palis (1), Christophe Larroque (1), Thomas Lebourg (1), Hervé Jomard (2), Aurélie Flamand (1), Françoise Courboulex (1), Maurin Vidal (1), and Pierre-Louis Robert (1)

(1) CNRS GEOAZUR, VALBONNE, France (palis@geoazur.unice.fr), (2) Institut de Radioprotection et de Sûreté Nucléaire, Fontenay-aux-Roses, France

A comprehensive description of the instrumental seismicity in the Western Alps highlights several hundred of low to moderate magnitude earthquakes each year. The seismicity is diffuse and rarely related to known faults. The distribution of the epicenters follows the arcuate shape of the belt and the focal depths are shallow (<20km). Occasionally, earthquake swarms disrupt this seismic background, such as the swarms occurring near Barcelonnette in the Ubaye valley.

The seismicity of the Ubaye valley is documented by regional seismic networks: (1) the largest earthquake recorded occurred near Saint-Paul sur Ubaye on April 5, 1959 (ML = 5.5), (2) few km north of Saint-Paul two swarms were identified in 1977 (1500 events in one month) and 1989 (250 events in 4 days), (3) in 2003-2004 the largest swarm (16 000 events) was recorded between Saint-Paul and Barcelonnette, (4) on February 26, 2012 occurred a Mw 4.1 earthquake followed by 4700 low-magnitude events until January 2014 between Saint-Paul and Barcelonnette and (5) at the same place on April 7, 2014 occurred a Mw 4.8 earthquake followed by several thousands of low magnitude (up to Mw 3.8) events, still running at the end of 2015. The focal mechanisms of the four Mw>3.5-events attest to mainly normal faulting along NW-SE to N-S fault planes. Therefore this region appears clearly as an anomaly in comparison to the seismic pattern of the western Alps.

In terms of seismic hazard, determining the origin of these swarms is of major concern and one of the main questions is to determine if higher magnitude events are possible along the faults activated during these swarms. We try to answer two questions: are regional faults identifiable from subsurface geophysics and did some of these faults produced large earthquakes during the Quaternary?

We focus our attention on the 2012-2014 epicentral area. This area is characterized by a gentle slope extending from 1400m of elevation at the Parpaillon River up to 2900m on the surrounding summits. The slope displays creeping landforms developed during the late glacial period and the little ice age, overlying upper-cretaceous deposits (calcareous sandstone, so-called “flyschs à Helminthoides”).

A 2150m-long Electrical Resistivity Tomography Profile was performed to image the first hundreds meters depth. To do so, we used 4 electrical lines of 72 electrodes (10m spacing). We did the acquisitions using 2 array types: dipole-dipole and pole-dipole. Both arrays are sensitive to vertical structures and are well suitable for faults detection at depth. Our objective is to detect if faults extends through the epicentral area and if faults scarps, possibly resulting of a postglacial activity are hidden by the recent periglacial deposits and colluviums. From a preliminary analysis, the ERT imagery of the shallow 200m help us to identify: (1) the geometry of the surficial glacial and periglacial deposits (0-20m thick), (2) the folded calcareous sandstone characterized by a shallow resistive area (100m thick) and a deep resistive area (more than 150m thick), and (3) weaker vertical structures cutting the flyschs substratum that we interpreted as a fractured zone.