Geophysical Research Abstracts
Vol. 21, EGU2019-14600, 2019
EGU General Assembly 2019

The Saint Paul en Forêt seismic swarm: an unusual activity in the seismically quiet Maures massif (South-Eastern France)

Maxime Godano (1), Anne Deschamps (1), Bertrand Delouis (1), Etienne Bertrand (2,1), Jérôme Chèze (1), Philippe Langlaude (2,1), Xavier Martin (1), Michel Pernoud (2,1)

(1) Université Côte d'Azur, Géoazur, Sophia Antipolis, France (godano@geoazur.unice.fr), (2) Cerema Méditerranée, Valbonne Sophia Antipolis

In February 2018, the area around the locality of Saint Paul en Forêt (Eastern part of the hercynian Maures massif, south-eastern France) was struck by 3 earthquakes of ML 3, 3.5 and 2.9 within a few hours. Such seismic activity is quite unusual in this area that is considered to be stable and seismically quiet compared to the surrounding regions (Subalpine Thrust and Fold Belt of Castellane and Nice to the north and East, Ligurian Basin to the South-East, Provencal Thrust Belt to the West). These 3 earthquakes are the main shocks of a seismic swarm (72 events) located by the permanent French seismological network (RESIF) a few kilometers west of Saint Paul en Forêt and at around 15 km depth. A few hours after the beginning of the activity, we deployed a temporary network of 5 seismometers around the epicenter in order to improve the location of the seismicity.
Such unusual seismic swarm activity in this region questions about (1) the tectonic structure responsible for it, (2) the potential implication of aseismic deformation and fluids and (3) the assessment of the seismic hazard of the zone that is currently considered as low to moderate.
To understand in detail the spatial and temporal activity of the swarm, we first perform a template matching analysis on the continuous recordings to detect additional earthquakes not detected by the usual routine processes (STA/LTA). We use as templates the 72 earthquakes of the swarm detected and located in routine. The template matching process is applied on the four nearest permanent stations (distance 30-40 km) for the daily continuous recordings between February 1st and June 8th in 2018. As a result, we detect more than 600 earthquakes (ML > -0.58) on the nearest permanent station (TRIGF station, $\sim$ 30 km). The seismic activity started on February 16th and the majority of the earthquakes occurred up to February 20th with a climax on February 17th and 18th (up to 80 events/hour and the occurrence of the 3 main shocks). After February 20th, a small but regular activity (a few earthquakes per week) lasted up to June.
Second, we focus on the 282 earthquakes detected on the 4 nearest permanent stations. We locate these events by adding data of two nearby stations of the temporary campaign AlpArray (A205A and A206A), one nearby CEA-LDG station (LMR) and data of our own temporary network. We use double-difference relocation method (hypoDD software) by inverting catalog times and delay times measured by cross-correlation. As a result, the earthquakes cluster in a 500 m x 500 m elongated NE-SW structures dipping toward the NW. This geometry is in agreement with the fault plane solution we otherwise computed for the 3 main shocks.
Finally, we analyze the spatio-temporal dynamics of the swarm and discuss the possible causes of such seismic activity.