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Complex behaviour highlighted by earthquake aftershock and swarm sequences in Ubaye Region (French Western Alps).

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The Ubaye Region, where the city of Barcelonnette is settled, is the most seismically active region in the French Western Alps since at least two centuries. Seismicity in this area exhibits a dual behaviour, with mainshock-aftershock sequences alternating with abnormally high rate of seismicity associated with seismic swarms. Understanding processes triggering such a peculiar seismic behaviour is of primary importance in order to assess the seismic hazard in this region. The latest swarm activity started on February 26, 2012, with an earthquake of moment magnitude 4.2. It was followed two years later (on April 7, 2014) by a shock of magnitude Mw 4.8. From the first earthquake to the end of 2016, the seismic level has not returned to the background level and shares the same characteristics as a seismic swarm.

With the aim to discuss the seismogenic processes involved in the area, we focused on the two months following the 2014 mainshock (Mw=4.8). During this period, a dense temporary network (7 stations) was operating at a maximal distance of 10km from the epicentre area. We analysed this period starting with a double-difference relocation of ~ 6,000 earthquakes previously detected by template-matching. These hypocentres did not align on the fault plane of the 2014 mainshock, but on conjugated structures belonging to the 2-km wide damaged zone of the main fault plane and on remote structures with various orientations further away. We then computed 99 focal mechanisms from a joint inversion of P polarity and S/P ratio to clarify the geometry of the active structures. Many nodal planes are inconsistent with the structures deduced from the alignments of the earthquake locations. The stress-state orientation obtained from those focal mechanisms (σ_1 trending N27°± 5°, plunging 50°± 9°, a σ_2 trending N215°± 5°, plunging 40°± 9°, and a sub-horizontal σ_3 trending N122°± 3°) is consistent with those previously calculated in the area (Fojtíková and Vavryčuk, 2018). Nevertheless, some structures are unfavourably oriented to slip within this stress-field, suggesting that additional processes are required to explain them. As the presence of fluids was highlighted for the 2003-2004 and the 2012-2015 crisis, we calculated the fluid pressure needed to trigger slip on the planes from the focal mechanisms using Cauchy's equation. We found that a median fluid-overpressure of ~20 MPa (range between 0 to 50 MPa) is

needed to cause slip. Although the origin of fluids and how they are pressurized at depth remains open. The fluid processes seem to be the most favourable additional processes and were also proposed to explain the 2003-2004 crisis.