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An aftershock study of the ML 4.9 Vallorcine (French Alps) earthquake of 8 September 2005

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The Vallorcine earthquake occurred on 8 September 2005 at 11:27 UTC. Its epicentre was located in the vicinity of Vallorcine, in the French Alps close to the Swiss border, some 12 km north of Chamonix. Its magnitude reached ML 4.9 (after RéNaSS and SED, the French and Swiss national networks). It was felt over a broad area with a radius of at least 200 km. The maximum intensity reached a value of V EMS 98 with only slight damage in the Vallorcine (France) - Trient (Switzerland) area (BCSF preliminary results).

On 29 April 1905, this zone was hit by the damaging Chamonix earthquake, with a magnitude between 5.5 and 6.0. Recent investigations led to the hypothesis that the 1905 Chamonix earthquake might have occurred on the Remuaz fault, a normal fault located on the eastern flank of the Aiguilles-Rouges Massif. To obtain a detailed description of the fault segment that ruptured in 2005 and to investigate its relation to the Remuaz fault, we installed a temporary seismic network in the epicentral region. Beginning on the day after the mainshock, we deployed 27 mobile stations in the epicentral zone. This complete network was maintained for one month, while 4 stations were operated for an additional period of two months. One station, 4 km from the epicentre, is still kept operating.

A total of 290 aftershocks were recorded and located during the one-month period, with magnitudes between -0.8 and 2.4. The aftershocks are divided into three clusters. The main cluster (160 events) was active from the very beginning and throughout the whole recording period; it defines a 3-km-long subvertical fault segment, oriented N60˚E, at a depth between 3 and 5 km below sea level. It is located some 4 km NNW

of the Remuaz fault, under the Loriaz Massif. Assuming this segment corresponds to the mainshock rupture, it reveals a hitherto unknown fault, that could be as good a candidate as the Remuaz fault for the source zone of the 1905 earthquake. The focal mechanism and seismic moment of the main shock found from short period, broad-band and accelerometric permanent seismic stations (Sismalp, SED, and Geosciences Azur web sites) are in good agreement with the orientation and size of the fault as inferred from the distribution of the aftershocks presented here.

Two smaller clusters were located 2 and 6 km to the northwest, i.e. in a direction perpendicular to the trend of the main fault zone. They initiated several days after the mainshock and suggest that even a moderate-magnitude earthquake has the capacity to trigger aftershocks at distances larger than the source zone itself.