Plus que prévoir, anticiper

Earthquake of magnitude 4.8 on 7 April 2014 in the French Alps

An earthquake with a reported moment magnitude (Mw) of between 4.8 and 5.0 occurred on the evening of Monday, 7 April 2014 (at 9.27 pm local time), on the boundary between the French departments of Hautes-Alpes and Alpes-de-Haute-Provence, 9 km NNW of Jausiers, in Alpes-de-Haute-Provence, at a shallow depth of 2 to 5 km (Figure 1). Events of this type are not rare: 23 quakes with a moment magnitude of over 4.8 (and up to 5.8, to date) have occurred in mainland France since 1982. It should also be noted that an earthquake of magnitude 4.8 to 4.9 occurred at exactly the same location in February 2012, indicating that there is an active structure in that region.

Although the quake was widely felt in the south-eastern part of France, related damage was concentrated in a few towns, notably Jausiers and La Condamine-Châtelard where a road, houses and a clock tower were cracked, chimneys and pieces of ceiling and facade fell, and the structure of one building appears to have been severely damaged.

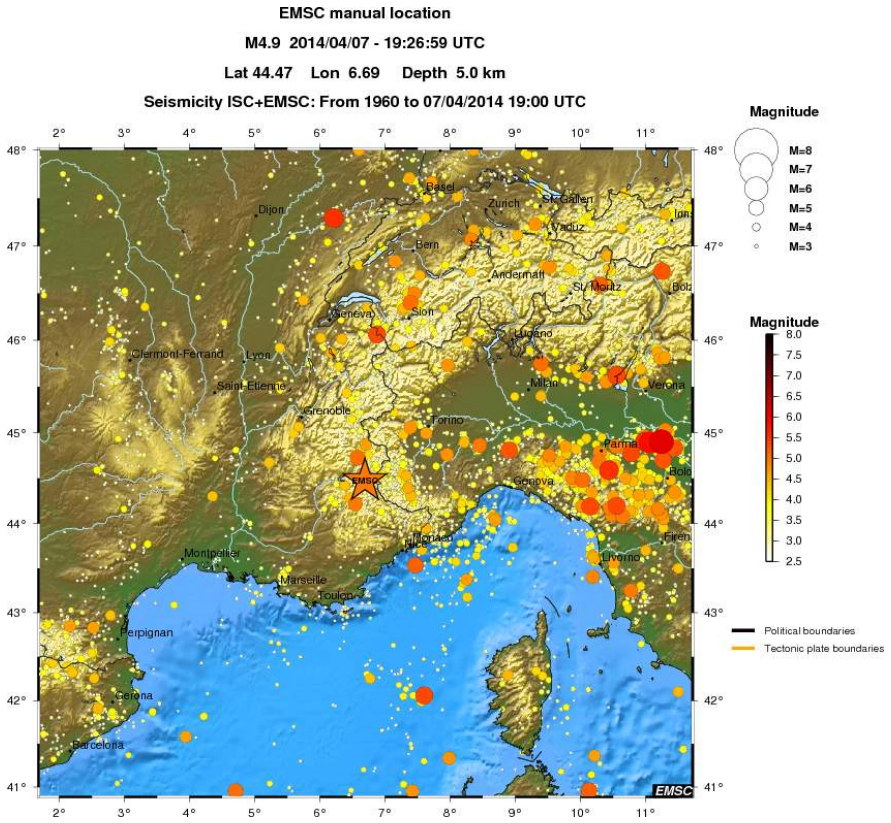

Figure 1: Regional seismicity recorded since 1960. The star indicates the epicentre of the earthquake of 7 April 2014, situated in a seismically active area covering the whole Alpine arc from the Mediterranean to the Jura mountains. *Source: European-Mediterranean Seismological Centre*.

This region, on the western edge of the inner Alps, is well known for its frequent seismicity of low to moderate magnitude. This area is monitored, particularly since what is known as the Ubaye crisis in 2003 and 2004, when the region experienced a seismic swarm of no fewer than 16,000 events in just a few months. However, most of those earthquakes were of too low a magnitude (< 3.0) to be felt by local people (Figure 2).

Then, following the earthquake of February 2012, a seismic swarm comprising more than 2,500 events (Figure 2) was recorded in the months after the main shock. Of these thousands of quakes, about 50 could be felt by people living in the valleys in the vicinity.

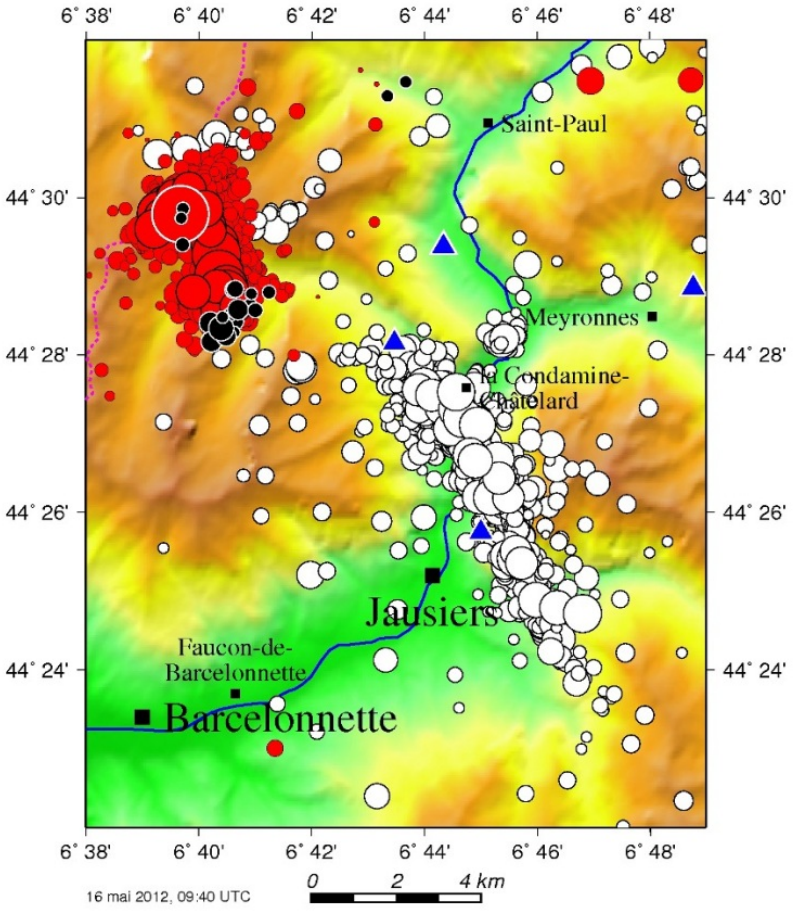

Figure 2: Seismicity in the area concerned by the earthquake of 7 April 2014. The seismic swarm of 2003-2004, when more than 16,000 events were recorded, is shown in white. The seismic swarm following the earthquake of February 2012 is shown in red. The black spots show the earthquakes detected just before the main shock on 7 April 2014 which is indicated by the red spot with a white rim. The seismic stations forming a locally dense network to monitor this active area are shown in blue. *Source: Réseau Sismologique des Alpes.*

There are conflicting opinions on the actual depth at which the earthquake occurred: **from 2 km to 5 km deep**. Nevertheless, this earthquake did occur near the surface, which explains to some extent why the event was felt in surrounding areas as far as 150 km away, in a large part of south-eastern France, stretching from Grenoble to Marseille, and Nice further to the east (Figure 3).

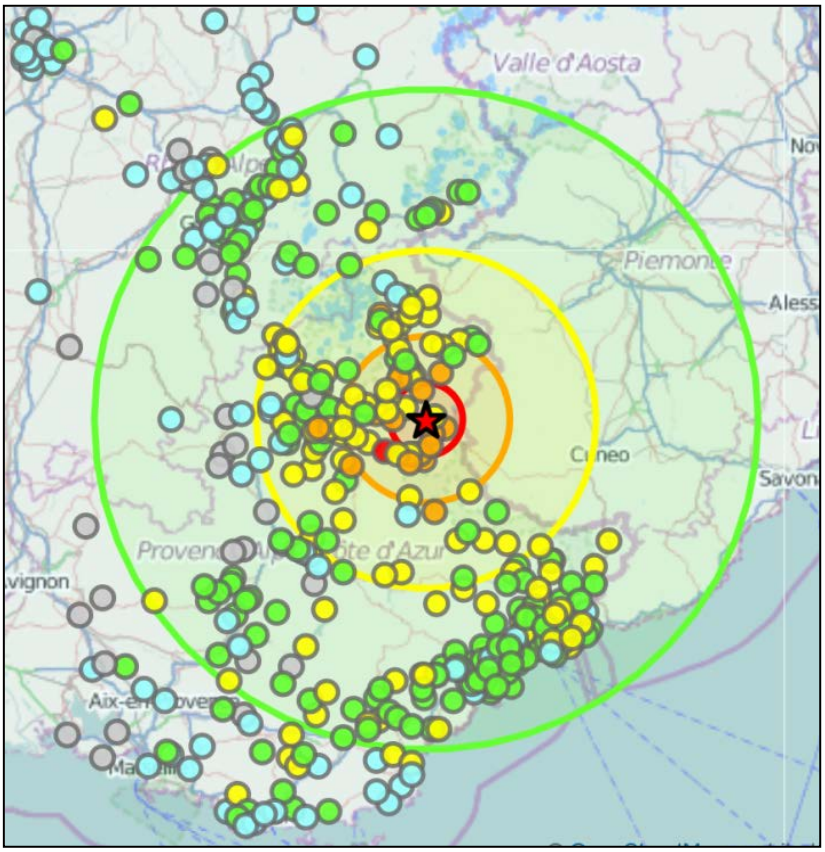

Figure 3: Map of "earthquake felt" reports for 7 April 2014 (1,755 reports collected to date). This map will be used in conjunction with data from field surveys to establish the final macroseismic intensity map for this event. The increase in intensity felt and potential damage is indicated by the green-to-red colour scale. The red circle shows the estimated area in which damage, including slight damage, may be noted. The red star indicates the epicentre. *Source: Bureau Central Sismologique Français*.

Although this earthquake did not cause major damage, it should not be forgotten that French territory is subject to earthquakes, especially the French Antilles. Destructive earthquakes are fairly rare but can generate significant costs as shown by the history of earthquakes that have occurred in France since the introduction of the French natural disaster compensation scheme (Table 1).

Earthquake	Date	Magnitude	Maximum macroseismic intensity	Nbr of towns eligible for nat. disaster compensation	Estimated market cost in €, 2012 value
Annecy 1996 ***Mainland France***	15/07/1996	5.3	VII	208	€111 M
Rambervillers 2003 ***Mainland France***	22/03/2003	5.4	VI-VII	79	€20 M
Les Saintes 2004 ***French Antilles***	21/11/2004	6.3	VIII	32	€85 M
Martinique 2007 ***French Antilles***	29/11/2007	7.4	VI-VII	15	€68 M

Table 1: Main earthquakes since 1982 and related market costs, within the scope of natural disaster compensation, expressed in euros at 2012 value. *Source: CCR.*

Among historic earthquakes, the one that occurred in Lambesc, near Aix-en-Provence (department of Bouches-du-Rhône) in 1909 is still well remembered in Provence, as it resulted in 46 fatalities, destroyed some 3,000 houses and damaged 5,000 more.
In 2011, CCR and the French geological survey bureau, BRGM (Bureau de Recherches Géologiques et Minières), conducted a study which assessed that, **if it occurred today, the cost of the Lambesc earthquake would be about €2 billion** within the scope of the natural disaster compensation scheme.