



## THE TWO EVENTS OF BARCELONETTE (French ALPS) , 2012 (Mw 4.1) AND 2014 (Mw 4.9) : THE ROLE OF DIRECTIVITY ON GROUND MOTIONS, MACROSEISMIC INTENSITIES AND SITE EFFECTS

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On April 7<sup>th</sup> 2014, an earthquake of magnitude Mw 4.9 stroke the Ubaye valley in the French Alps. It was one of the largest events well recorded in the Alps since the damaging earthquake that occurred close to Annecy in 1996 [Courboulex *et al.*, 1999; Thouvenot *et al.*, 1998].

We computed its moment magnitude (Mw 4.9) and its focal mechanism that depicts a general extensional regime as it is expected in this zone. Surprisingly this event, whereas its quite important magnitude, and its superficial depth did not create many damages.

About two years ago, a Mw 4.2 event occurred at the same location, with the same focal mechanism, and was followed by thousand of smaller events (see the web site of the Sismalp network : <http://sismalp.obs.ujf-grenoble.fr/cases/stpaul/stpaul.html>). This event had a strong directivity effect of its rupture process towards a direction N160° very well seen on ground motion data (Figure 1, top) and macroseismic intensities [Courboulex *et al.*, 2013]. It was apparently not the case for this event (Fig 1, comparison between station MON and OGMU).

It is interesting to note that whereas the fact that the low frequency content of these events are really different (Mw 4.1 and 4.9), their ground motions values in the city of Nice (directive direction) are similar (see for example the PGA value at station MON).

We compared for the two events : (1) the PGA values obtained on all the stations of the french accelerometric network RAP-RESIF (Figure 1), (2) the macroseismic intensities and also use an empirical Green function deconvolution to retrieve the source time function of this event.

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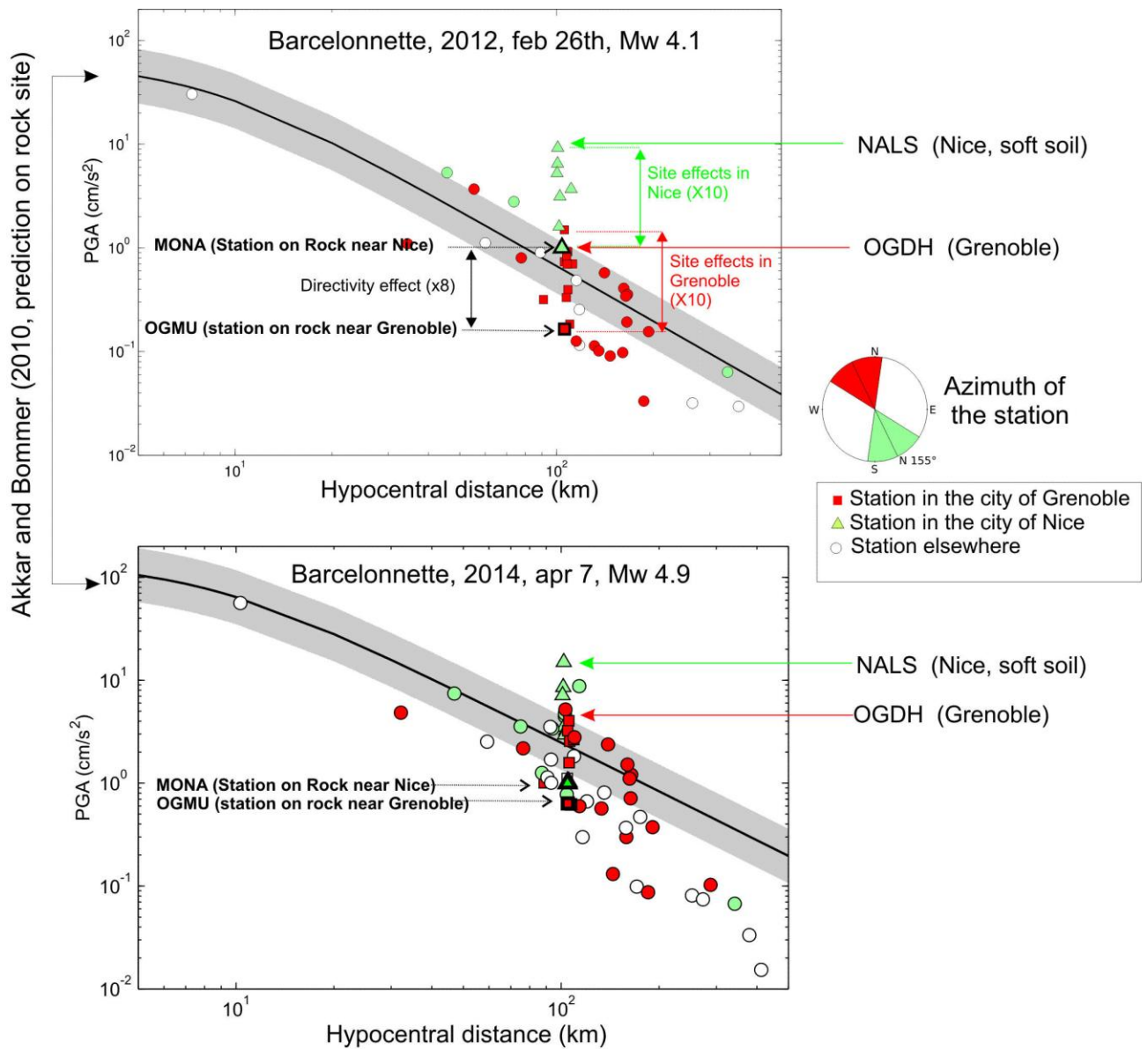


Figure 1. Top : Mw 4.1 earthquake (2012), bottom Mw 4.9 earthquake, same location, Barcelonnette (France). PGA values (maximum between horizontal and vertical components) are represented with hypocentral distance. Squares indicate values in the city of Grenoble, triangles in the city of Nice and circles for other locations. In order to evidence the azimuthal differences (directivity effect for the 2012 event), the symbols that represent the values at stations that are in an azimuth N155 $\pm$  33 $^\circ$  are filled by light color (grey or green), and the ones in the opposite direction are filled by dark color (dark grey or red). The GMPE of Akkar and Boomer (2010) for rock sites conditions is represented by a black line for the median value and grey area that represents the 16th and 84th percentiles ( $\pm\sigma$ , one standard deviation for a logarithmic representation)

Then, we analysed the site effects activated in the cities of Nice and Grenoble, particularly well instrumented. Figure 2 shows the time domain and frequency domain accelerations on EW components at 4 stations: 2 in, or near, Nice (NALS on soft soil and MON on rock) and 2 in, or near, Grenoble (OGDH on soft soil and OGMU on rock). Site effects are very clear in both cities, their values are rather similar but the amplified frequencies are very different, and then may have a very different impact on populations.

Amplification effects during the Barcelonnette Earthquake (Mw 4.9, April, 7, 2014) in the cities of Nice and Grenoble (100km from the source)

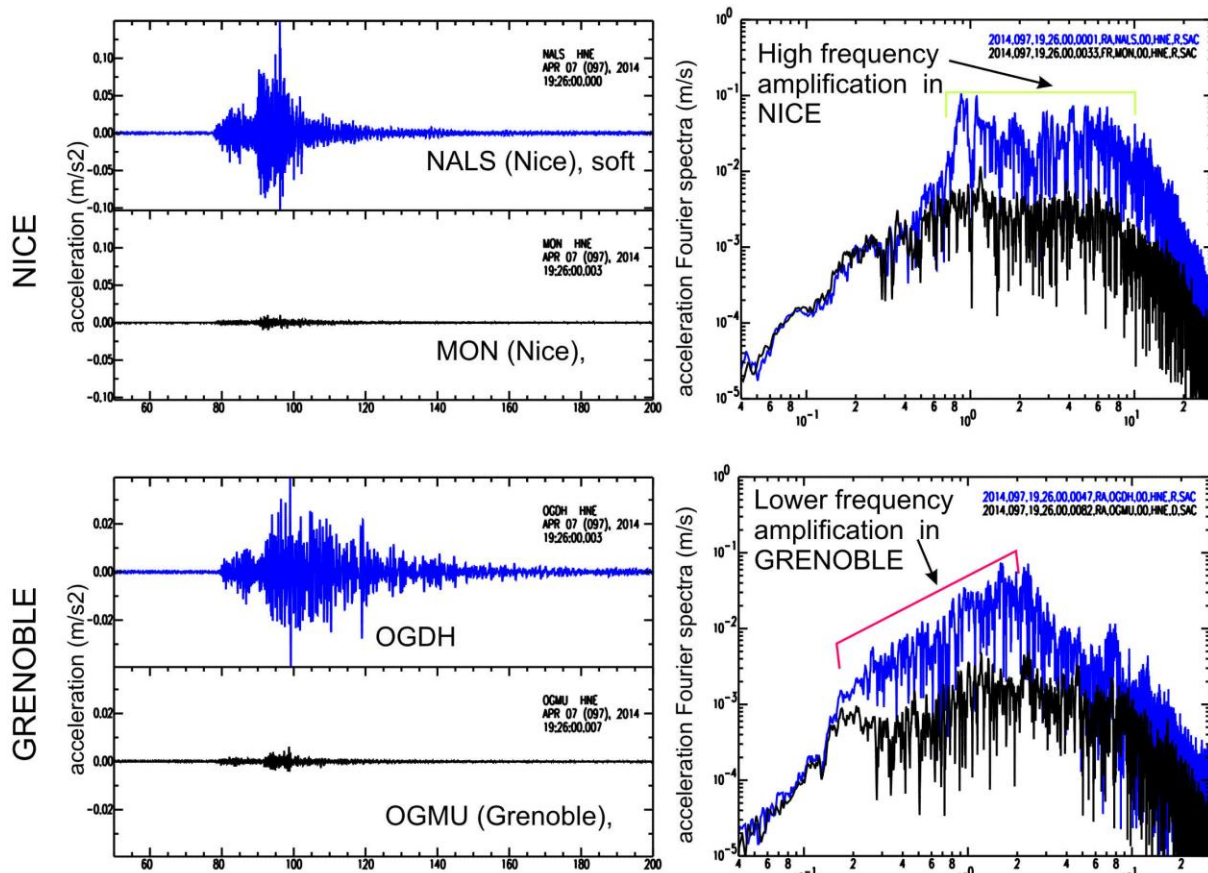


Figure 2. Mw 4.9 Barcelonnette event (without directivity effect) recorded in Nice (top) and Grenoble (Bottom) on 2 stations on rock and 2 stations on soft soil (stations highlighted on Fig 1 also). Left : time domain accelerograms (RAP-RESIF network). Right : Fourier spectra.

### REFERENCES

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