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Detection of discharge changes in Pyrenean mountain rivers using seismic data.

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The seismic noise is a continuous vibration of the ground due to natural and artificial sources (e.g. oceanic waves, human activities). The investigation on this noise allows understanding the physical processes of its sources. Water flow in rivers has been identified as one of the sources of seismic noise at local scale. Its generation is related to two important processes associated, turbulence and transport of sediments. Those processes creates vibrations in the ground that travel as seismic waves and can be monitored using seismic stations close to the river channel.

In the work by Díaz et al. (2004) we analysed the seismic signal of one station located in Canfranc underground Laboratory (LSC). We found an unusual signal in the 2-10 Hz frequency band and documented if relationship with the variations in the discharge of the Aragon River (southern Pyrenees), about 400 meters from LSC. We want to highlight that the conditions of this station, located in a tunnel, are privileged, as it is slightly affected by other sources of seismic noise, as wind or cultural noise. We concluded that the seismic record can be used to monitor the river discharge.

Following this study, we are now testing if the same observations can this relation can be seen with seismic stations in typical conditions. To do so, we have installed three temporal stations close to Cinca and Segre Rivers (southern Pyrenees) and collected the hydrologic and atmospheric data available in the vicinity of the stations. First results show that a seismic signal associated to river can be identified for moderate increases in river discharge. However, wind gusts also produce seismic noise in similar frequency bands. Our aim now is to discriminate between wind- and river-related seismic noise episodes, in order to be able to monitor river discharges only using seismic data. As seismic data can be recorded and processed in near-real time, the seismic monitor of hydrological events can be of interest to prevent risks associated to floods to population near alpine-style rivers.