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The Whispering Karst

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The knowledge of karst structure and geometry is a major limit for studies of groundwater flow in karst hydrosystems. For shallow caves and conduits, geophysical methods (gravity, Electrical Resistivity Tomography, Ground Penetrating Radar among others) shows successful results in some cases. Deep caves or small conduits are only discovered and mapped by speleologists. The geometry of deep karst conduits is therefore a major gap in the knowledge of the karst. And the impact of each particular cave or conduit on the water transfer could be only inferred from in-situ measurements. But such in-situ measurements are scarce as the access to the underground caves are often complicated, time consuming and sometimes dangerous.
The main purpose of the present study is to show the potential of seismology to provide new information (at least qualitative and potentially quantitative) about the main active caves or conduits during karst flooding. Floods in the karst are well known from speleologists (fast water level elevation), farmers (“blast noise”) and hydrogeologists. The transfer of water in the caves leads an enhanced level of noise or vibrations due to waterfalls, rocks and water turbulence. The ability of seismometers to measure the surface river noise at a distance of a few hundred meters has been proven in past studies (Burtin et al., 2011) but never applied to underground rivers.
For the study, seismological data from the Laboratoire Souterrain à Bas Bruit (LSBB) located in and under the Vaucluse karst (south of France) are used. First, evidences of increase of noise level during floods are presented. The characteristics of the underground river noise are then used to infer the origin of the signal. The available network of several seismometers allows in a simple analyses a first location in depth and in space of the active conduits. Finally, the perspectives of underground river noise for research and water management institutions are detailed.