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Continuous monitoring of river bed load transport from the analysis of the induced seismic noise

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River bed load transport, through the induced erosion, is a key-actor of the landscape evolution. Despite this relevance, continuous measurements of bed load remain highly difficult or even impossible to assess during extreme hydrologic conditions: the methods of sediment sampling are generally *in situ* techniques, which are not adapted for large flood events. Here we present our ongoing developments of the use of seismic sensors to monitor continuously bed load transport within a large spatial coverage. The approach relies on the monitoring of ground vibrations produced by the impacts of sediments on a river bed and that propagate to seismic stations installed nearby the stream. Since these stations are sheltered from the largest floods, the seismic monitoring offers a great potential for the survey of bed load transport during extreme events. We explore the interest of the spectral analysis of continuous seismic noise produced by rivers. We apply this method along two rivers with different hydrological characteristics including water discharge and grain size distribution: the trans-Himalayan Trisuli River and the "torrent de St Pierre" in the French Alps. In both cases, we observe strong spatial and temporal variations of the high-frequency (1-80 Hz) seismic energy produced along the river. Comparisons with the regional meteorological and hydrological data along both rivers reveal some clear correlations. Along the Trisuli River, a hysteresis pattern between the high-frequency seismic noise level and the river water level attests that a significant part of the observed seismic energy is caused by bed load transport. In addition, analyses of seismic signals and their comparisons with sediment sampling data suggest a frequency signature related to the sediment particle size. Other methods of signal processing, as noise correlation, show our ability to locate river segments that produce an intense sediment transport and where erosion processes are potentially increased. With a demonstration that such a seismic monitoring is still feasible along rivers with low water discharges and a reduced grain size distribution (French Alps), we confirm the strong potential of seismic bed load measurements. Further developments are still required to improve the method. Thus, calibration experiments in natural sites and in laboratory are expected to link spectral content and the seismic energy to a direct quantification and characterization of sediment transport.