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Seismic constraint on bedload movement and water flow for the low-gradient-to-steep river channel

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Seismic technique has been used to study the behavior of river sediment transport. However, most of studies mainly focused on the steep mountain stream with relatively high gradient riverbed. In this study, we deployed the seismic array along the Zhenwen River from upstream to downstream area, which provide opportunity to understand the capability of seismic monitoring on regions with variable slope angles of riverbed. For example, the seismic station of ZW02, which are near by the low-gradient river channel with slope angle of 0.09°, exhibited the strong variations in power spectral density (PSD) of seismic records during the typhoon/storm events. The maximum PSD value of -125 dB could be observed at stage of peak water level of 43 m. With the available information of grain size distribution, fluvial parameters (channel width, water depth) and seismological parameters (quality factor, shear-wave velocity), we predict the model features to explain the frequent-depended PSD contributed from the bedload impact and water flow. An obvious hysteresis pattern between water level and PSD value can also support the bedload movement excited seismic signals with a range of 20-60 Hz. During the flooding period, the maximum bedload flux (q_b) is 0.3×10^{-4} m^2/s. Our study demonstrated that the seismic technique has high potential to monitor the sediment transport on low-gradient-to-steep channel river.

Keywords: power spectral density (PSD), hysteresis pattern, bedload flux (q_b)