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Isolating bed load transport from river induced seismic signals

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Bed load transport is a critical parameter in the study of landscape evolution and also provides valuable information for problems in the fields of ecology, river and landuse management, and civil engineering. Bed load transport is difficult to assess due to its stochastic nature and highly variable transport rates, and traditional measurement techniques have struggled to capture the spatial and temporal variability of bed load transport. In recent years, bed load monitoring based on seismological observations has emerged, which allows non-invasive and continuous indirect measurements. However, there still remains a significant challenge to independently characterise the seismic signature of bed load from other sources of noise, such as turbulence. Our study aims to explore seismic data recorded at the highly braided River Feshie in Scotland, which has undergone significant morphological change in its history and has been highly monitored over the last couple decades through Digital Elevation Models. Since the deployment of our seismometers in December 2020 we have captured three independent high flow events plus an isolated earthquake, which are being used to determine the environmental signals and the site specific signal characteristics. In some previous studies, an observed hysteretic relationship between seismic power and hydrological parameters has been interpreted as being characteristic of bed load transport. From the data we have gathered we have observed a hysteresis in the signals, and through Shields calculations it is suggested that bed load transport would be expected during these events. However, without independent constraints we do not feel we can be absolutely certain that this behaviour is a result of bed load transport. Our ongoing study therefore aims to combine multiple physical measurement techniques, such as hydroacoustic measurements, time-lapse imagery and seismic observations, to try and pinpoint what is contributing to the seismic signals recorded and how we can isolate the bed load transport component.