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Earth Surface Dynamics Discussions

Interactive comment on "Seismic constraints on dynamic links between geomorphic processes and routing of sediment in a steep mountain catchment" *by* A. Burtin et al.

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This is a very interesting manuscript that uses seismic monitoring to characterize geomorphic processes. I am a seismologist with some interest in non-earthquake seismic signals, but little knowledge of geomorphic processes. From a seismological point of view, this work is interesting, the methods and the interpretations of seismic observations are valid and clearly explained. Maybe even more information could be obtained from the seismic signals (rockfall volume? propagation velocity of debris flow??). I think that this manuscript is suitable for publication. More comments, questions, and suggestions below.

* Location method The method used in this study is certainly valid and well described. But I'm curious to know why the authors did not use the same method (SSA, source scanning algorithm) as in their 2013 JGR paper? There are two classes of antenna methods to locate seismic events: 1- measure time delays by cross-correlation of seismic waveforms (as in the present work) or of envelopes (Burtin et al 2009), then search for location and velocity that minimize time residuals. 2- beam-forming methods, such as the SSA method (Burtin et al 2013) or methods that maximize cross-correlation of signals migrated in time (Almendros et al, GJI 1999; Lacroix and Helmstetter, BSSA 2011). Did you also try beam-forming methods? Could you justify your choice of the cross-correlation method?

* Comparison between seismic signal (Figure 9). Several additional mechanisms may explain the weak correlation between seismic energy and flow depth First, the seismic station is located 400 m upstream from CD29, so that the propagation time between the 2 stations is about 2 mn (if the flow velocity is 3-4 m/s). This partly explains the time delay between seismic energy and flow depth. Second, the seismic sensor can detect the debris flow before it reaches the sensor. This explains the progressive increase of seismic energy with time, compared to the sharp rise of flow depth. This effect may even be used to estimate the propagation velocity, assuming we know the attenuation of seismic energy with distance. The timing of the three pulses could be added in Fig 9, as done in Fig 3.

* Rockfall volume and total volume of sediments It would be interesting to have estimates of debris volume, and to quantify the importance of rockfall volume compared with other sources of materials. Could you estimate total volume of debris from observations of flow depths? seismic energy? Or from videos? You only mention in the conclusion that "long-term surveys should include independent constrains on slope activity like laser scanning ... to calibrate the conversion from measured seismic energy to mass of rock or sediment displaced. " Some researchers have already published relations between the magnitude of the seismic signal and the volume (Deparis et al

2008, Dammeier et al 2011). You could use these relations to estimate rockfall volume from magnitude, and use recorded local earthquakes to calibrate a magnitude-distance-amplitude relation. But there is a lot of spread in the data shown in these studies, with only a weak correlation between volume and magnitude.

The manuscript is well written. I found only two typos but they were already reported by the first referee.

Fig 3: could you use the same colorscale to help comparing the amplitude at all seismic stations?

Interactive comment on Earth Surf. Dynam. Discuss., 1, 783, 2013.