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Landslide maps and seismic noise: Rockmass weakening caused by shallow earthquakes

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Some studies have suggested that the shaking and deformation associated with earthquake would result in a temporary increased hillslope erodibility. However very few data have been able to clarify such effect.
We present integrated geomorphic data constraining an elevated landslide rate following 4 continental shallow earthquakes, the Mw 6.9 Finisterre (1993), the Mw 7.6 ChiChi (1999), the Mw 6.6 Niigata (2004) and the Mw 6.8 Iwate-Miyagi (2008) earthquakes. We constrained the magnitude, the recovery time and somewhat the mechanism at the source of this higher landslide risk. We provide some evidences excluding aftershocks or rain forcing intensity as possible mechanism and leaving subsurface weakening as the most likely. The landslide data suggest that this ground strength weakening is not limited to the soil cover but also affect the shallow bedrock.
Additionally, we used ambient noise autocorrelation techniques to monitor shallow subsurface seismic velocity within the epicentral area of three of those earthquakes. For most stations we observe a velocity drop followed by a recovery processes of several years in fair agreement with the recovery time estimated based on landslide observation. Thus a common processes could alter the strength of the first 10m of soil/rock and simultaneously drive the landslide rate increase and the seismic velocity drop. The ability to firmly demonstrate this link require additional constraints on the seismic signal interpretation but would provide a very useful tool for post-earthquake risk managment.