EGU2020-1043
https://doi.org/10.5194/egusphere-egu2020-1043
EGU General Assembly 2020

Low-cost interferometric optical fibre-based sensor for landslide monitoring: laboratory tests under different applications

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Landslide monitoring must keep pace with the development of technology. The costs of elaborate monitoring tools could however be quite elevated, especially when considering that monitoring instruments in direct contact with the measurand could undergo irreversible damage and thus be obliterated. A variety of landslide monitoring tools based on the optical fibre technology have emerged in the past few decades. While authors tend to focus on the reduced costs of the sensing cables, the economic and practical aspects related to the interrogating systems are often disregarded. In fact, commercially available units are hardly exploitable outside the laboratory. In this regard, we propose a newly developed interferometric optical fibre-based monitoring system which offers high sensitivity strain monitoring at a significantly reduced cost of the instrumentation involved. Moreover, the devised setup could easily be exported for field use. The setup has been tested in controlled conditions as a monitoring tool in a downscaled landslide model. Two major modes of operation have been experimented: a) direct strain sensor where the optical fibre cable undergoes deformation, and b) a high frequency elastic wave detection mode where the sensor is able to distinguish the energetic footprint generated by ground movement. The two experimental schemes indicate that the newly developed sensing system could eventually be put into effective use for a variety of landslide phenomena where the most appropriate mode of application would depend of the circumstances of the problem under investigation. The design of a field application of the monitoring tool are currently underway.