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Development and calibration of instrumented rock for monitoring rockfalls

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Rockfalls can be detrimental to the safety of people and exposed infrastructure or property. Especially in the mountainous areas, rockfall disasters are common and unpredictable. In many countries and regions around the world, rockfalls have directly and indirectly caused great economic losses and even loss of life. In Scotland, an average of 1.4 million pounds a year is lost due to rockfalls. In China, a direct economic loss of 170 million pounds was caused and 858 people were killed by rockfalls In 2018. Most of the current prevention methods are costly and time-consuming. The objective of this study is to develop a new sensor that could monitor the dynamics of rockfall process. This paper discusses the development and calibration of a spherical instrumented rock with low-cost sensors, simulating spherical rocks and stones, which can be used to record the triaxial accelerations and angular velocities. The instrumented rock is tested on an appropriately designed dry flume for a range of slopes and fixed bed roughness. The preliminary experimental setup and results will be presented and discussed. By utilizing the impact forces obtained from the instrumented rock for the assessment for rock-fall dynamics with the designed dry flume physical experiments, we demonstrate how rockfall hazards can be monitored directly or indirectly using a low-cost tool.

Key words: rockfalls, instrumented rock, sensors, dynamics of process, earth surface hazards