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Quantitative assessment of the effectiveness of a rockfall warning system

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Rockslides and rockfalls can pose high risk to human settlements and traffic infrastructure. In addition to structural mitigation measures like rockfall nets, warning systems are increasingly installed to reduce rockfall risks. Whereas for structural mitigation measures with reducing effects on the spatial extent a structured evaluation method is existing, no or only few approaches to assess the effectiveness for warning systems are known. Especially for higher magnitude rockfalls structural mitigation measures are not effective, and reliable early warning systems will be essential in future. In response to that, we developed a classification and a framework to assess the reliability and effectiveness of early warning systems (Sättele et al, 2015a; 2016). Here, we demonstrate an application for the rockfall warning system installed in Preonzo prior to a major rockfall in May 2012 (Sättele et al., 2015b). We show that it is necessary to design such a warning system as fail-safe construction, which has to incorporate components with low failure probabilities, high redundancy, low warning thresholds, and additional control systems. With a hypothetical probabilistic analysis, we investigate the effect of the risk attitude of decision makers and of the number of sensors on the probability of detecting an event and on initiating a timely evacuation, as well as on related intervention cost. We conclude that it is possible to quantitatively assess the effectiveness of warning systems, which helps to optimize mitigation strategies against rockfall events.

References

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