



## **Quantifying the effect of indirect costs on the benefit-cost-ratio of mitigation measures calculated by EconoMe**

Michael Bründl and Linda Zaugg-Ettlin

WSL Institute for Snow and Avalanche Research SLF, Snow Avalanches and Prevention, Davos-Dorf, Switzerland  
(bruendl@slf.ch)

The Federal Office for the Environment (FOEN) in Switzerland introduced the online tool EconoMe in 2008 for a comparable evaluation of the effectiveness and the economic efficiency of mitigation measures against gravitational natural hazards. The method implemented in EconoMe is based on the risk concept for natural hazards published by the National Platform Natural Hazards PLANAT in 2004 and revised in 2018. EconoMe relates the risk reduction induced by mitigation measures to the cost of said measures. Until recently, risk calculations in EconoMe only took into account direct damages to people, buildings, infrastructure, agricultural areas, forests and parks. Costs due to business interruption and other indirect costs according to definitions by Meyer et al. (2013) were excluded.

In 2018, we developed a method to include business interruption and indirect costs in EconoMe risk calculations. In order to deal with the problem of system boundaries – an issue often discussed in literature – we consider only the objects which are expected to be directly affected by the hazard. The method was integrated into the development platform of the online tool allowing us to calculate benefit-cost-ratios of mitigation projects with and without the consideration of business interruption and indirect costs. Depending on the objects potentially affected, we show with case studies that indirect costs can have a considerable effect on the economic efficiency of mitigation projects and therefore on the decision whether or not a project should be realized.

### Acknowledgements

We thank Reto Baumann, André Burkard, Fabian Dolf, Eva Gertsch-Gautschi, Peter Gutwein, Wolfram Kägi, Michael Lobsiger, Bernard Loup, Nicole Oggier, Maren Salz and Adrian Schertenleib for their contributions in this project and the Federal Office for the Environment (FOEN) for the financial support.

### Reference:

Meyer, V., Becker, N., Markantonis, V., Schwarze, R., van den Bergh, J.C.J.M., Bouwer, L.M., Bubeck, P., Ciavola, P., Genovese, E., Green, C., Hallegatte, S., Kreibich, H., Lequeux, Q., Logar, I., Papyrakis, E., Pfurtscheller, C., Poussin, J., Przymuski, V., Thieken, A.H. and Viavattene, C., 2013. Review article: Assessing the costs of natural hazards – state of the art and knowledge gaps. *Nat. Hazards Earth Syst. Sci.*, 13(5): 1351-1373.