Natural Hazards and Earth System Sciences Discussions

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Comment on nhess-2021-128

Anonymous Referee #1

Referee comment on "Multi-method monitoring of rockfall activity along the classic route up Mont Blanc (4809□m□a.s.l.) to encourage adaptation by mountaineers" by Jacques Mourey et al., Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2021-128-RC1, 2021

The manuscript by Mourey et al. “Rockfall and vulnerability of mountaineers on the west face of the Aiguille du Goûter (classic route up Mont Blanc, France), an interdisciplinary study” investigates the rockfall occurrence at the west face of the Aiguille du Goûter, discusses potential triggers of rockfall and analyses hazard potential for mountain climbers. The study addresses an interesting topic, the use of mountains for recreation, the economic importance of this use and geomorphic hazards threatening the participants that potentially increase due to climate change and due to an increase of climbing. Therefore, the manuscript could be suited for Natural Hazard and Earth System Sciences. However, the study is a case study and it remains unclear how representative the study results are for other mountain regions, which should be more clearly discussed. The study quantifies mountaineering activity, thermal processes able to trigger rockfalls, rockfall occurrence and links triggers to rockfall and hazard potential. Unfortunately, (1) the basic definitions are unclear, (2) the manuscript is poorly written and structured, (3) the role of preconditioning and preparing factors are not addressed and (4) important rockfall triggers are not investigated at all or not sufficiently. However, the presented data set is impressive and the manuscript could be an important contribution to a little investigated topic. Therefore, I recommend major revision.

(1) The authors use the terms vulnerability, danger and hazards without defining them. Vulnerability includes the mountaineers and their potential to mitigate the hazard. Mountaineers could develop strategies to reduce risk. However, this is not investigated in this manuscript. The authors focus to quantify the number of mountaineers and, therefore, they investigate the hazard potential of rockfall and not the vulnerability of climbers. They have no data to analyse vulnerability. In addition, they should be careful to link accidents with rockfall. Accidents or rescue of mountaineers can have numerous reasons and there is no a priori link to rockfall.

(2) The manuscript is poorly written. The introduction pretty vague and geomorphic knowledge necessary to understand the objectives are presented in Chapter 2 after the outline of this study. In addition, the outline of the objectives remain pretty vague or unclear. The study area is insufficiently introduced. The climbing route is important to understand the hazard potential, however, not every reader is a specialist to mountain climbing in the Mont Blanc area and familiar with the route. The methods are not sufficiently described. The authors record 68 days of seismic data in 2019 and classify this data but it remains unclear what the basis of the classification is. They "keep" data when the rockfall origin was sure but they present no information on which basis they decide if a rockfall is "sure" or not. They present a Figure 3 with seismic data without explaining it and it is completely unclear how they process the data to get the energy or number of rockfall they analyse in the manuscript. The authors use automatic photogrammetry to monitor snow cover, however, it is unclear what kind of equipment they use (camera type), how they process the data (software, filters…), how they calculate the snow covered area and how representative this area is. Does the photograph covers the entire route? Furthermore, the authors use three temperature loggers for three years without presenting any data. They correlate one logger to air temperature and use a 16-17 year data set to drive the thermal model CRYOGRID2. It remains unclear what parameters CRYOGRID2 uses and what values are used as input data. Why a 17-year data set is necessary to analyse 68 days of rockfall in 2019 remains unclear. In summary, the author uses four different time periods in their study which is confusing and not necessary. In addition, the text is poorly structured, very repetitive and complicated written, which makes it very difficult to follow the story and to capture the key messages.

(3) The authors focus on triggers but are not investigating preconditioning and preparing factors at all. Rockfall is prepared by numerous processes including frost weathering or active-layer thaw that breakdown rock without that the rock is released as rockfall. The rock can be stored within the rockwall and later released as secondary rockfall. The authors can detect when the rockfall occurrence is but they should discuss more critically what they measure and what the limitations of their approach are.

(4) A priori the authors assume that freezing and permafrost are the major rockfall triggers. Other factors like earthquakes are excluded but can be an important factor. The authors mention rainfall and climbers as potential triggers but are not analysing the role of precipitation and climbers in detail. Permafrost and frost weathering can be important preparing factors but precipitation and climbers can be a major trigger of secondary rockfall, which is not equally addressed in this paper. In addition, frost weathering is very qualitatively addressed in terms of efficient freeze-thaw cycles and the discussion lacks

papers presenting new data and alternative interpretation of the data (e.g. Girard et al., 2013). Purely thermal processes were identified to trigger rockfall (Collins and Stock, 2016), however, the authors mentions these processes without going into detail. The paper lacks a multi-hypothesis approach where other potential triggers than permafrost and freezing are equally introduced and discussed.

For detailed comments, see the attached pdf.

Please also note the supplement to this comment:
https://nhess.copernicus.org/preprints/nhess-2021-128/nhess-2021-128-RC1-supplement.pdf