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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Climate anomalies associated to the occurrence of rockfalls at high-elevation in the Italian Alps" *by* R. Paranunzio et al.

Anonymous Referee #2

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General comments The article by R. Paranunzio and colleagues, entitled "Climate anomalies associated to the occurrence of rockfalls at high-elevation in the Italian Alps" presents the detection of anomalies of climatic parameters (temperature and precipitation) for 41 rockfalls occurred between 1997 and 2013 in the Italian Alps at high altitudes. The link between climate and rock wall stability in high mountain is crucial to understand the evolution of a natural hazard that seems to grow with global warming and pose safety problems for infrastructure and people. The value of the article - well-written, well-structured and not too long/short - is important but it suffers from a number of shortcomings and bias justifying a request for major corrections. The two main weaknesses include the non-representative nature (or at least non-systematic) of

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Discussion paper

the rockfall inventory and the fact that the links between the anomalies and destabilizations (physical processes) are poorly discussed. The authors work in the same way for 100 m3 and 2 Mm3 events while physical processes are yet probably very different. The triggering processes are therefore far too speculative with a lack of bibliographic support. Figures and tables are in good shape and referred to accordingly. English language seems of good quality and is easy to read.

Specific comments - P1, L11: The origin of the rockfall data and their respective altitudinal range must be indicated. - P1, L21: Given the work already done in Zurich, Bonn, Chambéry, in the Aosta Valley, I do not think we can consider the results of this study as a "first step". - P1, L26-27: Please, give numbers and the corresponding period. - P1, L31-32: It is imperative (1) to define what permafrost degradation is and (2) what the physical links between global warming and rock slope instabilities are. References must be largely completed on these topics. - P2, L1-2: What are the considered altitudes? - P2, L8: The authors deal with a "role" but they do not actually specify a role, but only relationships. - P2, L29: Replace "many" using the exact number of rockfalls in possible and probable permafrost zone. - P3, L7: Please discuss the data representativeness. Explain how were estimated the rockfall volumes and discuss their distribution east-west. - P3, L12-13: Give the corresponding altitudes. - P4, L1-2: Why do the authors need climate data-sets of 10 years if only 90 days of data before the events are used? - P4, L4: Explain the "compromise". - P5, L10: How useful are the temperatures of the 45 days after an event? - P5, L23: Explain the choice of 0.2. - P5, L34: What is the relationship between these two classes and the physical processes probably involved? - P6, L22-23 + Appendix A: The authors identify a precipitation anomaly for the Brenva event. How winter snowfalls at 3725 m a.s.l. can directly trigger a water pressure increase for a 2 million m3 rock-avalanche? - P6, L25: What are the remaining 12 %? - P6, L32: It is important to integrate geology to eventually understand its role in the observed asymmetry (this asymmetry is also perhaps only apparent since the data are not systematic): lithology, uplift, etc. - P6, P7 L36 + L1: Give %. - P7, L24-25: Expressing this. - P8, L1-2: How many? - P8, L6-9: It would

be interesting to cross season / volume / altitude. - P9, L12-13: Please develop. - P9, L16-19, L25-28 and after: The assumptions are too speculative. Furthermore, the authors do not rely it to the existing bibliography. - P10, L32-33: The systematic nature of the inventories and more important than the number of considered events!

Technical corrections - P1, L34: Exponent. - References are incomplete compared to what is mentioned in the text. - P3, L8, L31; P7, L23: a.s.l. - P3, L20: Google Earth in italics. - P5, L2: a "we" is overly. - P15, Table 1: Same exponents for volumes would facilitate comparisons. Event 36 is not in the Western Alps? - P19, Figure 1: Please, put the legend on the map for easy reading. - P20, Figure 2: Where is the red circle?

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