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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Assessing the interaction between mountain forests and natural hazards at Nevados de Chillán, Chile, and its implications for Ecosystem-based Disaster Risk Reduction" *by* Alejandro Casteller et al.

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Dear Anonymous Referee #1 Thanks for the valuable comments and suggestions for improving our manuscript. As indicated by the Editorial Support of Copernicus Publications, we reply below to your comments so that the Editor can make a decision about the further handling of our manuscript.

1. The title in this paper needs to be more detailed: The papers deals with snow avalanches and to a smaller extent also with debris flows.

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Discussion paper

Reply: The new suggested title is the following: “Assessing the interaction between mountain forests and snow avalanches at Nevados de Chillán, Chile, and its implications for Ecosystem-based Disaster Risk Reduction”.

2. The introduction needs a better structure: The first part deals with event documentation (in addition, the first and second sentence have no link). Then how settlement in mountains other than the Alps increased substantially and "thus it is particularly important in such more remote mountain areas, in which human populations and infrastructure are expanding, to learn more about different natural hazard processes and how they interact with mountain ecosystems". Why that? I would say it is important to know how these processes potentially affect the humans living there.

Reply: The need to learn more about different natural hazard processes and how they interact with mountain ecosystems in places where there is a lack of historical records is aimed at having better hazard and risk assessments. We will clarify this in the manuscript.

Next the introduction continues with how lacking event information can be obtained via dendrochronological methods. Then we pass on to the statement "forests can protect infrastructure from natural hazards in mountainous areas" and after that the authors only mention the interaction between forests and snow avalanches. And the paragraph ends with Eco-DRR, which is shortly introduced.

Reply: We will state in a more clear way that the main focus of our study is snow avalanches.

The goal is the paper is not specific enough: The overreaching goal of this investigation was to evaluate the role of mountain forest ecosystems as an Eco-DRR measure against natural hazards at Valle de Las Trancas, Nevados de Chillán, in the Biobío Region of Chile. The primary focus of the whole paper is on snow avalanches.

Reply: The manuscript was indeed originally broader (considering different natural

hazards), yet in the revised version we will make clear that the main focus of our study is on snow avalanches.

3. Make sure there is a link between the methods chapter and the results chapter. Suggestion for the structure of the methods chapter 1. Introduction - find the relevant tracks in the forest 2. Forest structure analysis 3. Tree ring analysis 4. Avalanche simulation with forest effect.

Reply: In the revised version (also following the advice of Anonymous Referee #2), the description of the study area and of the biogeographic setting will be included in the Materials and Methods chapter. Then we agree that in this chapter we can separate between “Forest structure analysis” and “Tree ring analysis” to make a clearer link with the Results chapter and we will do this structural modification.

4. The methods chapter mentions (p. 6, line 14): "In some of the avalanche tracks, we also observed abundant evidence of the occurrence of debris flows which were confirmed in some cases by documentary records" and "it was not possible to differentiate between the snow avalanches and debris flows". Then in the results (p.7 /line 18) the authors mentions: "The results of our tree-ring analyses allowed us to reconstruct past snow avalanche and debris flows years" This all confusing. In the discussion again: "In the current investigation area, however, we were not able to distinguish between avalanche and debris flow events using tree-ring methods because both processes occur typically during the same season (winter), when most of the precipitation commonly occurs. However, through available records, types of damages in the forest, topographical features (including channel geometry) and process modelling we were able to distinguish - to a large extent - one process from the other". The paper needs to provide more clarity!

Reply: We acknowledge that the different parts of the manuscript related to the distinction between the occurrence of debris flows and snow avalanches are currently not clear enough. In the revised version will better describe up to which extent it was

methodologically possible to distinguish one process from the other and make this also clearer in the result and the discussion chapters.

5. The paper refers to the snow avalanches and debris flows as: natural hazards, natural events, disturbances, natural disasters. Probably it would help the reader if you reduce the number of different terms you use in the paper.

Reply: We agree with this suggestion and we will reduce the number of different terms in the revised version. We will thus refer mainly to “natural hazards” when referring to snow avalanches, debris flows or other natural phenomena with potentially direct negative effects on humans. For other natural disturbances in forest ecosystems (with no direct impact on human settlement or infrastructure) we will use the term “natural disturbances”.

6. Conclusion "Our study shows that a combination of different methods and approaches is crucial to a comprehensive understanding of interactions between natural hazards, forest ecosystems and human drivers" natural hazards => only snow avalanches and debris flows, which is not that well understood because of the difficulty to separate the two human drivers => where does this suddenly come from, not analysed in the article.

Reply: As indicated in a previous comment, we will clarify in the revised version of the manuscript the way and to which extent it was methodologically possible to distinguish between the occurrence of snow avalanches and debris flows at the study area. Human drivers (related here to activities conducted by local communities in the area, such as wood extraction) are not a focus of our investigations and yet we bring this issue in the discussion and conclusion chapters to show the broader picture.

"provide a sufficient basis for decision support" decision support on what?

Reply: We mean here that all elements need to be considered for a comprehensive decision support about risk reducing measures, such as organizational, related to spa-

tial planning, afforestations and avalanche barriers. We will include this information in the revised version for more clarity.

"This is particularly true for complex mountainous regions like the Nevados de Chillán" why are they complex?

Reply: We mean here that this is a region of occurrence of multiple natural hazards (and other natural disturbances) that sometimes interact with each other (e.g. volcanic activity triggering snow avalanches or mud flows). In addition, the complex topography (steep mountain terrain) results in a more difficult acquisition of accurate digital terrain models which are necessary for the applied simulation models. We will include this new information in the revised manuscript.

"the combination of different methods applied in this study suggests that the conservation of regional native forests may contribute" The findings of the study may suggest that, not the methods.

Reply: We will modify this statement as suggested for more clarity in the revised version.

"it is important to better integrate related spatial information as an input for land-use planning tools" rephrase this sentence please

Reply: We will rephrase this sentence for more clarity in the revised version.

7. Overall remark: the scope of the paper needs to be improved, a good red line is currently missing. A range of different results are presented and finally linked with Eco-DRR in the discussion without properly explaining what this concretely means in this region.

Reply: We will better integrate the concept of Eco-DRR in our study by including other relevant examples and citations from the region (which are in fact quite limited) but also from other regions of the world.

8. Figure improvement - Fig. 1: Focus is on the yellow square- please zoom in on the yellow square and the red line - Fig. 4: Replace plot number by "forest plot (fp) number" - Fig. 6 : scale is missing; the green dots are probably sampled trees – not mentioned;

Reply: Fig. 1: we will improve the figure as suggested. Fig. 4: We will do the indicated replacement. Fig. 6: we will add a scale and indicate what the green dots represent in the figure.

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