Response to RC2

We are grateful for the helpful review provided by an anonymous referee. We respond to the comments in this review below. Reviewer comments are displayed below in **bold**, author responses are in standard text.

Responses to the interactive comment:

The authors investigated the relationship between the avalanche activity classified as 3 types (no avalanche days, avalanche days, and avalanche cycles) based on observation data and 11 synoptic types classified using ERA-5 reanalysis data in the Nordenskiöld Land region, Spitsbergen. They showed that avalanche activity depends on the synoptic condition with precipitation, wind speed and temperature. Namely, Avalanche activity becomes active under the condition including large precipitation, strong wind, rapid rising temperature. They also investigate the relationship between avalanche types (dry, mix, and wet) and synoptic types. Finally, they tried to discuss the influence of climate change in avalanche activity based on their findings.

It is clear to see that a lot of hard work has been put into the study, especially for the quality check of avalanche data. Therefore, I do not doubt that their results based on these reliable data should be contribute to the avalanche studies in the study area although their findings are not so much different from the previous studies. The manuscript, figures and table are designed well, but some of parts include so long sentences that the readers are forced to understand their implication harder. Therefore, I recommend to revise these parts briefly before publication in TC.

Thank you for taking the time to review our manuscript! We appreciate the recognition of our work to develop the avalanche database and the contribution our results may present to avalanche work in the future. Furthermore, these comments on our manuscript will help us prepare an improved revised manuscript which hopefully more clearly presents our work. We have attempted to shorten lengthy sentences in the revised manuscript, with specific examples also included in our response to RC1.

Additionally, please consider to clear the following two points, which should be related to foundation of their discussion, before making the final version of the manuscript.

We have addressed both points in the revised manuscript. Specific comments and responses are found below.

The AAI is a key term in the manuscript, but its definition is not cleared in the text. Therefore, the reader can not understand the benefit to use AAI. Please add more detailed description of AAI.

Thank you for highlighting this omission. We've addressed this concern by adding a more explicit description to the Section 2.1, which describes our methods related to avalanche activity index calculations. The added description now reads:

We calculated a daily avalanche activity index (AAI) after Schweizer et al. (2003b) using this daily avalanche activity record. The daily AAI represents the sum of all observed avalanches, with each individual avalanche's contribution to the daily sum weighted based on the avalanche's destructive size and trigger type. We assigned usual weights (e.g. Schweizer et al., 2003b) of 0.01, 0.1, 1 for avalanches of destructive sizes 1-3, respectively (we had no destructive 4 or 5 avalanches in our record). We further assigned naturally triggered avalanches a weight of 1, human triggered avalanches a weight of 0.5, and we assumed avalanches with an unknown or unspecified trigger assumed to be natural and thus assigned a weight of 1. An example day on which two naturally triggered size 1 avalanches (2 avalanches x 0.01 size weight x 1 trigger weight = 0.02) and one human triggered size 3 avalanche (1 avalanches x 1 size weight x 0.5 trigger weight = 0.5) occurred would result in a daily AAI of 0.52 (0.02 + 0.5).

They classified the avalanche days and avalanche cycles based on AAI and discuss their relationship with synoptic types, but the determination method of the threshold values between avalanche days and avalanche cycles seems to be ambiguous. Please add more description how to determine the threshold value with scientific evidence if possible.

Thank you for this comment. We admit the threshold differentiating low activity days (previously: "avalanche days) and high activity days (previously: "avalanche cycles") has been selected partially subjectively based on experience in Svalbard's snow and avalanche setting. However, we contend the differentiation between a low and high activity day must rely at least partially on knowledge of an area's avalanche regime. In Svalbard, avalanches activity is rather limited. Previous work in central Spitsbergen by Eckerstorfer and Christiansen (2011b) used the threshold of two size 2 avalanches to differentiate between a "non-avalanche day" and an "avalanche day". Two size 2 avalanches are equivalent to an AAI of 0.2 in our analyses –or half of our threshold to differentiate between low and high activity days. We thus argue the threshold value of 0.4 is defensible for two reasons: 1) based on previous work's threshold values and knowledge of Svalbard's avalanche regime, an AAI of 0.4 can be subjectively representative of a high avalanche activity day, and 2) this threshold represents roughly the 83rd percentile of days with observed avalanche activity – a more objective representation of "high activity" based on our AAI distribution. We have updated Section 2.1 in the revised manuscript with this information to help clarify ambiguities with the determination method.

The added justification for the selection of the 0.4 threshold value in the revised manuscript now reads:

We based our decision to use 0.4 as the threshold to differentiate between low and high activity days on knowledge of Svalbard's avalanche regime (where avalanche activity is generally limited relative to other locations) and an analysis of the daily AAI distribution (Fig. 3). Previous work in Svalbard used a threshold of two size 2 avalanches (equivalent to an AAI of 0.2) to differentiate

between a "non-avalanche day" and an "avalanche day" (Eckerstorfer and Christiansen, 2011b). Using a value double the 0.2 threshold used in this previous work, we explored AAI values of both 0.4 and 0.5 as potential thresholds for the differentiation between low activity days and high activity days. The 0.5 threshold represents roughly the 86th percentile on our daily AAI distribution, and results in 26 days classified as high activity days. The 0.4 threshold corresponds to the 83rd percentile of days with avalanche activity, resulting in 34 days classified as high activity days. We ultimately selected 0.4 as the threshold after detailed analyses indicated the differing threshold values had relatively little impact on the final results, but lowering the threshold to 0.4 increased the number of high activity days in our analyses which aided in, for example, more robust composite analyses and significance calculations as described in Section 2.2.1. High activity days above the 0.4 threshold (0.4 <= AAI) represent 20% of all days with observed avalanche activity and 5% of all 729 winter days included in these analyses. The 132 low activity days (0 < AAI <0.4) below the 0.4 threshold represent 80% of all 166 days with observed avalanche activity and 18% of all 729 winter days included in these analyses.

Eckerstorfer, M., and Christiansen, H. H.: Relating meteorological variables to the natural slab avalanche regime in High Arctic Svalbard, Cold Regions Science and Technology, 69, 184-193, doi:10.1016/j.coldregions.2011.08.008, 2011b.