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# On the reliability of indicator path avalanches for local avalanche forecasting

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Still today we cannot reliably predict the occurrence of snow avalanches at the local scale, e.g. for a section of a transportation corridor. As avalanches are clear signs of instability, they are often considered as the best predictor for further events. In fact, avalanches that release at the beginning of a period with high avalanche activity, are called indicator path avalanches by avalanche professionals as they indicate a high probability of further avalanche events in that specific area. In the present work, we will check whether such indicator path avalanches exist and whether they can be used to improve local avalanche forecasting.

Long-term avalanche occurrence data for three areas in Switzerland, namely the Urseren valley in canton Uri as well as for Davos and Zuoz in the Canton of Grisons are analysed. We focus on avalanche paths where avalanches frequently occur, which may have the potential to act as precursors. We define an avalanche path as indicator path, if the majority of all avalanches in the surrounding region release at the same day or on one of the consecutive three days. Releases on the days before would decrease the value of a typical indicator path avalanche. In the region of Davos, the Salezertobel avalanche with a return period of about one year was found to have a certain precursor function, but only if it is of a certain size (Figure 1). The return period of these large-sized avalanches is five years. In the Urseren valley which runs about west to east from Realp to Andermatt, two indicator path avalanches were found: the Böschenlauri on the northern slopes of the valley and the Lochthal-, Lauital- and Spitzegglaui avalanches on the southern slopes. These three avalanches can be grouped to one single precursor avalanche as they have similar aspect, incline and length. In the community of Zuoz, in the Upper Engadine valley, four adjoining avalanches were considered and analyzed as a single indicator path avalanche. All these four avalanches with precursory function are characterized by heavy precipitation before or during the event, in most cases in combination with strong wind.

Even if indicator path avalanches can predict other avalanches to follow, the quality of the forecast remains poor. Whereas there is a good chance that the release of an avalanche in an indicator path is followed by other avalanches, there are too many situations when some of these avalanches release but not the one in the indicator path. To sum up, based on our analysis, it seems not feasible to forecast other avalanches simply based on the avalanche occurrence in an indicator path.

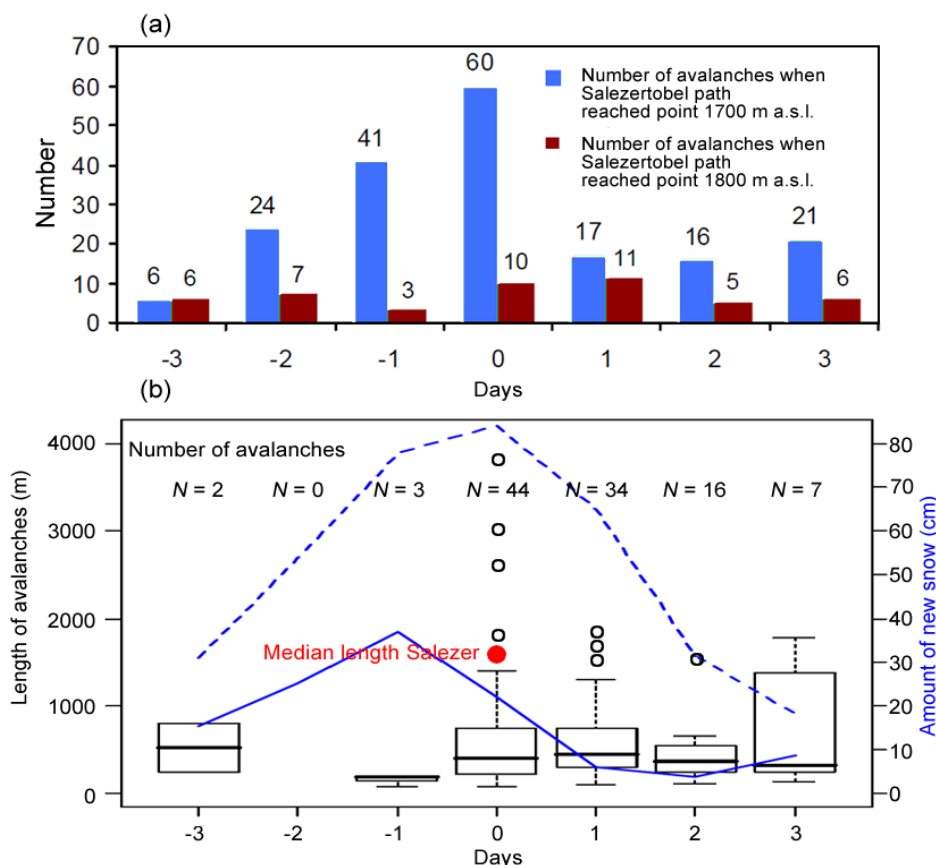


Figure 1. (a) Number of avalanches recorded in the surroundings of Davos on the 3 days before, on the day and during the 3 days after the Salezertobel avalanche run to an elevation of 1700 m a.s.l. (blue) and 1800 m a.s.l. (b) Length distribution of the avalanches recorded in the surroundings of Davos on the 3 days before, on the day and during the 3 days after the Salezertobel avalanche occurred. Boxes show interquartile range, black lines the median, whisker 1.5 times the interquartile range and open dots indicate extreme values. Red dot indicates median length of the Salezertobel avalanche. Blue solid line shows the new snow depth within 24 h, dashed blue line the 3-day sum of new snow.