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Investigating glide snow avalanche release using seismic monitoring in combination with time-lapse photography

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Glide avalanches occur when the entire snowpack glides over the ground until an avalanche releases. These avalanches are difficult to forecast since the gliding process can take place over a few hours up to several weeks or months. The presence of liquid water at the interface between the snow cover and the ground surface is of primary importance as it reduces frictional support. Glide avalanches are often preceded by the opening of a tensile crack in the snow cover, called a glide crack. Past research has shown that glide crack opening accelerates prior to avalanche release. During the winter of 2012-2013, we monitored glide crack expansion using time-lapse photography in combination with a seismic sensor and two heat flux sensors on a slope with well documented glide avalanche activity in the Eastern Swiss Alps above Davos, Switzerland. To track changes in glide rates, the number of dark pixels in an area around the glide crack is counted in each image. Using this technique, we observed an increase in glide rates prior to avalanche release. Since the field site is located very close to the town of Davos, the seismic data was very noisy. Nevertheless, the accelerated snow gliding observed in the time-lapse images coincided with increased seismic activity. Overall, these results show that a combination of time-lapse photography with seismic monitoring could provide valuable insight into glide avalanche release. Recordings of the heat flux plates show that the energy input from the soil is fairly small and constant throughout the observed period. The results suggest that ground heat flux is a minor contributor to the water production at the snow-soil interface. Instead, the presence of water at the base of the snowpack is probably due to a strong hydraulic pressure gradient at the snow-soil interface.