Submitted Abstract

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Abstract

On glaciers, an important element of the collective imagination has so far been the subject of almost no study: the snow bridge (SB) which, like an arch, can form above crevasses more or less durably. If a SB can generally support its own weight, this is sometimes no longer true in the case of overloading (skier, mountaineer) and the accident rate associated with it in the Alpine massifs is far from negligible. To improve the management of risks related to crevasses and to better understand this natural object, observational data were needed, in particular to understand how SB forms, evolves and destabilizes.

Despite the difficulties inherent to high mountain environments (glacier movement, extreme weather conditions), we installed in August 2016 a monitoring system of a series of crevasses at 3450 m a.s.l. in the Mont Blanc massif (Western European Alps). It has recorded various snow-meteorological parameters during two years at an hourly rate. An automatic camera surveyed the surface geometry of the SBs while an extensometer measured the evolution of the opening of the first crevasse monitored (37.5 m long, 6 m wide and 18 m deep at the date of the setting up). In 2021, a geophysical campaign (ground penetrating RaDAR) was carried out to image the thickness of the glacier and the position of the crevasses in the study area while stakes were installed to quantify the glacier surface velocities.

RaDAR highlighted the fact that the monitored crevasses form at bedrock humps under more than 25 m of ice. Data showed that a wind parallel to a crevasse favours its filling with snow while a wind with a significant angle to the crevasse can create a SB through cornice accretion under conditions of high wind and very low temperatures. High temperatures, interruption of freeze/thaw cycles, and associated snowmelt metamorphism are responsible for most of the observed natural failures.