

Multi-parameter monitoring of the construction and evolution of a snow bridge over a crevasse on an Alpine glacier

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Snow bridges that form over the crevasses of the Alpine glaciers allow mountaineers and skiers to cross them easily but constitute an important danger in case of rupture. Between 2008 and 2014, 37 injured persons and 13 deaths related to falls into crevasse were recorded (i.e. an average of two deaths per year) on the glaciers of the French side of the Mont Blanc massif – out of the famous Vallée Blanche ski route, which however embodies an important part of the aid related to falls into crevasses.

To understand the construction and evolution of these fragile structures, instrumentation was set up on the Glacier du Géant, at 3450 m a.s.l., near the Aiguille du Midi (3842 m a.s.l.), on the French side of the Mont Blanc massif, close to a crevasse whose bridge had recently collapsed over a length of 37 m. The maximum width of the crevasse in this area is 6 m. At the top of a 7-m-high pole – to prevent future snowfalls –, sensors have been installed in September 2016 to measure different snow and weather parameters: air temperature, wind speed and direction, snow height. An automatic camera surveys the crevasse and the snow bridge geometry. Several other sensors monitor the temperature of snow and air in the crevasse. In addition, an extensometer was installed into the crevasse to measure the evolution of its width. The results of the first 6 months of survey are presented, including the formation of the bridge in mid-November, during a period of snowfall associated with a strong wind.

Although the instrumentation is well suited to the high mountain conditions, its maintenance is delicate due to the strong instability of the environment (glacier movements and extreme weather conditions, primarily) but the results of this work will bring new glaciological knowledges which should participate in a better safety on glaciers.