Submitted Abstract

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Abstract

Gravity-driven ice collapses from the front of steep avalanching glaciers is a major natural hazard at high altitude. High-magnitude break-offs could potentially lead to the triggering of complex geomorphic chain processes that involves materials such as snow, water and debris, enhancing the magnitude of the event. Ice avalanches occurrence probability is linked to the ice surface kinematics, therefore precise estimates of surface displacement in unstable glacier sectors are crucial. These types of phenomena can occur in all major mountain ranges and understanding their dynamics, as well as implementing robust real-time monitoring stations is critical for risk management.

The purpose of this work is to present ground-based radar interferometry results from the real-time displacement monitoring of Planpincieux Glacier's right lobe. This relatively small avalanching ice-front is located on the Italian side of the Mont Blanc Massif (Grandes Jorasses), with the monitoring station placed 2.7 km from the glacier front. We will discuss the operational challenges, risk-management aspects and the detailed spatiotemporal ice-displacement data continuously acquired since 2019.

The radar system, based on the LiSALab© technology developed by ellegi srl, is a ground based interferometric synthetic aperture radar protected under a radar-transparent dome and the entire monitoring station is enclosed within a shelter adaptable for different environments. The system offers continuous data acquisition and processing with threshold-based automatic alarm messages and emails.

Monitoring results show seasonal variations of surface displacement, with summer peaks (reaching 10 m per week) followed by winter slow down (below 2 m per week). In addition to these trends, we also recognize short lived, sudden accelerations of small frontal areas usually associated with break-off events.

During the periods of high ice-flow speed it was possible to detect with considerable detail the extent of the fast-flowing area and assist decision makers on risk-mitigation strategies.