Geophysical Research Abstracts
Vol. 20, EGU2018-18024, 2018
EGU General Assembly 2018

Multi-temporal avalanche debris mapping in the French mountains using synthetic aperture radar observations from Sentinel-1

Fatima Karbou (1), Maxime Lefort (1), Marie Dumont (1), Nicolas Eckert (2), Michael Deschrtres (2), and Rémy Martin (3)

(1) CNRM UMR3589, Centre d'Etudes de la Neige, Grenoble, France , (2) Irstea, Grenoble, France, (3) Service RTM Rhône Alpes, ONF, Annecy, France

Remote sensing of avalanche debris in mountain areas offers new opportunities to improve our understanding of avalanche activity and to evaluate the physical models of avalanche hazard forecasts. The location of avalanche debris and the estimation of their sizes are of great interest for studies dealing with the stability of the snowpack and also for studying the variability of natural avalanche activity, which could be related to climate change. In addition, time series of avalanche events, with relevant time and space resolutions, would be highly relevant to better identify avalanche risk zones and periods. Such time series would complement some other existing database mostly based on visual observations (for instance Enquête Permanente sur les Avalanches (EPA) database, Sensitive Avalanche Paths (SSA), and the CLPA database (Localization Map of Avalanche Phenomena)).

Sentinel-1 satellites offer a unique tool to monitor some properties of the snowpack using a C-band Synthetic Aperture Radar (SAR) with a high spatial resolution (20m) and with a revisit frequency of 6 days over the French mountain massifs. We use a change detection algorithm to isolate avalanche debris-like features based on the backscatter contrast between avalanche debris and the surrounding undisturbed snowpack. The debris detection is based on major changes in the backscatter coefficients due to changes in snow properties following the avalanche event (height, density, roughness, ...), with the medium around the avalanche remaining almost unchanged.

Our algorithm has been successfully tested in the French Alps and Pyrenees and has been designed for an automatic use which will make an operational implementation possible in the near future. It also make it possible to infer new 2D avalanche activity indicators to complement existing database. Multi-temporal evaluations between Sentinel-1 avalanche masks and available in-situ data (EPA) have been performed. An avalanche event mapping database is under construction since the winter of 2014-2015 and would be a considerable tool for a throughout analysis and evaluation of some relevant past situations and also to derive useful 2D avalanche activity indicators over large mountain areas.