

Sentinel-1 based near real-time ice velocity mapping system

Andreas Wiesmann (1), Tazio Strozzi (1), and Frank Paul (2)

(1) GAMMA Remote Sensing AG, Gümligen, Switzerland (wiesmann@gamma-rs.ch), (2) University of Zurich, Department of Geography, Zürich, Switzerland

Knowledge on ice surface velocity of glaciers and ice cap contributes to a better understanding of a wide range of processes related to glacier dynamics, for example glacier mass flux, flow modes and flow instabilities (e.g. surges), subglacial processes (e.g. erosion), supra- and intra-glacial mass transport, and the development of glacier lakes and associated hazards. In addition, the comparison of the spatio-temporal variations of glacier velocities will improve understanding of climate change impacts.

Synthetic Aperture Radar (SAR) interferometry and offset tracking methods have been successfully applied to estimate glacier motion. The advantage of radar is in its independence of daylight and clouds. Continuing its long-term policy of providing continuous SAR data, the European Space Agency (ESA) launched Sentinel-1A in 2014, and its twin satellite, Sentinel-1B, in 2016. Both are equipped with a C-Band sensor. A major improvement of the Sentinel-1 mission is the reduction of the revisit time of the sensor, which has dropped to 12 days for Sentinel-1A, and 6 days in the full Sentinel-1A/B constellation. The data is made available through the Copernicus Science Hub a few hours after acquisition.

Within the ESA Glacier_CCI project (<http://www.esa-glaciers-cci.org>) a processing chain based on SAR interferometry and offset-tracking was established to derive ice velocity fields from various SAR data sources. For many glaciers and ice caps historical ice velocity maps of the 1990's (ERS-1/2 and JERS-1) and 2000's (ALOS-1) were computed. Starting from 2015 velocity fields of glaciers and ice caps are routinely computed with a remarkable quality from Sentinel-1 data for the regions where suitable data pairs are acquired. The availability of periodic ice velocity information allows studying changes in the ice dynamics in some cases on a weekly base. This already has and will continue to reveal unprecedented insights in glacier dynamics and related processes.

The availability of near real-time SAR data from Sentinel-1 satellites allowed to setup an operational near real-time ice velocity processor to study changes in the ice dynamics in some cases on a weekly base. In our contribution we will present our processor implementation and show results of recent ice dynamics, with a special focus on Svalbard and the Karakoram mountainous region.