Master of Science Project

Geoscience and Remote Sensing

Themes: SAR Interferometry, Ice motion

Application of SAR Interferometry to high resolution glacier velocity mapping

Background

One of the many indicators of climate change is the acceleration of outlet glaciers in some parts of Greenland and Antarctica. This acceleration is linked to an increase of ice discharge that translates to a loss of ice mass and, subsequently, to sea-level rise. Systematic monitoring of ice stream velocities can only be achieved through satellite-based Earth Observation (EO) techniques. Synthetic Aperture Radar (SAR) observations are particularly relevant. One reason is that, in contrast to optical sensors, it can provide imagery throughout the year independently of weather and solar illumination conditions. A second reason is that, because the radar signal penetrates to some extent in the subsurface, SAR images reveal features that are not present at shorter (optical) wavelengths.

Indeed, sequences of SAR images have been used extensively to estimate glacier velocities. These are estimated by tracking features present in the amplitude of subsequent images. Nowadays, this is done operationally using Sentinel-1 SAR data. Given the high temporal sampling provided by Sentinel-1, there is enough coherence between pairs of images to apply interferometric techniques. There are a number of operational reasons, and technical challenges for which, however, this is not done.

Research Objectives

In this thesis we want to investigate the added value of applying InSAR techniques. The hypothesis is that InSAR is not going to significantly improve the estimation of the large scale component of the ice flow, but that it should expose the small scale structure of the velocity field.

InSAR processing is relatively computationally intensive. A possible approach to reduce this cost is to use of available velocity products within the interferometric processing chain.

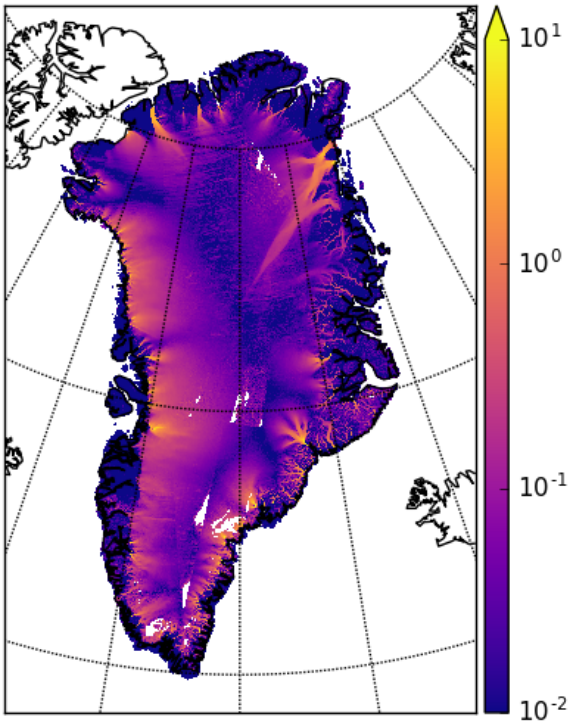

Figure 1 Greenland's ice velocity [m/day] map retrieved using Sentinel-1 SAR data. (Velocity estimations courtesy of ENVEO).

Student Profile

Candidate students should preferably have some prior knowledge about Synthetic Aperture Radar and SAR Interferometry, and have an interest in signal theory/processing. During the project, the student will be exposed to the details of the interferometric processing chain developed at the department. The work involves adding some optional steps to this chain, and implementing some post-processing algorithms in a high-level programming language, preferably Python.

Advisor and Information

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