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Car-borne repeat-pass interferometry at L-band: measuring glacier flow velocity

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In this contribution, we show first results of repeat-pass interferometric measurements of glacier flow velocity obtained in fall 2018 with Gamma Remote Sensing's novel GS-L system, a compact synthetic aperture radar system at L-band. In this experiment, the GS-L SAR system was operated in a car-borne mode so that mobile mapping of a glacier and its surroundings could be performed from a road. Several repeat-pass SAR acquisitions where taken along a slightly curved road section on the "Susten" mountain pass, in central Switzerland, from which substantial parts of the "Steingletscher" glacier can be imaged.

The carborne SAR data was focused along a synthetic aperture of approx. 250m using a time-domain back-projection (TDBP) approach and the data was focused directly to a reconstruction grid in map coordinates [1,2].
A CUDA/ ANSI C implementation of the TDBP focusing was used to focus the data as described in our previous Ku-band carborne SAR test cases [3-6].
The TDBP-processing to map coordinates — involving an accurate digital elevation model — allows to directly form differential interferograms in map coordinates.
A highly-precise navigation-grade ring-laser-gyro INS/GNSS system with a local GNSS reference station was used for positioning and attitude determination of the SAR system so that the azimuth-varying baselines (due to the repeated slightly different driving paths on the road) are well-known and the topography induced phase can be directly removed to a large extent by means of the TDBP-based focusing procedure.

In the context of the DInSAR-based estimation of glacier flow velocity that is presented we discuss aspects such as mitigation of troposphere-induced phase contributions and residual motion-induced phases, as well as interferometric stacking of the time-series of carborne repeat-pass measurements.

References:
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