Intercomparison and validation of SAR-based ice velocity measurement techniques within the Greenland Ice Sheet CCI project

Ice velocity is one of the products associated with the Ice Sheets Essential Climate Variable. This paper describes the intercomparison and validation of ice-velocity measurements carried out by several international research groups within the European Space Agency Greenland Ice Sheet Climate Change Initiative project, based on space-borne Synthetic Aperture Radar (SAR) data. The goal of this activity was to survey the best SAR-based measurement and error characterization approaches currently in practice. To this end, four experiments were carried out, related to different processing techniques and scenarios, namely differential SAR interferometry, multi aperture SAR interferometry and offset-tracking of incoherent as well as of partially-coherent data. For each task, participants were provided with common datasets covering areas located on the Greenland ice-sheet margin and asked to provide mean velocity maps, quality characterization and a description of processing algorithms and parameters. The results were then intercompared and validated against GPS data, revealing in several cases significant differences in terms of coverage and accuracy. The algorithmic steps and parameters influencing the coverage, accuracy and spatial resolution of the measurements are discussed in detail for each technique, as well as the consistency between quality parameters and validation results. This allows several recommendations to be formulated, in particular concerning procedures which can reduce the impact of analyst decisions, and which are often found to be the cause of sub-optimal algorithm performance.

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