Evaluating glacier velocity maps derived from satellite image feature tracking using GLAcier Feature Tracking testkit (GLAFT)

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Accurate assessments of glacier velocity are crucial for understanding ice flow mechanics, monitoring natural hazards, and projecting future sea-level rise. However, the prevailing method for obtaining glacier velocity maps, known as feature tracking, often relies on empirical parameter choices that lack consideration for glacier physics or uncertainty. We have examined two metrics that integrate statistical and physics-based approaches to evaluate velocity maps derived from optical satellite images of Kaskawulsh Glacier in Yukon, Canada, using various feature-tracking workflows, in situ GNSS data, and synthetic velocity maps. We observed that velocity maps with metrics conforming to our recommended ranges exhibit fewer erroneous measurements and a higher degree of spatially correlated noise compared to maps with metrics that deviate from these ranges. Consequently, these metric ranges are suitable for refining feature-tracking workflows and evaluating the resulting velocity products. To facilitate the computation and visualization of these metrics, we have released the GLAcier Feature Tracking testkit (GLAFT), an open-source software package.

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