Three Dimensional Ice-Flow Velocity Estimation Using Satellite Radar Interferometry

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An understanding of the flow dynamics of an ice sheet's outlet glaciers and ice streams requires knowledge of their flow velocity and strain rates (i.e., velocity gradients). Prior to the recent advent of satellite radar interferometry, it was not possible to measure detailed ice-flow velocity over the vast featureless areas that comprise most of the ice sheets. Since the launch of ERS-1, the use of satellite radar interferometry (SRI) data for making densely-sampled ice-flow velocity measurements has been firmly established by several studies. A repeal-pdss interferometer, however, is sensitive only to surface displacement that is directed along the line of sight from the radar to the ground. As a result, interferograms acquired along a single track cannot resolve the full three-component velocity vector.

If we make the assumption that ice is constrained to flow parallel to the surface, then data acquired from along two non-parallel satellite tracks are sufficient to estimate the full velocity vector. This approach requires that we have detailed knowledge of the surface topography, which we can determine interferometrically.

There are **several** sites in Greenland where. data from crossing ascending and descending passes were acquired during the tandem phase of ERS-1 and **2.** We have. combined data from non-parallel orbits with surface slope information to make vector ice-flow measurements for the Ryder Glacier, Greenland. Qualitatively, the estimated velocity vectors agree well with flow direction inferred from flow bands and channel geometry as seem in SAR amplitude imagery. Although comparison with GPS ice-velocity measurements is needed to fully validate this technique, our results for the Ryder are promising and indicate that repeat-pass interferometric data can be used to make vector measurements of ice velocity.

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