Tidal Flexure at the Grounding Line of the Rutford Ice Stream Shown by ERS Interferometry

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Abstract

The Rutford Ice Stream drains a 49,000 km2 area of the West Antarctic Ice Sheet (WAIS), a marine ice sheet with much of its bed below sea level. The ice stream drains into the Ronne Ice Shelf, and is at the southerly limit of coverage by the European Remote−Sensing Satellites ERS–1 and ERS–2.

Synthetic Aperture Radar (SAR) data covering the ice stream from onset to grounding line were obtained for phases B, D and G of the ERS mission, the First and Second Ice Phases and the Second Multi–Disciplinary Phase respectively. A series of interferograms were produced, using three day pairs and a six day pair for January and February 1992, three day pairs and a three day triplet for January 1994, and tandem differential pairs for January to March 1996. The interferograms clearly show vertical motion over these time periods at the grounding line and for up to twenty kilometres upstream.

The most likely explanation for the observed vertical motion is the seven metre tidal range at the Rutford Ice Stream grounding zone. A tidal model has been used to show the height and phase of the tide at the time of acquisition of each SAR image, and therefore the difference in tidal height between each interferometric pair. The role of the central pinning point on grounding is also seen to vary with tidal phase. It is therefore more appropriate to think of a grounding region of tens of kilometres, the width of which varies with the tide, rather than a clearly defined grounding line. Further work examining these observations will be carried out.