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SAR interferometry over Rutford Ice Stream and Carlson Inlet, Antarctica

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Abstract

An interferogram is formed from two sets of ERS-1 SAR SLC images acquired six days apart over Rutford Ice Stream, Antarctica. Ground surveys carried out in the area over the last 15 years provide more than 100 tie-points with which to optimise the interferometric baseline.

Where flow is approximately along levelled lines between tie-points, the vertical component of ice movement is estimated by assuming that flow is parallel to appropriately averaged surface slopes. Non-independent tie-point errors are dealt with by constructing a variance-covariance matrix for the expected values of the unwrapped interferometric phases at the tie-points. When the weighted residual variance is minimised, RMS tie-point residuals of less than 1 cm are obtained. These can be attributed to a combination of interferometric phase noise, movement survey errors and inadequate slope information.

The pattern and size of the residuals suggest no changes in ice movement between 1978 and 1992. The upper 50 km of Carlson Inlet are confirmed to flow at less than a tenth of the speed of the neighbouring Rutford Ice Stream. The entry of faster moving ice into the lower reaches of Carlson Inlet and the position of part of the Carlson Inlet grounding line are confirmed.

Keywords: Glaciology, Rutford Ice Stream, Antarctica, slope, tie-points, residuals