

Ice Flow Velocity in East Antarctica from 1960s to 1980s derived from Historical Remote Sensing Imagery

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Ice flow velocity is an important parameter for estimating mass changes in Antarctica. Long-term observations of the surface velocity are of great significance for assessing the relationship between the mass loss of Antarctic ice sheet and global sea level rise. Existing research on Antarctica ice velocity based on modern satellite remote sensing dated back to 1970s, but to date, no ice velocity products are available covering the entire Antarctica before 1990s. The release of the scanned ARGON images made it possible to explore the ice flow velocity of the Antarctica surface back to 1960s.

This research presents a comprehensive processing method for estimating Antarctic ice flow velocity fields by using ARGON and Landsat satellite images, which include selection of image pairs, image pre-processing, orthorectification, image matching, quality inspection, precision analysis, interpolation, and mosaicking. Two kinds of ice flow velocity mapping methods, including a novel parallax decomposition algorithm and feature matching technique, were applied to the three image pair configurations, namely, ARGON stereo, ARGON and Landsat, Landsat and Landsat. The above methods for estimating ice flow velocity are applied in mapping the major glaciers of East Antarctica (Totten, Amery, Filchner, etc.) from 1960s-1980s for the first time. Comparison with recent Antarctic ice velocity products by Rignot et al. (2011) shows change patterns in different glaciers.