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Volumetric and Area Changes of the Kaskawulsh Glacier, Yukon Territory, Canada

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This study quantifies changes in the Kaskawulsh Glacier from the 1930s to present. The glacier extent was digitized based on aerial photographs from the 1930s and 1956/57, Landsat images from 1977, 1990 and 1994, ASTER images from 2001, 2003, and 2006, and a SPOT image from 2007. These images were georectified using ground control points (GCPs) collected in July 2008 with differential GPS, and were used to calculate temporal changes both in areal extent and terminus retreat.

A variety of data types were also used to create digital elevation models of the glacier surface; these include Canadian Digital Elevation Data from 1977, non-scanning laser altimetry profiles from 1995 and 2000, ASTER scenes from 2001, 2003, and 2006, a 2007 scanning laser altimetry profile, and SPOT images from 2007. These datasets were orthorectified and checked using the 2008 GCPs. The DEMs were differenced to determine the spatial and temporal distribution of thinning/thickening across the glacier, and to map rates of vertical change.

Preliminary results show that terminus retreat has exceeded 11 m yr-1 between 1956 and 2006. Furthermore, between 1977 and 2007, mean thinning along the central arm of the glacier exceeds 6.5 m, constituting an average of 0.22 m yr-1. Thinning is most pronounced at the glacier terminus where some areas have undergone more than 73 m of loss. Above the equilibrium line, some areas show thinning (generally on the order of 7-16 m) while other areas show increases in thickness (generally on the order of 3-12 m). Recently, the rate of thinning along the glacier has decreased; from 2000-2007 the glacier thickened slightly on average, although thinning at the terminus continued. This research presents the most accurate calculations to date of changes in this large valley glacier, and provides insights into the wider changes occurring within Kluane National Park.