Abstract

As anthropogenic climate change continues to accelerate, long-term and large scale monitoring of glaciers is crucial. The Taku Glacier offers a unique opportunity to apply remote sensing methods to a glacier with a long history of advance. The behavior of the Taku Glacier has been historically out of phase with regional climate and other proximate glaciers, which have undergone recent, and in some cases dramatic, retreat. Although remote sensing has been established as an effective tool for glacier monitoring, few studies have applied these methods to such a large glacier with so many diverse facies. This study establishes the effectiveness of using remote sensing to quantify long-term changes in glacier parameters including surface area, equilibrium line altitude (ELA), and accumulation area ratio (AAR) by combining a digitized historical topographic map, Landsat images, and a USGS DEM.

The results of the remote sensing analysis demonstrate significant downwasting and loss of mass at the margins of the glacier and areas of the glacier that are bounded by bedrock. In-situ monitoring has chronically underestimated this downwasting. This study quantified a substantial up glacier migration of the ELA and a corresponding reduction in AAR. Comparison of the AAR associated with each Landsat scene to the established equilibrium AAR for the Taku Glacier indicated that the Taku glacier has transitioned from a long period of positive mass balance to relative equilibrium. This transition likely presages a new period of retreat for the Taku glacier, which will have widespread consequences for downstream ecosystems and economies.