Abstract

Tree-ring dates show that valley glaciers in coastal south-central Alaska have made multiple advances during the late Holocene. While the timing of these advances has generally been synchronous throughout the region, termini have differed in the distances they reached down-valley. As a result, dates of outermost Holocene moraines range in age from C.E. 1710s to early 1900s, and the regionally prominent 1870s-1900s moraine varies from being a terminal moraine to a recessional moraine at different forefields. Because adjacent termini often show these differences in outermost moraine age, it seems unlikely that this variability is due to regional variability in the magnitude of the climatic forcing. Rather, we hypothesize that localized glacier-specific effects have filtered the climatic forcing to cause some glaciers to advance farther than others in response to the same climate changes.

In this study we test this hypothesis using a dataset of 36 glaciers in coastal south-central Alaska for which previous work has provided dates of terminal moraines. Glacier boundaries for the mid 20th century were delineated from U.S.G.S. topographic maps in ArcGIS 10.2 and used to clip digital elevation models for each glacier. These were then used to determine glacier areas, high and low elevations, hypsometries, flow lengths, and slopes. Correlation of these variables with outermost moraine dates found a significant relationship for slope at the 95% confidence level, with steeper glaciers having generally older outermost moraines; other geometric factors did not show significant relationships. This result is consistent with other studies that have found steeper glaciers to be different to less steep glaciers in their response to 20th century climate change. Ongoing work is examining the possible roles of forefield geometry, geology, and geomorphology in influencing the magnitude of late Holocene advances.