Research exercise: Climate-Glacier Relationship of Retreating Alaskan Glaciers

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GLACIERS OF ALASKA: AN ASSESSMENT OF CHANGES OVER THE PAST 30 YEARS

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ABSTRACT

Portage, Whittier, Eklutna, as well as many other well-known "tourism glaciers" in the vicinity of Anchorage, Alaska are known to have retreated in the past 30 years. This begs the question, "what of the other, lesser-known glaciers? Do they follow the same patterns and minimal glacier models?" Glaciers such as Byron, Leonard, Matanuska, Raven and Spencer may be a minimal model. Information on Byron and Leonard is sparse, as both have become hanging glaciers. Other glaciers, such as Raven, are small enough to be deemed insignificant, yet may have information to give. Consequently, our objective is to study five Alaskan glaciers and determine wide-ranging variability to changing regional climate. To do this we obtained field geo-location data and characterized glaciers based on the satellite imagery and climate reevaluation. Our results show that the glaciers in the region are retreating irrespective of their aspects, location and altitudinal variability. Moreover, our presentation establishes the strong climate-glacier relationship and defines retreating snowline patterns over the few last decades.

STUDY AREA

The focus area for this study was the Anchorage-Seward region of Alaska. This study was based on those glaciers accessible to tourists, thus the focus area extended up to four hours (driving time) from central Anchorage. Glaciers covered include Matanuska, Knik, Portage, Whittier, Eklutna, as well as many others. The focus area extends as far north as Glacier View (near Lake George Glacier, 20 miles north of Anchorage), as far south as Seward, with Exit Glacier and Bear Glacier a stone's throw away from the city.

METHODS

Due to the relative inaccessibility of much of the study area via road and path, much of the data used in this study was obtained through an analysis of LANDSAT satellite imagery. The data was gathered using furthest extent point data using ArcGIS, which was then normalized to a transect line on each glacier for a straight-line vertical comparison. The data was then analyzed according to various time periods; the most representative and comprehensive results were selected from these different time periods.

Next, land based climate station temperature and precipitation data was gathered from the National Oceanic and Atmospheric Association. The data was then plotted in Excel; trend lines were created, and the results were analyzed for possible relationships between the temperature, precipitation, and advance/retrat of the glaciers in a given region.

RESULTS & CONCLUSION

Glaciers in the Anchorage-Seward area have largely shown to be retreating over the past 30 years. In both areas, climate data gathered from the NOAA station data has indicated a gradual increasing trend in temperature, though precipitation shows an increasing trend in the Anchorage area and a decreasing trend in the Seward area. In fact, the Anchorage station has experienced a decrease in precipitation of four times the rate of increase in temperature. In Seward, precipitation increases have been a factor of approximately four times the rate of temperature increase.

All the glacier covered in this study were at relatively low altitudes, and there is speculation that the lower altitude would increase the reactivity of the glaciers to climate condition variance. Fluctuating temperature and precipitation in the region might explain the fact that many of the glaciers in this study showed an oscillatory advance-retreat tendency, though the trend was mainly retreat. In cases such as 20 Mile Glacier (also known as Allen Glacier) and Bear Glacier, large scale retreat (as compared with the other glaciers in the study) occurred. Later examination of these glaciers will likely reveal a more direct relationship with temperature and precipitation than other, relatively static glaciers.

Future work in the area could include a mass-balance assessment as well as modeling a response pattern of the stated glaciers (and others) to the previously indicated climate variance. Additional climate data could be gathered from stations on or at the glacier sites, so as to better represent the climate fluctuations at the glacier’s specific elevation.

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REFERENCES

Land-Based Stations Climate Data available at www.ncdc.noaa.gov


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LANDSAT Satellite Imagery courtesy of US Geological Survey