

PHOTOGRAMMETRIC AND MECHANICAL ANALYSIS OF GLACIERS  
WITH AN EMPHASIS ON TIDEWATER GLACIER DYNAMICS

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## ABSTRACT

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Earth's glacial mass changes are considered to represent a climate related monitoring system. This is due to the fact that glacial mass changes provide important quantitative data on rates of movement, advancing and receding, which are interpreted to be caused by climatic changes. Climate and mass changes of mountain or alpine glaciers have been shown to correlate over both long (years-decades-centuries) and short (days-months-seasons-year) timescales. Tidewater glaciers, however, have alternate driving forces for movement. Although their long term movements are dependent on global climate fluctuations, their short term movement mechanisms primarily deal with the glaciers dynamics. Understanding the role of glacial movements in terms of climatic feedbacks is incomplete without a better comprehension of the glacial mechanics that generate the movements of both alpine and tidewater glaciers.

Photogrammetric comparison of 5 glaciers in the Kenai Fjords of Alaska was used to analyze the overall movements of the glaciers between the years of 1990 and 2004. Photographs of two other well studied and highly affected mountain glaciers were also used to show the climate related movements of alpine glaciers. The photogrammetric results document that alpine glaciers have receded due to climatic changes and that tidewater glaciers have receded and advanced due to non-climatic influences.

**The movement mechanics of tidewater and alpine glaciers were investigated in order to evaluate the potential impact of climate change on their movement. Columbia Glacier and Hubbard Glacier research was used to examine tidewater glacier mechanics and the calving glacier cycle. Results prove that tidewater glaciers essentially move due to non-climate related factors such as water depth, fjord geometry and ice thickness.**

**In contrast, research on alpine glaciers indicates that their movement mechanics are driven predominantly by climate. These results imply that nearly all tidewater glacial movements are unsuitable for any short timescale climate change studies. Therefore, it is necessary to make alpine glaciers the focus of short term climate change research. The receding of alpine glaciers gives conclusive evidence that Earth's climate is changing.**