

# GLACIER MASS-BALANCE TRENDS IN ALASKA AND CLIMATE-REGIME SHIFTS

by  
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<http://www.water-ak.usgs.gov/glaciology>

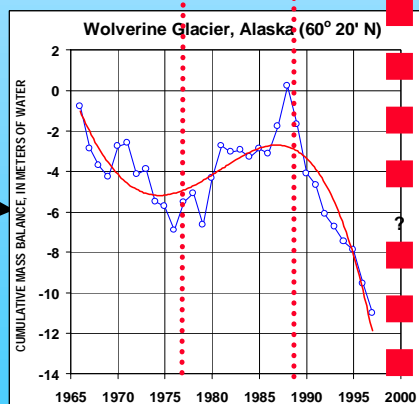
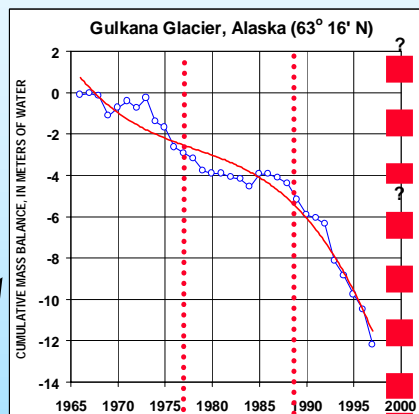
## ABSTRACT

Cumulative net mass-balance trends at Wolverine and Gulkana Glaciers in Alaska are strongly correlated with the 1976/77 and 1989 interdecadal climate-regime shifts recognized for the North Pacific. Wolverine Glacier is a south-facing valley glacier near the southern coast of Alaska on the Kenai Peninsula in south-central Alaska. Gulkana Glacier is a south-facing branched valley glacier on the southern flank of the Alaska Range in interior Alaska, about 350 kilometers northeast of Wolverine Glacier. At Wolverine Glacier, the negative trend of cumulative net mass balances, since measurements began in 1965, was replaced by a growth trend (positive mass balances) during the late 1970's and 1980's. The positive mass-balance trend was correlated with warmer winters and increased precipitation at Wolverine Glacier during the 1976/77 to 1989 period. At Gulkana Glacier, the cumulative net mass-balance trend has been negative throughout its measurement period, but with rate-change inflection points that coincide with the interdecadal climate-regime shifts in the North Pacific. Since 1989, the trends of both glaciers have been an unbroken series of negative mass balances, at the highest rate in the entire record. These trends agree with other studies that suggest that the period since the 1989 Pacific climate-regime shift has been unusual. As the possibility of another decadal climate-regime change looms, the question is how the current negative mass-balance trend will change.

**NOTE:** Between the North Pacific climate regime shifts of 1976-77 and 1989, the mass loss rate at Gulkana Glacier was the lowest for the entire period of measurements, and Wolverine Glacier grew. The growth of Wolverine Glacier was due to increased precipitation.

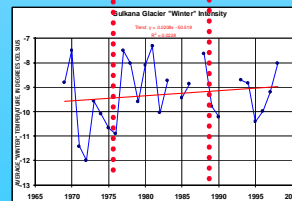
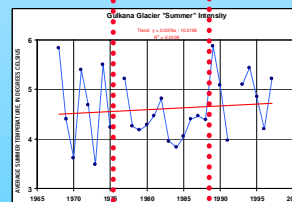
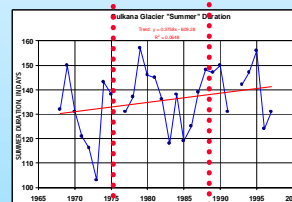
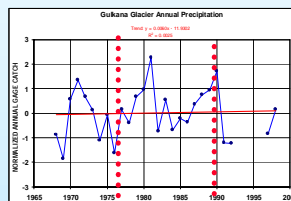
## North Pacific Interdecadal Regime Shifts

1976-77      1989      Next?



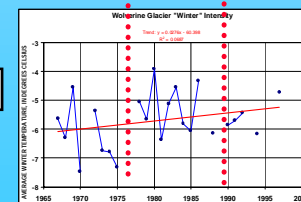
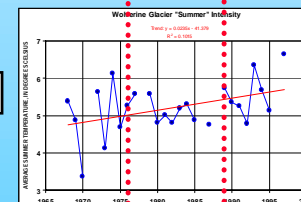
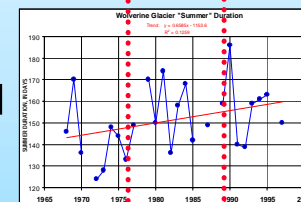
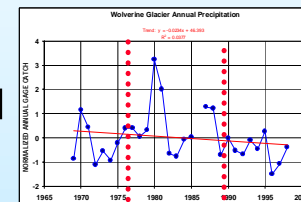
## Gulkana Glacier

1976-77      1989



## Wolverine Glacier Growth Period

1976-77 to 1989



Normalized annual precipitation catch

Number of days per year with a positive average temperature

Cumulative positive degree-days divided by the number of positive degree days

Cumulative negative degree-days divided by the number of negative degree days

An unprecedented rate of mass-balance change has occurred at both Gulkana and Wolverine Glaciers since 1988.

