Glacier Surveys 2024

Survey Details

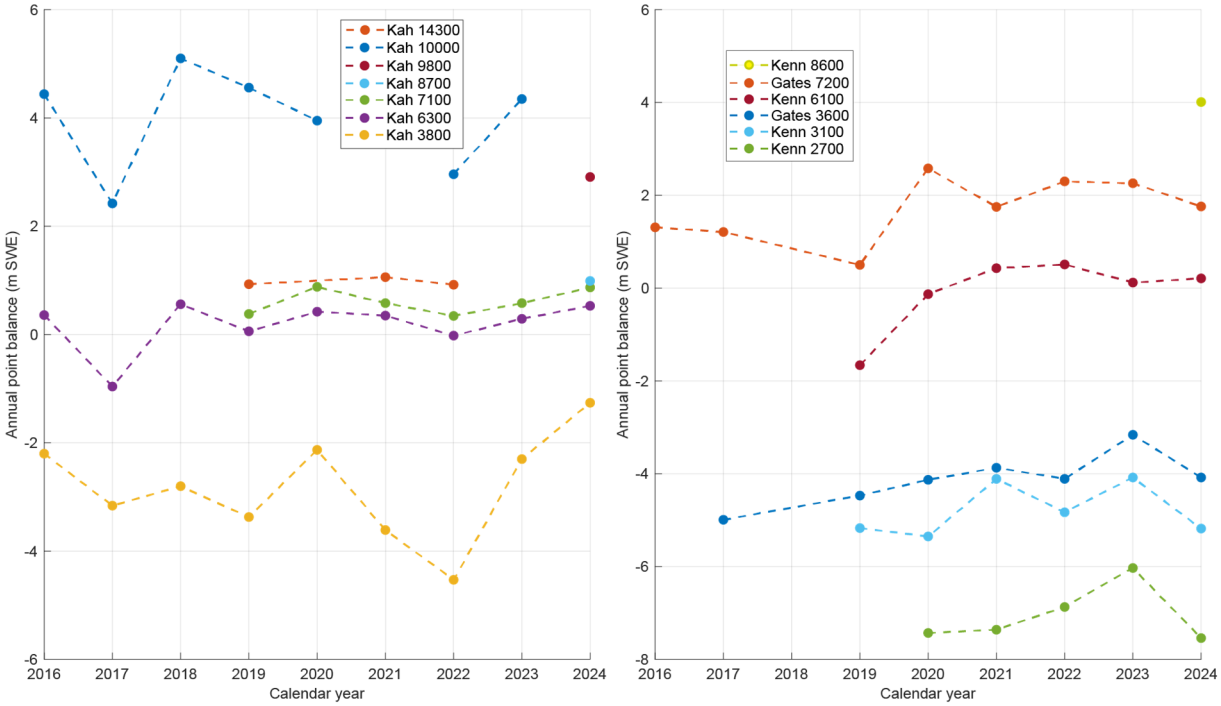
Central Alaska Network Principal Investigator Michael Loso worked closely with scientists from the USGS Alaska Science Center to monitor Kennicott Glacier and Kahiltna Glacier in spring and fall 2024. The updated glacier monitoring program now measures snow and melt characteristics at six sites on each glacier. This survey work is ongoing.

USGS glaciologist Louis Sass extracting a snow core from Kennicott Glacier.

Results

These measurements convey a sense of the variability in annual balances at a variety of sites on each glacier. Annual balance describes the amount of material (snow/ice/water) gained or lost at a given elevation on the glacier between successive fall measurements. Because snow, ice, and water have different densities, we normalize the values to the density of water and express them in terms of Snow Water Equivalent (SWE).

The most obvious trend is an expected one: higher (more positive) balances at higher elevations where it is colder and usually snowier. We also see a tendency of higher elevation sites to respond differently to climate than lower elevation sites, presumably because balances respond differently to summer temperatures and to winter temperatures in those areas. But note also the year-to-year patterns. 2018 was a “good” year on Kahiltna Glacier, while 2023 was a particularly good year on Kennicott—at least at lower elevations. Results like these, combined with seasonal balances (not shown), provide us with an understanding of how the glaciers are responding to different aspects of the changing climate.



Annual mass balances for Kahiltna Glacier (left) and Kennicott Glacier (right). Sites are numbered by approximate elevation (ft).

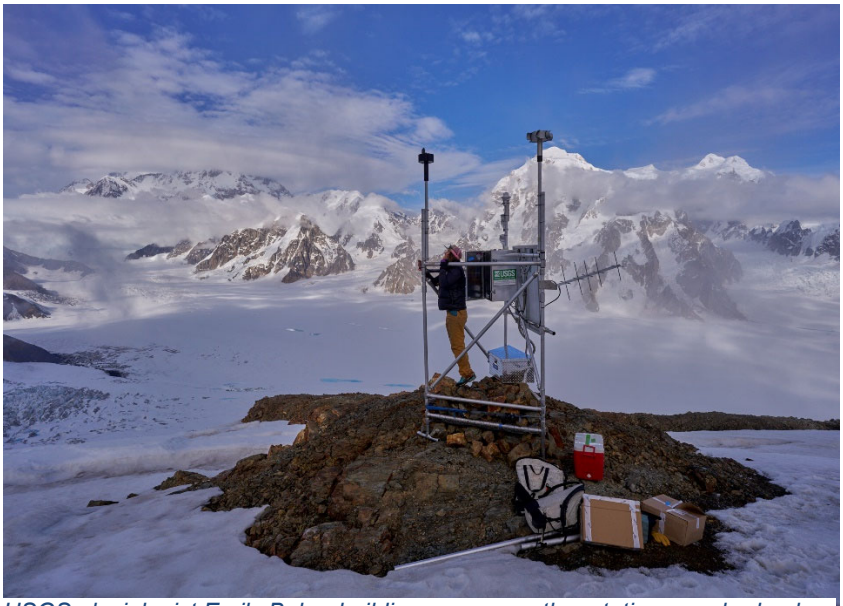
Why Is the Glaciers Vital Sign Important?

Glacier growth and retreat is linked directly to climate, which makes them valuable indicators of climate change and its consequences. As Alaskan glaciers retreat, they have the potential to contribute significantly to sea level rise, limit water supply to major rivers, reorganize watersheds, and trigger landslides. A better understanding of the local trends of this vital sign will improve our ability to anticipate the scale and timing of such events and to strengthen our preparedness and response. The glaciers featured in this monitoring project are well known because they are used frequently for recreation and are strong assets to their respective parks and communities.

What Do We Want to Know About Glaciers?

The goal of this monitoring is to document the long-term climate-driven changes at Kahiltna and Kennicott glaciers. To interpret this relationship, we need to record when and where mass is gained or lost at various sites on both glaciers and details of the local microclimates. This is done by tracking annual balance, which is the net mass a glacier gains or loses over the course of a year (accumulated snow + summer melt). A good comparison to climate requires good weather data, which is collected by weather stations positioned on or near the glaciers.

Snow Water Equivalent (SWE)
When tracking the mass of a glacier, 10 cm of light fluffy snow does not equate to 10 cm of dense ice! To make direct comparisons between measurements of snow to ice to everything in between, glaciologist convert it all to snow water equivalent (SWE), which is the amount of liquid water that would be left if the snow or ice melted.



USGS glaciologist Emily Baker building a new weather station on a bedrock ridge near Kahiltna Glacier

How We Monitor Glaciers

Every spring and fall, scientists revisit established sites on the Kahiltna and Kennicott glaciers to measure accumulated or melted snow and ice. In the spring, snow pits are dug to determine the amount of snow accumulated since the previous season. If the bottom can't be reached by digging, a snow core is extracted from the bottom of the pit using a drill-powered snow corer. Snow density is measured along this profile by weighing snow of a known volume. Vertical stakes, up to 12 meters long, are installed to measure accumulation and melt based on how much of the stake is buried or exposed when they are revisited. Weather stations are positioned on the glaciers to record accurate and ongoing readings of precipitation, temperature, wind speed, and solar radiation on the glacier surface. The work on Kahiltna Glacier began in 1991 and has been expanded in recent years. The work on Kennicott Glacier began in 2015.

How Monitoring This Vital Sign Can Help Park Managers

- Maintain up-to-date information on the status of glaciers – some of the park's most unique and spectacular resources – for scientists and visitors alike.
- Understand the local impact of climate change on their park with direct and familiar examples.
- Anticipate the future trajectory and position of glaciers to inform park infrastructure and resource planning.
- Contribute valuable data to scientific research in fields like glaciology, meteorology, geomorphology, etc.

Contact Information

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