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Water Isotope Geochemistry and Glacial Climatology on the Juneau Icefield

Content

Stable water isotope data on the Juneau Icefield (JIF) in Southeast Alaska has been collected since 2012 as part of the Juneau Icefield Research Program (JIRP). Samples are from snow pits, surface transects, shallow snow cores, and one deep ice core drilled in 2019, referred to as the Matthes-Llewelyn Ice Core. The 2019 core reveals data anomalies in the first 24 meters of the core, and these anomalies are the center of the research. We investigate two prominent hypotheses. The first hypothesis centers around the impact of recent changes in atmospheric conditions, namely temperature, on isotope signature in the Matthes-Llewelyn Core. The second hypothesis has to do with the possibility that liquid water stored within the glacial ice is altering the isotope values. To approach these questions, this research analyzes snow samples collected throughout the 2021 summer field season alongside isotope data collected from 2012-2019 on the icefield. The goal of these samples is to assess the profile of the last year's accumulated snow, the behavior of isotope signature with changing elevation, and the isotopic character of subsurface liquid water to examine whether or not trends similar to the Matthes-Llewelyn core become apparent. This research works to interpret temporal and spatial variability across the JIF to understand potential drivers of isotopic shifts within the 2019 ice core. Using the Simple Water Isotope Model developed by Bradley Markle, we reconstruct surface and evaporation source temperatures from isotope values, which we compare to observations on the JIF over the same time period. Preliminary findings suggest that the first hypothesis is likely not viable, leading to a focus on the second hypothesis as a reasonable explanation for observed isotope trends in the 2019 Ice Core. The intent is to investigate past climate trends of the Juneau Icefield, develop a more complete picture of the climate of this icefield in Southeast Alaska, and contribute to the body of climate research pertaining to temperate glacial change in Alaska.

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