

Ground-Penetrating Radar Ice Thickness Survey of Matthes, Llewellyn, and Tulsequah Glaciers on the Juneau Icefield, Alaska and Canada.

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In this study we investigated the bed topography and ice thickness of Matthes, Llewellyn, and Tulsequah Glaciers. Matthes is a major tributary to one of Southeast Alaska's largest and deepest temperate glaciers, Taku Glacier. Taku Glacier recently ceased a long term advance likely due to a decreasing accumulation area ratio, making it an object of concern for potential future retreat. Measurements of ice thickness and estimated volume, with mass balance and ice flow velocity records which are collected annually across the Juneau Icefield, provide crucial data for modeling future advance or retreat. However, measuring deep temperate valley glacier ice is notoriously difficult due to high attenuation rates and valley wall clutter. We used a 1.5 MHz ground-penetrating radar (GPR) dipole antenna set with a 2.5 kV Kentech transmitter towed by snow machine to measure ice thickness over 80 km of glacier terrain. Data included a centerline profile of Llewellyn and Matthes Glaciers and a 3.5 km by 2.8 km grid at 350 m spacing collected at the triple ice divide between Matthes, Tulsequah, and Llewellyn Glaciers between July 20-28th, 2018. GPR surveys revealed smooth valley wall reflections on glacier cross sections and ice thicknesses over 900 meters depth near the center of Matthes Glacier. Continued monitoring of the Taku Glacier is crucial to understand how Matthes, Llewellyn, and Tulsequah glaciers will react to further climate change impacts. Our results, in conjunction with other available mass balance and velocity datasets, provide information for robust modeling of this system.