Application of Ground Penetrating Radar and Geodetics to the Selection of an Ice Core Drill Site on the Kahiltna Glacier of Mount McKinley, Alaska

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Interest in global climate change continues to fuel the search for more sources of quality paleo-climate information in hopes of accurately reconstructing and predicting past and future climates respectively. Ice core records from the Arctic and Antarctic have provided some of the most reliable data for paleo-climate modeling however, the validity of these data and models rely heavily on a number of assumptions regarding ice stratigraphy and glacier structure. Unfortunately, many Arctic valley glaciers are unsuitable for ice core drilling because they exhibit significant melt, ice flow, deformation, and dipping stratigraphy due to their thermal regime and confined flow boundary conditions. Other valley glaciers do exhibit stable accumulation basins with conditions suitable for ice core drilling, however these sites need to be validated through a variety of geophysical and glacio-chemical techniques. A thorough assessment of local meteorological data, snow chemistry, ice flow dynamics, glacier structure, and stratigraphy prior to ice core drilling in a valley glacier is important to determine if the site meets the proper criteria.

A glacio-chemical and geophysical reconnaissance of the Kahiltna Glacier on Mount McKinley, Alaska, was performed in 2008 and 2009 to search for an appropriate deep ice core drill location in Central Alaska. Surface velocity measurements from a rapid static GPS survey were coupled with approximately 10 km of 100 MHz GPR profiles to determine surface and subsurface glacier structure and dynamics at a promising drill site near Kahiltna Pass (3078 masl). The GPR profiles reveal a pocket of ice east of Kahiltna Pass with horizontal stratigraphy and 300 meters of ice; based on local accumulation rates and ice flow modeling, this depth of ice likely represents 500 +/- years of climate record. Preliminary geodetic data suggest low velocities (less the 0.1 m/day) at the potential drill site and velocities up to 0.45 m/day 7 km down slope of the drill site. These velocities are comparable to previous velocity measurements recorded on the Kahiltna Glacier. Stratigraphic complexities do exist in the upper Kahiltna Glacier region; interpretation of these features and their relevance to local ice flow and drill site selection will be discussed.

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