Geophysical Research Abstracts
Vol. 16, EGU2014-6085, 2014
EGU General Assembly 2014
© Author(s) 2014. CC Attribution 3.0 License.

Ice thickness profile surveying with ground penetrating radar at Artesonraju Glacier, Peru

Rachel Chisolm (1), Antoine Rabatel (2), Daene McKinney (1), Thomas Condom (3), Alejo Cochacin (4), and Luzmilla Davila Roller (4)

(1) Univ. of Texas at Austin, Center for Research in Water Resources, Austin, Texas, USA (rachel.chisolm@gmail.com), (2) Univ. Grenoble, CNRS, LGGE, Grenoble, France (rabatel@lgge.obs.ujf-grenoble.fr, +33 4 76 82 42 01), (3) IRD, Univ. Grenoble, LTHE, Grenoble, France (thomas.condom@ird.fr), (4) Unidad de Glaciologia y Recursos Hidricos, ANA, Huaraz, Peru (acochachin@hotmail.com, luzmiroller@hotmail.com)

Tropical glaciers are an essential component of the water resource systems in the mountainous regions where they are located, and a warming climate has resulted in the accelerated retreat of Andean glaciers in recent decades. The shrinkage of Andean glaciers influences the flood risk for communities living downstream as new glacial lakes have begun to form at the termini of some glaciers. As these lakes continue to grow in area and volume, they pose an increasing risk of glacial lake outburst floods (GLOFs). Ice thickness measurements have been a key missing link in studying the tropical glaciers in Peru and how climate change is likely to impact glacial melt and the growth of glacial lakes. Ground penetrating radar (GPR) has rarely been applied to glaciers in Peru to measure ice thickness, and these measurements can tell us a lot about how a warming climate will affect glaciers in terms of thickness changes.

In the upper Paron Valley (Cordillera Blanca, Peru), an emerging lake has begun to form at the terminus of the Artesonraju Glacier, and this lake has key features, including overhanging ice and loose rock likely to create slides, that could trigger a catastrophic GLOF if the lake continues to grow. Because the glacier mass balance and lake mass balance are closely linked, ice thickness measurements and measurements of the bed slope of the Artesonraju Glacier and underlying bedrock can give us an idea of how the lake is likely to evolve in the coming decades.

This study presents GPR data taken in July 2013 at the Artesonraju Glacier as part of a collaboration between the Unidad de Glaciologia y Recursos Hidricos (UGRH) of Peru, the Institut de Recherche pour le Développement (IRD) of France and the University of Texas at Austin (UT) of the United States of America. Two different GPR units belonging to UGRH and UT were used for subsurface imaging to create ice thickness profiles and to characterize the total volume of ice in the glacier. A common midpoint survey was also undertaken to determine the radar velocity in the ice at Artesonraju Glacier. GPR measurements of Artesonraju Glacier show the ice thickness ranging from 20 meters at the terminus and gradually increasing to about 160 meters at the deepest part in the tongue of the glacier. After this point the bed slope begins to increase and the ice thickness decreases in the direction of the accumulation zone. A negative bed slope from the glacier terminus to the middle of the glacier tongue indicates that the conditions are favorable for the growth of a glacial lake with a potential maximum depth of about 60-80 m.