Volume Determination and Area-Volume Scaling on a Small Bolivian Cirque Glacier, Charquini SE

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ABSTRACT

Tropical glaciers serve as important climate indicators, as well as crucial water resources for local rural populations and nearby urban population centers. There is concern that this water resource is disappearing at an accelerating rate due to climate change. Policy makers require a better understanding of the amount of water currently contained in these glaciers, as well as of future projections for continued runoff to maximize their ability to store meltwater from these glaciers and to enact effective public policy measures. This study focuses primarily on the small Charquini SE cirque glacier located in the southern Cordillera Real in Bolivia. During an August 2012 field campaign, differential Global Positioning System (dGPS) and ground penetrating radar (GPR) measurements were collected along transects totaling 3189 meters. At this time, the glacier had a surface area of 2.42 square kilometers which has subsequently been much reduced. Initial analysis of the GPR measurements indicates success in capturing the ice rock interface. Ordinary kriging was used to generate both glacier surface and subsurface topographies. In 2012, based on calculations between these two surfaces, this glacier contained 3,900,000 cubic meters of ice. Historical aerial photos of this glacier, acquired in 1963 and 1983, were also obtained and are being processed to generate surface topographies for previous periods. This will enable volume loss for different periods to be calculated. In addition to calculating volumes directly, area volume scaling relationships will be determined based on our measurements on Charquini SE and other modern and paleoglacier measurements in the Bolivian Andes.

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