INTEGRATING MULTIPLE GEOPHYSICAL METHODS TO UNDERSTAND GROUNDWATER STORAGE AND DISCHARGE IN TROPICAL PROGLACIAL CATCHMENTS

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The Cordillera Blanca in North-western Peru is home to 25% of the world's tropical glaciers, where hydrologic regimes are rapidly changing due to warming- induced glacier recession. Proglacial alpine meadows are storing a significant portion of annual basin discharge, and buffer dry season low flows as glaciers continue to lose their influence on the regional hydrologic cycle. We used integrated seismic (refraction, H/V passive seismic) and electrical (2D ERT and 1D soundings) in conjunction with borehole data to characterize the nature of proglacial talus aquifers in alpine meadows at elevations above 3500 masl. The meadow subsurface exhibits a transition from relatively slow (400-800 m/s) to fast (~2500 m/s) seismic p-wave velocity at depths of 4 to 8 am, coinciding with the top of a composite layer of buried talus boulders, according to borehole data. Artesian pressure head in piezometers screened at the boulders indicate the presence of an aquifer confined by clay sediments. Resistivity profiles suggest that the upper most portions of the buried talus deposit are infilled with saturated clay, which dissipates with depth where sediments become more electrically resistive. Passive seismic and 1D electrical soundings suggest that total sediment thickness extends deeper than 20 m, allowing for first estimates of talus aquifer storage volumes and groundwater residence times. Based on the results from this study, we present a refined conceptual model of talus aquifers, from their formation to hydrologic function. Throughout the Cordillera Blanca, buried talus aquifers have the potential to store between 7 and 20% of annual basin discharge, which will allow for future predictions of dry season base flow for the region's principal river.