Submitted Abstract

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First Author First Name Last Name	 Charlotte S. (1) Curry
Submitting Author First Name Last Name	 Charlotte Stephanie Curry
Correspondence	cscurry1@sheffield.ac.uk
Co-Authors >> E-Mails will be not listed	Rowan, Ann V. (1); Livingstone, Stephen J. (1); Bryant, Robert G. (1); Quincey, Duncan J. (2); Bravo, Claudio (3); Newton, Andrew M.w. (4)
Organisations	1: The University of Sheffield, United Kingdom 2: The University of Leeds, United Kingdom 3: Centro de Estudios Científicos, Chile 4: Queen's University Belfast, United Kingdom
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Abstract

Glaciers in the Andes were sensitive to localised changes in temperature and precipitation during the Last Glacial and Holocene time periods. However, large research gaps exist between 31°S and 40°S in the arid Chilean Andes. Over anthropogenic time scales, mining for copper, gold and other metals at sites such as Andina and Los Bronces mines present additional complications for understanding glacier evolution. These mines generate large volumes of mineral dust that is deposited on glaciers and affects their surface energy balance by modifying albedo and accelerating melt, and thus the demise of these glaciers. Glacier mass loss will have a detrimental impact on the timing and volume of glacially derived water resources for highly populated downstream areas such as Santiago.

This project aims to assess the impact that mining has had on glaciers between 23° and 40°S in the arid Andes in the context of ongoing Holocene climatic change, to understand glacier change in the past, establish their current volume and recent evolution, and project the future recession and impact for water resources. A combination of geomorphological mapping and 10-Be cosmogenic nuclide exposure-age dating will be used to create a moraine geochronology. This will be used with a glacier model to simulate and evaluate regional glacier evolution through the Holocene across the study region, and project how these glaciers may evolve under a number of different future climate scenarios.

Decadal-scale surface elevation changes between 2000 and present day using ASTER satellite images, and albedo variability between 1972 (start of the Landsat satellite era) and present day for the entire study region will be produced to determine recent glacier change. In addition, we will focus on glacier changes in response to mining activities in the Olivares Basin, where glaciers are approximately 5 km from the Andina and Los Bronces mines. We plan to use a combination of surface reflectance, X-ray diffraction and X-ray fluorescence to determine the distribution and provenance of mine wastes and impact that this dust has had on glacier mass change.