As climate change accelerates glacial ablation glacialized catchments worldwide face dramatic changes. Determining the contribution of glacial melt to the hydrological system is an important step in building resilient and sustainable water use strategies. Glaciers retreat in the tropical Andes has been accelerating in recent decades due to anthropogenic driven climate change. How changes in glacial meltwater contribution will impact water resource availability downstream is of great importance in the Andes where there is no seasonal snow cover outside of glacial areas to provide additional seasonal recharge.1 The Coropuna ice cap is one of the largest tropical ice masses on Earth.1,2 Coropuna is the largest freshwater store in the department of Arequipa, Peru (population > 1 million).3 Over the past three decades Coropuna has lost 24% of its ice mass.4

**Hypothesis:** Coropuna glacial meltwater contributes substantially to adjacent watersheds.

**Introduction**

The Coropuna ice cap is one of the largest tropical ice masses on Earth.1,2 Coropuna is the largest freshwater store in the department of Arequipa, Peru (population > 1 million).3 Over the past three decades Coropuna has lost 24% of its ice mass.4

**Methods**

Stable water isotopes were measured at Purdue University on a Los Gatos Research Stable Water Isotope Analyzer. Samples are reported on the international VSMOW standard scale. Analytical precision for δD is less than 0.2‰ and for δ18O is less than 1 ‰.

**Results**

- **Fig. 3** Illustration of glacial meltwater contribution to drainages. Contribution is higher on SW side of ice cap where ablation is highest.
- **Fig. 4** Water stable isotopes follow different gradients due to moisture sources and orographic effects.
- **Fig. 5** SIMM Mixing plots of surface (triangle) and spring (squares) contribution from glacial and precipitation end-members for each of the four drainages Rio Arma (green) and Capiza (red) and Quebrada Del Castillo (blue) and Blanco (orange).
- **Fig. 6** Diagram showing sources of radiocarbon to glacial meltwater.
- **Fig. 7** Radiocarbon age of glacial ice is older than expected due to cryogenic carbonate or magmatic CO₂ outgassing. Mixing of glacial melt with modern recharge causes groundwater radiocarbon ages to decrease with distance from glacial source (A). Comparison of SIMM and radiocarbon ages (B).
- **Fig. 8** Study area differences in glacial meltwater contribution to drainages surrounding Coropuna ice cap.

**Conclusions**

Glacial meltwater contributes more to ground and surface waters at a higher elevation with diminishing contributions at lower elevations up to 2000 masl as evidence by the stable isotopes and radiocarbon dating of springs. Glacial meltwater is a greater proportion of groundwater (from springs) in the southwestern drier drainage basins Quebrada del Castillo and Blanco than the northern Arma drainage. Future work will focus on determining the application of radiocarbon tracing in glacial meltwater systems in other regions. Our results suggest that the projected loss of the Coropuna ice cap by the end of the century will substantially decrease discharge in adjacent watersheds from 33 to 99%. These losses, will be unevenly distributed to the surrounding drainages due to the disproportionate contribution of glacial melt and spatial heterogeneity of recharge.

**References and Acknowledgements**