Submitted Abstract

ID IMC22-FSAbstr- 583

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Country	Chile
Region	South America
Title	Cold-Blooded: Drivers Of Climate Change Refugia For Glaciers And Streamflow Responses – A Blueprint.
Keywords	Glacier-Climate Interactions, Glacier Sensitivity, Climate Change Refugia, Mountain Streamflow
Type	List Of Focus Session
Focus Session ID	23

Abstract

We introduce a novel perspective to interpret glacier responses to climate changes and the impact on streamflow. Our research, recently funded by the Chilean Science Council, is conceptualized as a multidisciplinary and international team that is combining diverse methodological approaches to determine conditions of "Climate Change Refugia" for Glaciers (CCR), a metaphor that simultaneously encapsulates glacier resistance and resilience before predominant regional climate trends, and the hydrological consequences thereof. The susceptibility of glaciers to disturbances in rainfall and thermal regimes makes them one of the most sensitive systems to climate variations. For downstream glacierized mountain catchments, meltwater is crucial to sustain streamflow during dry periods, allowing relatively continuous baseflow to sustain diverse activities. Although fluctuations in temperature and precipitation are intrinsically linked to dynamics of mass loss and gain, there are examples of mountain glaciers with similar size and elevation range, and located within broadly homogenous climatic regimes, that have shown a differential volumetric response. This apparently anomalous climatic sensitivity can be linked to topographic constraints leading to particular hypsometric ice mass distributions. This suggests that climatic sensitivity is a non-stationary or dynamic attribute, in the sense that glaciers may fluctuate from being highly coupled to decoupled from climatic trends. To date, most research has focused on explaining ice loss and its consequences whereas less research exists on the reasons why certain glaciers resist disappearance and what impact they have on mountain hydrology, considering that these environments usually also contain other transient water reservoirs. For regions depending on meltwater, understanding changes in sensitivity, the causes thereof, and identification of conditions and locations of glacier survival become as important as pinpointing areas of full disappearance. We use CCR to denominate the combination of local geomorphometric and climatic conditions that decouple glaciers from regional warming and drying trends, thus maintaining a detectable influence on streamflow. This change in climatic sensitivity and its impact has been rarely examined. To achieve our research goals, we have developed a multidisciplinary approach that combines moraine mapping and dating, glacier reconstruction, water isotope analysis, geomorphometry, remote sensing, and coupled hydroclimatic numerical modeling. We will provide further details of our research while describing preliminary results, our geographical focus and what we foresee as further developments under this approach.