

# Investigating cryospheric water stores in central Asian rock glaciers using remote sensing, climate modelling drones and field survey

## Supervisors

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## Project description

Mountain hydrology plays a crucial role in maintaining social and economic development in many arid regions of the world through continuous provision of water supplies. However, climate change is leading to recession and eventual disappearance of mountain glaciers. This glacier recession will threaten future water supplies adversely with negative implications for development.

In many Asian arid mountain ranges considerable water is contained within rock glaciers - debris-covered ice-cored permafrost features. These landforms are an important component of hydrological systems, forming extensive potential reservoirs of water. With a surface cover of rock debris, the ice content is insulated from low amplitude and high frequency temperature changes and, as a result, rock glaciers are predicted to respond more slowly than ice glaciers to climate warming. Consequently, they have the potential to play an important future role in hydrological systems with global warming, supplying water to mountain communities as glaciers recede.

There are important barriers to understanding how rock glaciers may regulate mountain hydrology. *First*, there have been few systematic inventories of rock glaciers, despite the pressing need to assess the potential of rock glaciers to contribute to water supply and there is little fine-grained understanding of rock glacier function. *Second*, while much is known of the recession of ice glaciers in response to climate change, much less is known of the rock glacier response. *Third*, there is incomplete understanding of the amount of ice contained within rock glaciers, especially at the regional scale, and this hampers assessments of the importance of these landforms for providing reliable water supply to susceptible regions.

The proposed research will address the lack of a systematic inventory of rock glaciers in Asia and assess their response to recent climate change, and aims to provide a spatial database for investigating the ice content of rock glaciers and their importance as water sources. The research will focus on using freely available remotely-sensed data to provide regional scale assessments of rock glacier distributions. To support and validate this regional analysis, fieldwork will be carried out by the successful student in remote mountain regions where UAV technology will be used for fine-scale remote sensing surveys to support the broader synoptic monitoring. A spatially explicit understanding of the distribution of rock glaciers across this area will provide a unique scientific baseline from which rock glacier responses to observed climate change over this period can be assessed. Modelling of future temperatures using RCM data will allow the student to assess the ways in which rock glaciers will respond to future warming.

Image caption: Large rock glacier in Kazakhstan.

