



What makes a rock glacier? Insights into the structure and dynamics of an active rock glacier on the Tibetan Plateau

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Rock glaciers are typically regarded as periglacial features and their dynamics are supposed to be driven by ice content. Under ongoing global warming we expect these structures and dynamics to change and at least decay. This would be especially the case of rock glaciers in climate-sensitive high mountains of the Tibetan plateau, like in the Nyainqêntanglha range. Despite the similar past and present periglacial climatic conditions in this region, rock glaciers are only formed in a few, specific valleys. With this study, we aim to provide insights into the environmental conditions under which rock glaciers are formed and maintained, to be able to better understand how they will respond to changing boundary conditions, imposed by global warming.

To assess “what makes a rock glacier?” we studied such a feature in the Qugaqie basin, at 5500 m a.s.l. To describe the structure and the dynamics of this active rock glacier we applied several methods (geomorphological mapping, geophysics, remote sensing) and we incorporated catchment area properties such as geology, water and sediment sources. Mapping of the geomorphology, the geology and surface material properties characterizes the external structure of the rock glacier. The internal structure, like the active layer zone and the existence of ice, is described by electrical resistivity tomography (ERT). To investigate the surface dynamics of the rock glaciers, we quantify displacement rates using Interferometric Synthetic Aperture Radar (InSAR) time-series analysis. To gain insight to internal deformation dynamics we use environmental seismology, allowing for detection and location of crack signals within the rock glacier. The seismic network also allows tracking rock falls at the head scarp and continuously monitoring glaciofluvial patterns. We find that the singularity of the presence of the studied rock glacier is most likely related to a specific melange of the geological structures, former glaciation of the valley, catchment size and shape and especially water availability.