



Glacier-fed Irrigation Systems in upper Hunza: Evolution and Limitations of socio-hydrological Interactions in the Karakoram, northern Pakistan

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Unlike other Himalayan regions, where glacier retreat dominates, glaciers in the upper Indus catchment are characterised by an overall increase of total snow and ice volumes with significant regional differences. However, there are many cases where glacier termini are in retreat and where ablation reduces glacier surfaces, often resulting in the desiccation of irrigation channels across lateral moraines. The question of how glacial dynamics affect the livelihoods of mountain communities living in close proximity to these ice bodies has been largely neglected. Local irrigation systems in high mountain regions are unique examples of socio-hydrological interactions, which are characterised by an interplay of site-specific glacio-hydrological conditions, socio-economic development, institutional arrangements and external development interventions. Reliable crop production requires constant and sufficient melt-water supply from glaciers and snowfields. Based on three case studies, this study describes and analyzes the structure and dynamics of irrigation systems in upper Hunza, located in the western Karakoram, Pakistan. In these deeply incised and arid valleys, glacier and snow melt-water are the primary water sources for agricultural production. The study shows how glacio-fluvial dynamics impact upon irrigation systems and land-use practices, and how in turn, local communities adapt to these changing conditions: framed here as coupled socio-hydrological interactions. A combined methodological approach, including field observations, interviews, mapping and remote sensing analysis, was used to trace historical and recent changes of irrigation networks and land-use patterns.