



## **Socio-hydrological interactions and dynamics in the western Karakoram, Northern Pakistan – a case study from Upper Hunza**

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In semi-arid mountain regions of Central and South Asia, agricultural production generally depends on snow and glacier melt runoff. Even small glacier changes impact water availability and local communities have developed diverse adaptation strategies to upkeep local irrigation systems. Based on an in-depth study of the village Hussaini in Upper Hunza, located in the western Karakoram, Pakistan we investigate the impact of glacier changes on the socio-hydrological system. The usage of a combined methodological approach based on remote sensing data as well as repeated field surveys and interviews with local farmers enables to integrate environmental and socio-economical changes in an integrated analysis. The irrigation system of Hussaini strongly depends on the melt water of the adjoining Ghulkin Glacier. This debris-covered glacier is characterized by fluctuations of its front position and relatively small glacier thinning rates since the end of the 19th century. At various points in time, three different glacial water sources were abstracted for irrigation: water flowing across the lateral moraine, from the glacier terminus or from the glacio-fluvial stream. Glacier dynamics including fluctuations and floods directly impact the status of irrigation and local water availability. Site-specific adaptation strategies to these glacio-hydrological changes, including constructions and readjustments of water channels and intakes, efforts to maintain existing channels despite glacier thinning and corresponding changes in meltwater runoff, introduction of innovative solutions and changes of water management systems, were mapped and analyzed. Whereas some channels desiccated as a result of glacier down-wasting, some others were reactivated by local water users. Due to decreasing water availability and increasing cash crop production, the local population faces massive problems.