Université de Neuchâtel
Centre d'hydrogéologie
et géothermie

MSc in Hydrogeology and Geothermics

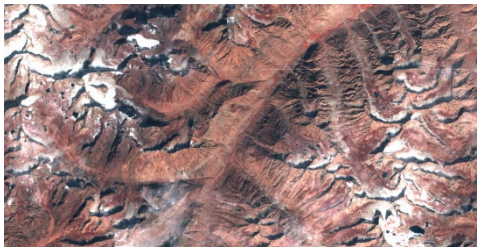
Thesis topic proposal 2023

Impacts of climate change and armed conflict on land use/land cover (LULC) and water resources in the Afghani Hindu Kush mountains

Context and objectives

The Afghani Hindu Kush mountains are a vital source of water for NE Afghanistan and neighbouring regions. In the past two decades, there have been marked changes in land use/land cover (LULC) due to both climate change and the Afghan war (2001-2021). Noticeable climate change effects in the Hindu Kush mountains, include retreating glaciers, changing precipitation patterns, and increasing temperatures. These changes have affected water availability, agriculture, and biodiversity in the region. There have also been conflict-related changes in LULC in the Afghani Hindu Kush mountains. The conflict and changing control of the region has led to deforestation, land degradation, and increased cultivation of opium poppy, which has further degraded the environment and contributed to social and economic instability in the region. The building of roads and other infrastructure for military purposes has also led to changes in LULC.

The project



This project will use remote sensing techniques to develop yearly land use/land cover maps for the Afghani Hindu Kush and neighbouring regions. We will identify specific locations and time-scales where climatic (e.g., changes in max snow cover extent/duration) and conflict-related processes (e.g., internal population displacement, abandonment of croplands) are highly pronounced. These will serve the basis for case-studies wherein impacts on water resources are analysed. We will establish baseline data prior to the 2001 US-led invasion of Afghanistan and will analyse the evolution of the landscape as the war progressed. We will also investigate LULC changes that have occurred since the Taliban takeover in 2021 by exploiting the very latest open-access raw remote sensing data. Finally, we will analyse seasonal and long-term trends in water storage using GRACE data.

This project will leverage some of the tools that have been recently developed and applied to the Orontes basin (Syria) by PhD candidate Saeed Mhanna (CHYN). These tools are implemented in the cloud-based tool Google Earth Engine which enables rapid processing of massive amounts of data.

There is potential for direct funding from GEOmountains, which would enable attendance of an international conference (e.g., AGU or EGU) by the student, given satisfactory results.

Supervision and collaboration

The project will be supervised by Dr. Landon Halloran, Saeed Mhanna, and Prof. Philip Brunner.

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