Understanding glacier mass balances based on snow cover extent, albedo and surface temperature

Background & Relevance:
Glaciers represent an important part of the world's freshwater resources used for agriculture and drinking water. Driven by global warming, most glaciers are losing mass at accelerated rates. Quantifying these changes with mass balances using photogrammetric or ground-based methods can be time-consuming and expensive. To approximate the annual mass balance and its spatio-temporal variability, the variations in glacier snow cover extent, the snow and ice albedo as well as surface temperatures can be involved. Optical satellite imagery of Landsat and Sentinel-2/3 facilitates a remotely-sensed, continuous glacier monitoring during the ablation period. The main objective of this MSc thesis is to quantify spatial and temporal variation in glacier snow cover extent, albedo and surface temperatures and relate these changes to existing glacier mass balance information. This thesis provides the opportunity to gain extensive experience in (1) processing optical satellite time series in the Earth Engine, (2) statistical data analysis, and (3) advancing glacial mass balance studies.

Study area:
Space: European Alps
Time: 2015 - 2022

Data Input:
- Landsat 7/8/9, Sentinel-2/3 time series
- Glacier mass balances (ground-based, geodetic)

Analysis tasks (to be discussed):
- Extract glacier snow cover extent, albedo and surface temperature time series
- Quantify relations with glacier mass balances
- Infer mass balances of un-surveyed glaciers
- Ingestion of retrieved time series into glacier mass balance model

Objectives:
- Proof-of-Concept on glacier mass balance approximation
- Closure of glacier surface energy balance
- Improved understanding of glacial changes across mountain ranges

Links & References:
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