Evolution of overland flow processes on moraines in the Swiss Alps

HILLSCAPE **HILLS**lope **C**hronosequence **A**nd **P**rocess **E**volution

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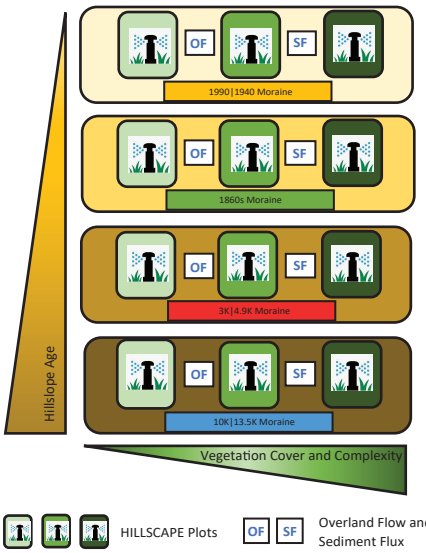
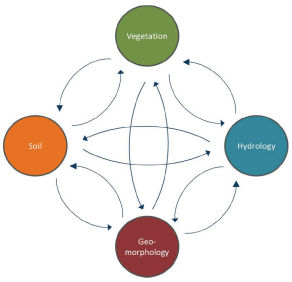


Chronosequence approach:
Three plots on four moraines (top: youngest moraine; bottom: oldest moraine) are investigated for biological, pedological and hydrological characteristics and responses to rainfall events.

Motivation and Research Questions

- The overall research question for the HILLSCAPE project is: How does the hillslope feedback-cycle evolve in the first 10.000 years of development and how is this related to the evolution of hillslope structure?
- We used a space-for-time approach and artificial rainfall experiments on two chronosequences of moraines in a silicate (Sustenpass) and carbonate (Klausenpass) proglacial area in the Swiss Alps. We studied the overland flow and sediment fluxes for the plots on the moraine chronosequences.

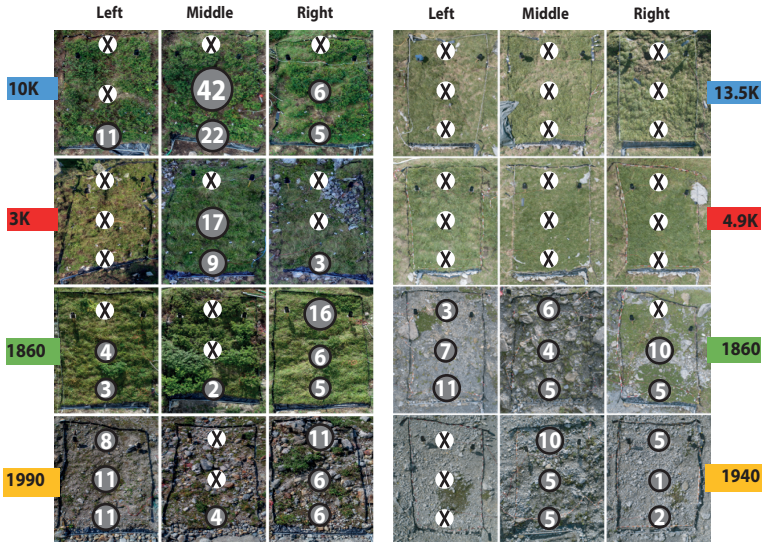


Left: The interdisciplinary HILLSCAPE-Team aims to investigate the hillslope feedback-processes.

Right: Photo of the instrumentation on a HILLSCAPE plot .

Results

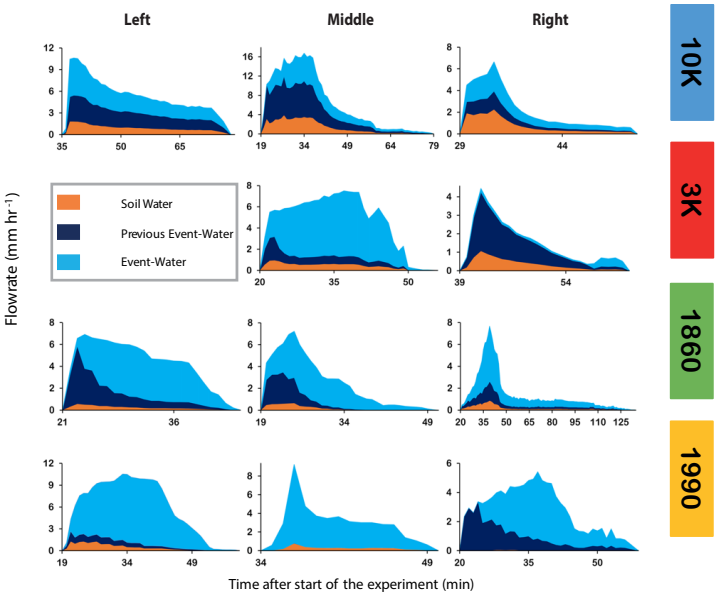
Sustenpass



Klausenpass

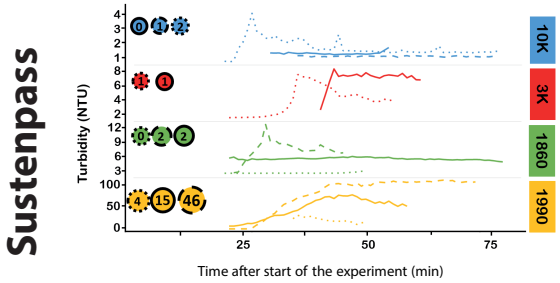
Drone images of the HILLSCAPE plots. The size of the circles and the number indicates the runoff coefficient (%) for overland flow. The top symbol is for a low rainfall intensity event (2-year return period) and the bottom circle for an extreme event (100-year return period). The runoff coefficient increased with moraine age and runoff was absent on the old moraines at Klausenpass (carbonate bedrock).

Sustenpass High rainfall intensity

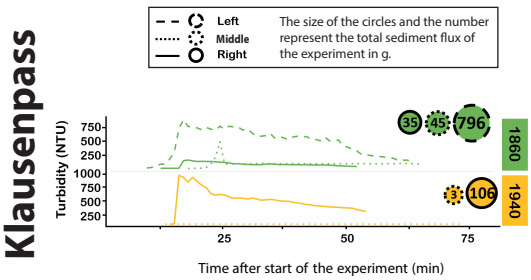


Hydrograph separation: The event water fraction decreases with moraine age. Soil and vegetation development on the old moraines increase water storage capacity, mixing and the residence time of the water.

Sustenpass



Klausenpass



On both chronosequences, the turbidity of overland flow and the total sediment flux decreased with the age of the moraine. This is strongly related to the development of roots and clay, which increase soil aggregate stability.

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