EnvSeis Newsletter

Spring 2025

Editor:

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Overview

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Follow-up on the individual ESRs projects

ESR01 – Stefania Ursica

GFZ, Potsdam, Germany

Over the past months, I continued developing the hybrid, bio-inspired method to detect and locate geomorphic surface events such as landslides, rockfalls, and debris flows. These processes are difficult to monitor directly, especially in remote regions where traditional

methods often fail. To overcome this, the method combines physical techniques with biologically-inspired strategies, allowing it to adapt to complex terrains and noisy seismic environments. A key part of this work involved using a catalogue of over 200 documented geomorphic events from different parts of the world. These events served as a benchmark to evaluate performance, improve arrival-time picking, and refine the location algorithm through iterative testing.
This work is ongoing and continues to evolve. Each round of testing reveals ways to improve the accuracy and efficiency of the method, and new features are still being added and optimized. In parallel, and just before a major cyclone impacted La Réunion island, I planned and carried out with local help the first complete maintenance and data download campaign for our field sensors. The operation was completed on schedule, ensuring continuous data flow and system reliability under challenging and rather uncommon environmental conditions.

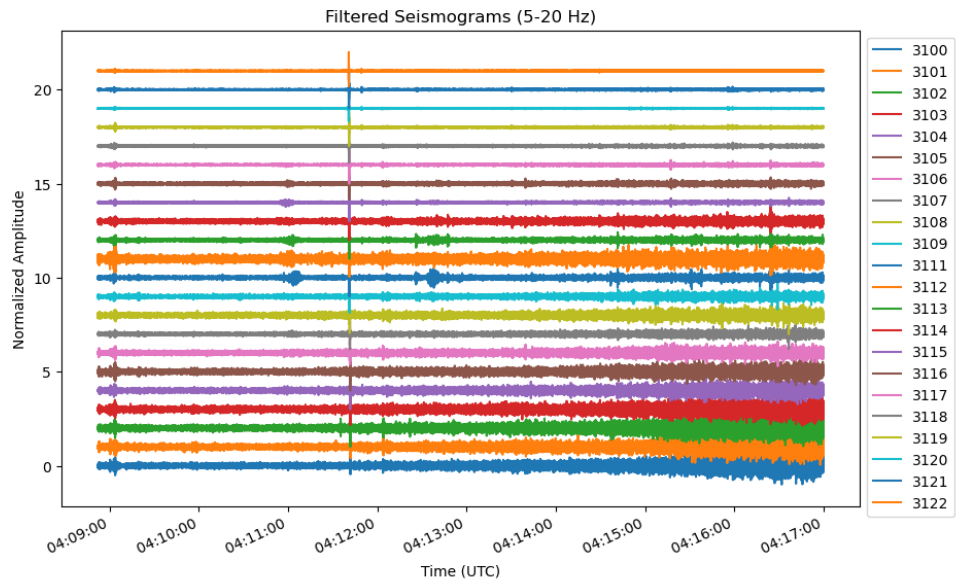
ESR02 – Sibashish Dash
GFZ, Potsdam, Germany

ESR03 – Aiswarya Padmadas
BGU, Beer-Sheba, Israel

Since the last report, we have conducted maintenance work in Eshtemoa, Israel. We also plan to switch the location from Eshtemoa to An'im, as Eshtemoa has stabilized due to cohesive deposits.

I have also been busy with coursework and proposal submissions. Additionally, I have been working on the analysis of data from ADLP. There seem to be some interesting trends in the data, showing a correlation with bedload data, but further analysis will be needed for confirmation. I will be focusing on that.

Alongside this, I am also planning site work in Austria and preparing for my presentation at EGU.



<u>ESR04 – Guilherme de Melo</u>

GEOMAR Helmholtz Centre of Ocean Research, Kiel, Germany

Since the last report sent in July of 2024, Guilherme has worked in the publication of the manuscript about a new moment magnitude and rupture length relationship. The manuscript was accepted and published on the Geophysical Research Letter journal (10.1029/2024GL112891). Guilherme worked on another research between January and March of 2025, about the investigation of the seismogenic zone behavior at the St. Paul transform system (SPTS). Surface waveforms of 37 earthquakes with moment magnitude >5.3 occurred at SPTS since 2004 and were modeled to identify the focal depths. Guilherme identified that the earthquakes occurred with a maximum depth of 18 km located more in the central area of the transform fault, with shallower earthquakes toward the ridge-transform intersection. These results combined with a 3D half-space cooling model indicated that the canter of the transform should be cooler, discording the warm center expected by the geodynamic model of previous papers. Guilherme wrote the manuscript of SPTS and it should be submitted to Solid Earth journal in the second week of April. Currently, Guilherme is working on a new topic: the Mw 6.5 earthquake that occurred at the Jan Mayen transform fault on 10/03/2025. The strong seismic energy released by the mainshock generated several environmental effects including ground motion, landslide, and infrasound signals at local Jan Mayen Island (JMI). Guilherme is investigating using different techniques, including INSAR, local GNSS sensors, satellite images, and regional seismic and infrasound stations located in Greenland, Iceland, Svalbard, Bear Island, Faroe Island, and Norway. The first results show that the earthquakes occurred deep and just 5.3 km away from the north side of the JMI, with the ground at the island moving ~2 cm toward the northeast and a large masse of landslide thrown into the sea by the local stratovolcano Mt. Beerenberg. Guilherme will continue his Jan Mayer's project with the co-supervision of Prof. Reginald Hermanns at the Geological Survey of Norway, during the visit to Trondheim in April/May of 2025.

ESR05 – Sophia Laporte
Umeå University, Umeå, Sweden

In January and February, I continued to run flume tests in Grenoble as part of my secondment in France. Using a smaller flow section and sand/gravel roughness elements, we succeeded in pressurizing the flow (no air bubbles visible passed a given discharge value). When increasing the discharge, we can observe pressure differences from variations in the water level in the upstream vertical pipe. Seismic data collected on top of the water-filled flume shows a scaling relationship between water discharge and seismic energy. Pump power is observed in a frequency band which doesn't interfere with hydraulic signals. We also installed a doppler ultrasonic velocimeter to obtain water velocity profiles. Now we are investigating the seismic signal properties and trying to differentiate between pressurized and open flow conditions.

In March I moved back to Sweden and have been collecting field data in Abisko and Sävaran. This winter has been very warm so we were not able to collect any under-ice water velocity data in Abisko (ice was too thin to walk on). Keith from WSL Switzerland is now here for her secondment and we just finished setting up a DAS experiment on river-ice in Sävarån, to monitor ice break-up. It's been a really intense and exciting time!

ESR06 – Selina Wetter
IPGP, Paris, France

At the beginning of this year, I was in the final stages of calculating event locations for my glacial earthquake catalogue. As part of this, we decided to exclude events that were not reasonably close to Greenland's coastline to ensure a more accurate analysis. With these refinements, the catalogue now spans 12 years (2013–2024) and includes exactly 6263 events, all recorded by at least three stations. With this foundation, we are now entering an exciting phase as we analyse the spatio-temporal variations in calving-related seismicity. To better understand these patterns, I have divided Greenland into nine regions, separating the largest calving glaciers where most newly detected events are clustering. A key aspect of this analysis is the shifting distribution of events over time. Olsen and Nettles (2017) observed a transition from east to west before 2013. My dataset, which starts in 2013, confirms a higher concentration of events on the West Coast. However, I identified a shift in 2017/2018, with more events occurring in the East, followed by another increase in West Coast activity in 2020. Seasonal variability is another striking pattern. Unsurprisingly, we observe about four times more events in summer than in winter, with July being the peak month for activity. Looking at long-term trends, the expected increase in event numbers over time is not yet evident. This is likely due to variations in station coverage. In 2023 and 2024, we had only half the number of stations available compared to 2018, directly impacting event detection. The next critical step is calculating surface wave magnitudes to gain further insight into these events. This is my current focus, and I look forward to uncovering more details soon.

ESR07 – Juliane Starke
ISTerre, Grenoble, France

Juliane recently returned from her one-month secondment in Sevilla, where she tested the finite element model she is currently using to calculate the resonance frequency of an unstable cliff. Her field data suggests that variations in resonance frequency result not only from changes in sonic velocities in the surface layer due to thermally induced stresses ('surface effect') but also from the opening and closing of the rear crack of the cliff ('fracture effect'). She is now investigating the extent of this influence.

ESR08 – Samidha V. Revankar
IGE, Grenoble, France

ESR09 – Amandine Missana
NTNU, Trondheim, Norway

Since last autumn I have been working simultaneously on the mapping and the seismology of my study area. The mapping focuses on Njárgavárri and the region around (area of ca. 40 by 25 km). The goal is to map the slope at Njárgavárri in detail to show the complexity of the slope activity, and then to map in a larger scale the region around to have a comparative overview. In fine, I hope to find factors which would allow to predict whether a slope has a high probability to fail as a rock avalanche and therefore is a high risk for the population around, or if it will slowly creep and flow down the slope. In the seismology part, I have been checking and reclassifying events detected by STA/LTA and automatically classified (done by Agnes Helmstetter, ISTerre, France). I have finished the catalogues from 2023 and I am now working on the ones for 2024. Njárgavárri seems promising as cracking and creeping activity is very visible with high frequency slope quakes. However, Indre Nordneset shows a few nice events but most of what I have seen so far was noise. I am also planning my last fieldwork, which will take place in June, to recover the broadbands and to go around the region for mapping the slopes.

ESR10 – Gwendal Léger
University of Seville, Seville, Spain

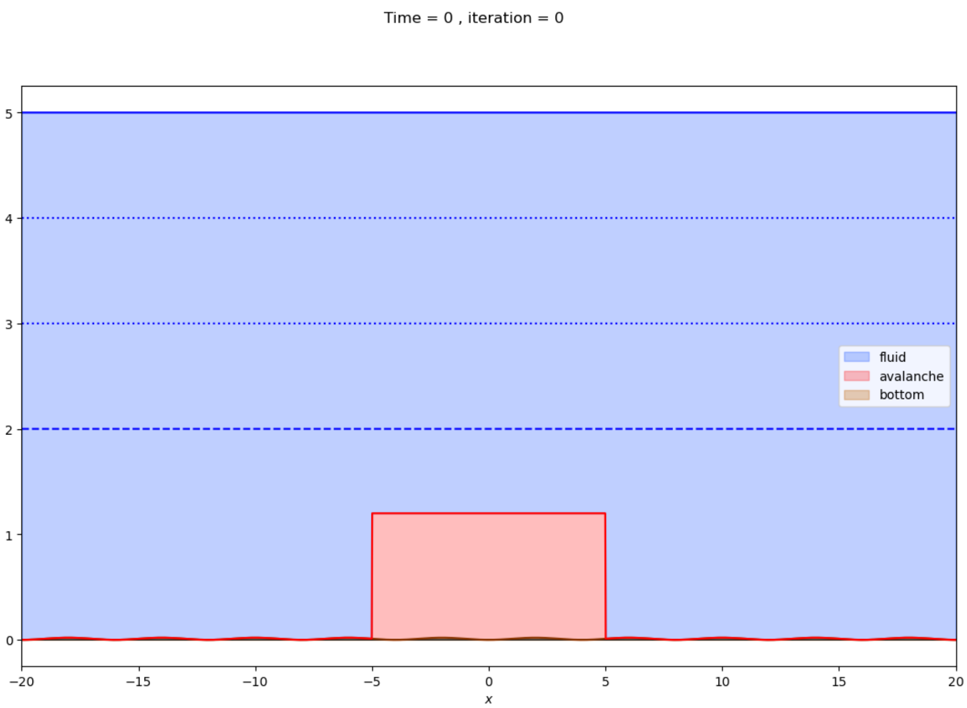
Since the winter holidays, we realised there were a few problems with our model, notably that it didn't respect some criteria such as the conservation of mass or of energy, which we always want to have to have at least a physical model!

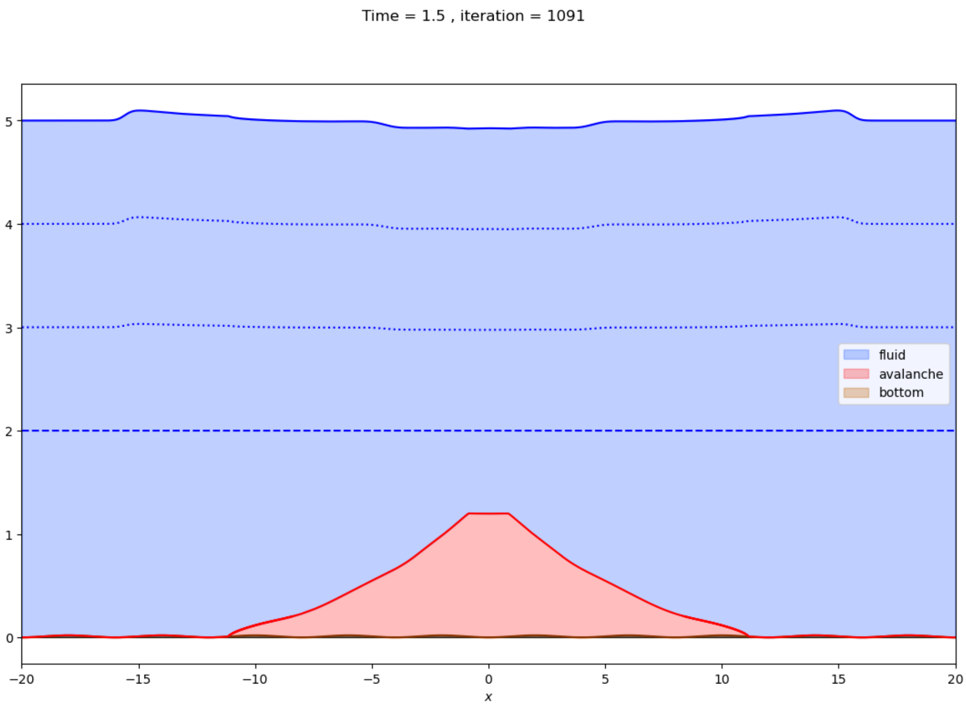
So I spent a month redoing all the computation to derive the model with care and I have been to the IPGP to work with Anne in January and in March, and we managed to advance a lot and solve a lot (if not all) our problems.

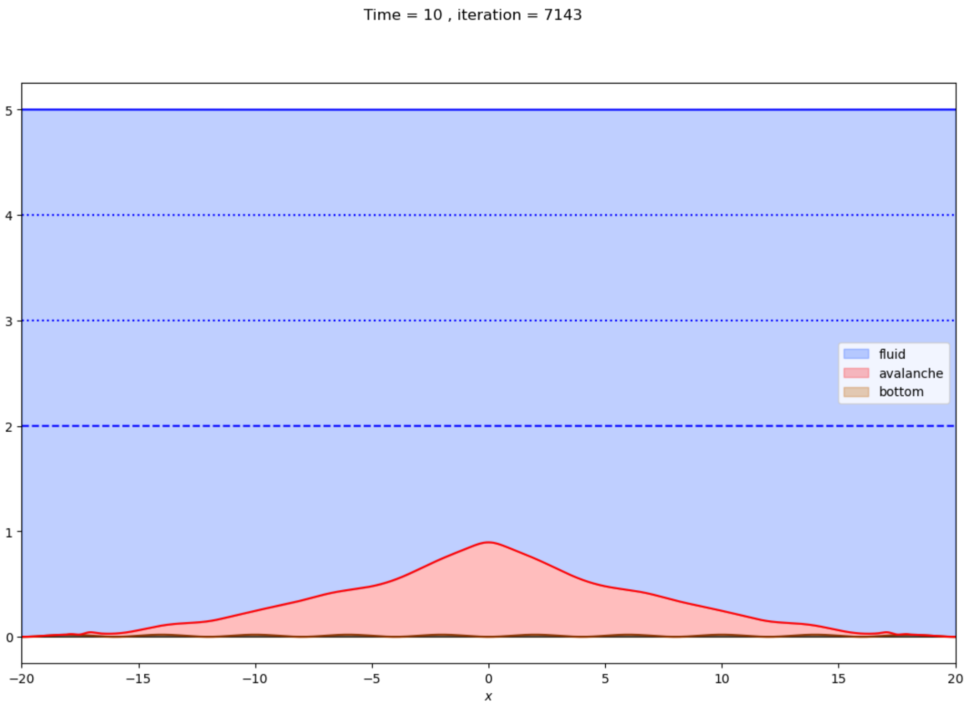
I corrected the model and am currently correcting the code implementing it. Once this (normally) minor work is done, I will begin simulating well-known as well as custom test cases and we hope to be able to start writing an article and submit it.

I will not be attending the workshop in Sweden as it is way too far from Seville by train (between three and four days only to get there!) and I feel it would be ridiculous to go by plane as by doing so I would emit, according to my calculation, at least an equivalent of one metric ton of CO_2, but I will use the time saved this way to progress my research and try to make up for the setbacks encountered in this beginning of 2025.

On the figure we can see snapshots from a simulation, with in blue the fluid, in red the avalanche and in brown the bottom. We can see the avalanche stopping and forming a pile due to the friction, which is what I wanted to model here.

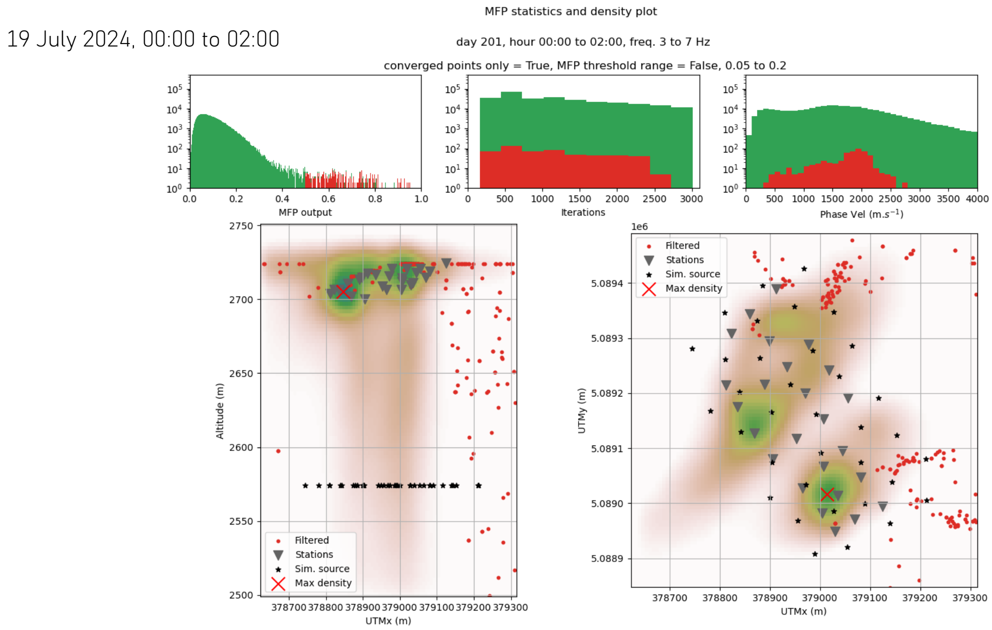






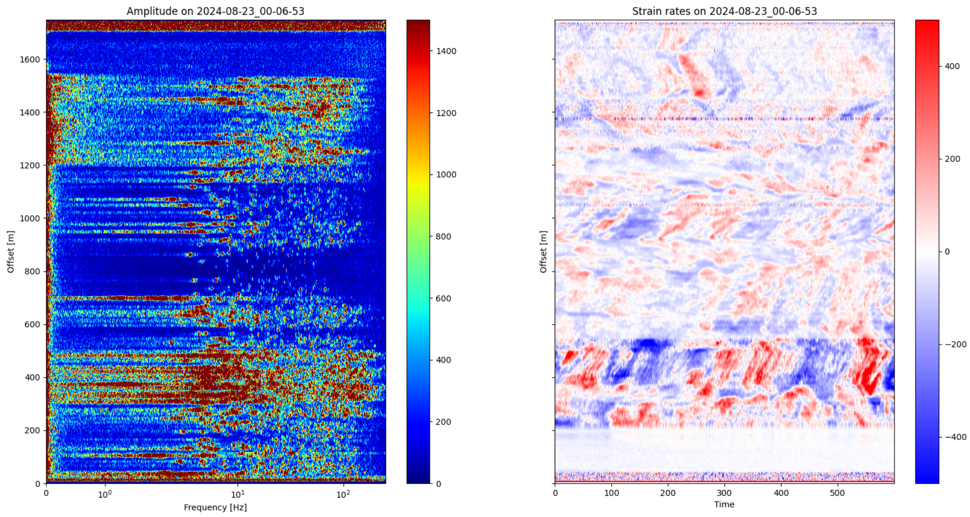
<u>ESR11 – Eva Wolf</u>
UNIL, Lausanne, Switzerland

I've spent the last three months at IPGP in Paris to work with Eleonore Stutzmann and Jean-Philippe Metaxian on processing my data using matched field processing (mfp) and beamforming. In the beginning I had to overcome difficulties in the parallel processing of seismic data with matched field processing approach. After I finally got the method running on a larger machine, we started our complementary method for the comparison of mfp results doing beamforming.



Matched field processing output for Otemma glacier (following Nanni 2021).

Our third step was the testing of DAS data for the matched field processing. It did not yet deliver good results because of the poor detection of frequency bands below 10Hz. Nevertheless, we were able to detect events on the glacier surface between 10 and 100 Hz and track and locate events that might correspond to rock fall and smaller glacial events such as crevasse openings.



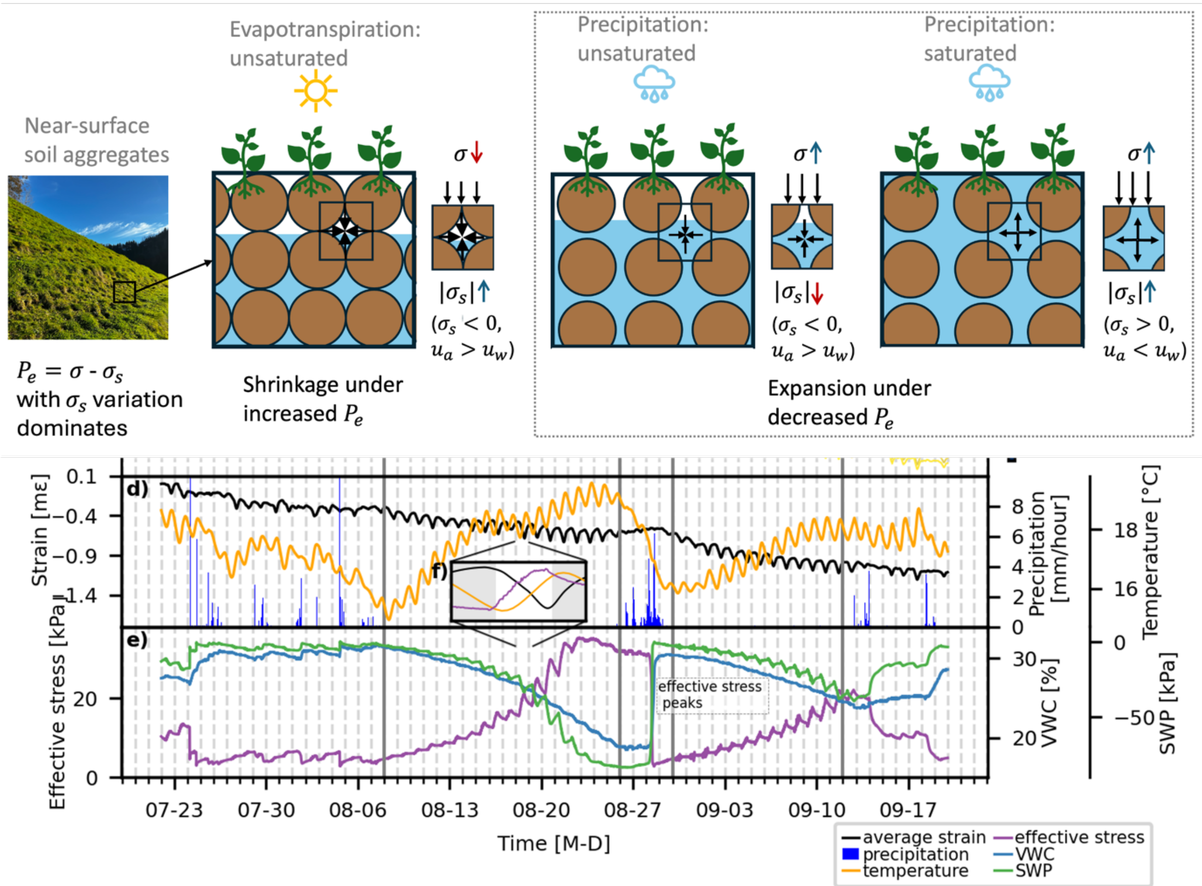
Das spectrogram und strain rate plot, main frequency content in range 10 to 100

The next steps are to identify DAS channels with particularly high quality that might be suitable to detect events in the 1 to 10 Hz frequency range. At the same time, I am going to finalize the results from the last months.

ESR12 – Jiahui Kang
WSL, Zurich, Switzerland

Over the past few months, we've monitored how soil responds to moisture changes on a hillside near Wasen in the Napf-Emmental region using DAS. Between July and September 2023, we tracked subtle changes in soil volume (strain) alongside weather conditions like rainfall and temperature.

We observed something interesting: as the soil dried out, tiny water bridges between soil particles created tension that pulled particles together, causing the soil to shrink (decreasing strain). Conversely, when it rained, water reduced this tension, allowing soil particles to move apart, leading the soil to swell (increasing strain). This cycle of shrinking and swelling is similar to the daily soil "breathing" —contracting during dry daytime conditions and expanding again overnight. A schematic figure to illustrate these processes is shown below along with the measured values.



Guest – Nicolas De Pinho Dias
IPGP, Paris, France

I have been working in collaboration with experimentalists to estimate the forces exerted on the glacier during an iceberg capsize. Two sources are identified: the iceberg/glacier contact force pushing the glacier upstream and the water pressure force which pulls the glacier downstream. In addition, in the case of a floating tongue, a depression is created under the glacier and bends it.

Comparing experiments and simulations show consistent results and this collaboration is so far mutually beneficial and greatly helps to understand the iceberg calving effects on the glacier.

I built a finite element glacier deformation model using the code Elmer. As a first step, we try to reproduce an iceberg capsize event a glacier deformation documented by Murray et al. 2015. The current model is only a static and elastic and but shows glacier deformations of the same order of magnitude as the field measurements (1 to 10 cm), see figure.

Note that a lot of uncertainties remain about the boundary conditions, friction coefficient of contact force tangent to the glacier front.