EnvSeis Newsletter

Fall/Winter 2024 – Christmas Edition*

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Overview

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*Santa's reindeer have gone on a holiday adventure and are hiding in this special Christmas edition! Can you spot all **9** of them and help guide them back to Santa's sleigh?

Follow-up on the individual ESRs projects

ESR01 – Stefania Ursica

GFZ, Potsdam, Germany

Update on the recent progress of my research involving the La Reunion study site. This brief report outlines the key advancements in my understanding and analysis of seismic events at these location and worldwide major exotic events.

Fieldwork and Deep Learning Analyses Over the past months, I have actively prepared and organized the deployment of six seismic stations across the Piton des Neiges volcano region on La Réunion Island. This involved securing permits from the National Park and from the ONF to cover the three major cirques—Salazie, Mafate, and Cilaos—ensuring comprehensive seismic coverage in conjunction with the existing network. Close collaboration was essential; I coordinated with local partners from the Université de La Réunion and the Observatoire des Sciences de l'Univers (OSU-Réunion) to align logistical and operational aspects. The preparation phase included shipping and adapting the equipment to withstand the island's challenging climatic and topographic conditions, followed by site installations. In November, Niels and I, we executed a two-week field campaign, deploying the stations and acquainting ourselves with the region's steep and dissected landscapes and no reindeer were spotted in the cirques. This network will collect data for at least one year, during which local collaborators will assist with its maintenance. Additionally, I advanced my analyses using deep learning techniques applied to exotic seismic datasets. Several promising results and methodological advancements bring us closer to a functional product.

ESR02 – Sibashish Dash

GFZ, Potsdam, Germany

I conducted fieldwork in Brinzauls, Switzerland, to retrieve a dense array of 30 geophones deployed for three months to study the dynamics of a slow-creeping landslide. With the local authorities evacuating the village again in anticipation of another rockslide from the steep terrain above, we redeployed the geophone array alongside two broadband stations to continue monitoring this critical hazard over the winter. I recently presented my research findings in a talk at the DGGM in Leipzig and in the GFZ-Grenoble workshop.

ESR03 – Aiswarya Padmadas

BGU, Beer-Sheba, Isreal

Since the last newsletter, I moved back to Israel after my secondment, took a 10-day break, traveled to Japan for three weeks of site work, and returned. The definition of jetlag is much clearer to me now!

The experience in Japan was indescribable. We visited two potential sites: one in the Japanese Alps region (**Ashi-Arai Dani**) and another in the Tateyama region (**Jōganji River**). Ashi-Arai Dani is located next to a very active volcano, **Yake-Dake**, while Jōganji is situated in an extremely fragile area. Both sites are seismic "virgins" but show great potential for future research.

During this trip, I had the privilege of learning from **Prof. Ohmi**, a seismologist specializing in earthquake hazard management, and we're optimistic about future collaborations. I also had the opportunity to give two talks about my work and introduce our network to professors from Kyoto University and Shinshu University.

Joganji River

Ashi Arai Dani

A special highlight of this trip was working with **Prof. Shusuke Miyata** from Kyoto University (profile here). He guided us throughout the visit, explaining the geology of the sites, potential noise sources, and even hiking with me upstream and downstream to identify potential deployment locations. I want to extend my heartfelt thanks to Prof. Miyata for making this visit so memorable.

Apart from the site visits, I've been analyzing data from my 2021 expedition in the US, though there's nothing conclusive to report at this stage.

Looking ahead, I'm excited to take some time to relax in Israel, with a bit of local site work on the horizon (hopefully). My immediate focus will be on submitting an abstract for **EGU 2025** and finalizing a university proposal, due January 15th.

Here's to a fantastic new year ahead:

Look how **PICTURESQUE** Japan is in Autumn (Don't mind the crazy lady on you right :D)

ESR04 – Guilherme de Melo

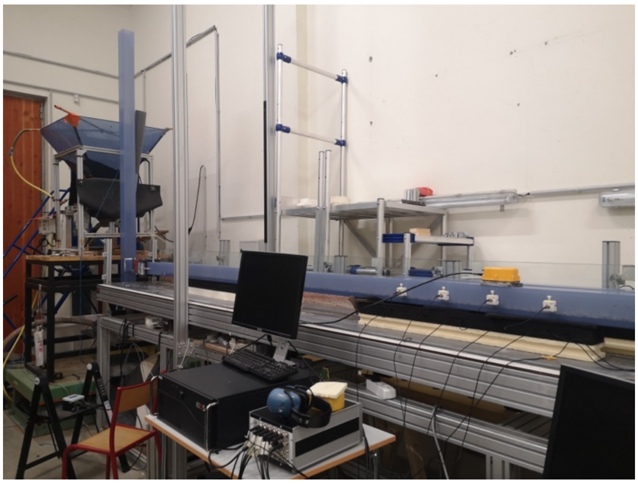
GEOMAR Helmholtz Centre of Ocean Research, Kiel, Germany

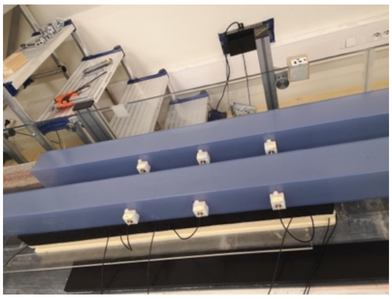
Since last report, Guilherme have worked in publication process of the first article about the hydroacoustic T-waves to study the rupture of seafloor earthquakes. The manuscript has been accepted to Geophysical Research Letter journal in Nov. 25, and it is production status that is going be online in a few days. Currently, Guilherme works in research of the St. Paul transform fault local seismicity, with data analysis completed, and manuscript writing. The technique used to locate the seafloor earthquakes with a single station have a powerful utility to detect other environmental quakes like submarine volcano explosions. We plan to submit the manuscript by the end of February to Nature Communications or Geology journal.

ESR05 – Sophia Laporte

Umeå University, Umeå, Sweden

In September, I moved to Grenoble for my 6-month « seismic immersion » secondment, working with my co-supervisor Florent Gimbert. I'm currently carrying out a flume experiment to investigate seismic signals from pressurized flows under river ice. With great help from Hervé Bellot and Alexis Buffet at INRAE, we built a flume from a 7m long transparent 10cmx10cm PVC tube. This tube represents an ice-covered river or subglacial channel. The idea is to compare the seismic signals from free-surface flow (when the water doesn't touch the top of the tube) and pressurized flow (when the tube is pressurized) for a given discharge. The varying parameters are roughness, water discharge and flume section. To modify the section, we can add or remove 6m-long plastic 1cm-thick layers into the tube. Roughness elements are fixed with glue on the top layer. Discharge is controlled by a computer connected to the pump and flowmeter. The slope is < 0.5% and considered a non-varying parameter for the moment.





We started by installing 6 Acoustic Emission (AE) transducers (KRN point-contact sensors) into white teflon mount holders and fixed them on the flume wall using double sided tape. I carried out several tests to identify background noise and water turbulence signals. One of these tests was comparing 3 sensors located on the flume with water, with 3 other sensors placed on an empty piece of tube.

I compared three flow conditions (Q=0, Q = 1.6 l/s and Qmax = 4 l/s, each steady state lasting 2-3 minutes), observed corresponding signal amplitudes and plotted their power spectral densities in the frequency domain. We observed significantly higher amplitudes on the signals corresponding to the water-filled flume for each flow condition. However, it was difficult to rigorously compare sensors between each other as they showed varying responses for similar setup conditions. This could possibly be due to differences in the strength of contact between the metal point and the low-rigidity material of the PVC tube, which is difficult to adjust manually. It could also be explained by the presence of some damage on the metal point interface for some sensors. Furthermore, the AE sensors were very sensitive to manipulation, showing response differences after each change of setup, making it hard to rigorously compare sensors between each other and to compare results from different setups.

Due to these difficulties, and when it was possible, we installed two three-component 4.5 Hz geophone (one on the water flume, one on empty tube) to test whether we can observe signals from water turbulence using this sensor on the tube. First tests confirmed that we can identify water-induced signals coming from the tube, and I'm now continuing to identify background noises (e.g. pump) and investigating the changes in signal between free-surface flow and pressurized flow in the water flume. Several more tests focusing on these geophone signals are on the way.

I've also been working on a review essay that I need to submit to my home university in Umeå before January, and on a paper related to river ice-cracking, which Stefania and I are planning to publish as co-main authors.

Overall, my secondment is helping me to become more comfortable with seismic data processing, I'm learning a lot by working on this lab experiment. I'm very grateful to my colleagues here who are very welcoming and eager to advance on this project. No ice, snow or reindeers this winter here in Grenoble – but at least we built an ice-covered river flume to make sure I don't forget my field study sites !!

ESR06 – Selina Wetter

IPGP, Paris, France

I have successfully completed the manual review of detected events from 2013 to 2023 and have started the localization process. Using a non-linear location method (NonLinLoc, Lomax et al., 2000), I can locate all events recorded by three or more stations. Events detected by only one or two stations require a different approach, which I have not addressed yet.

Because surface waves are primarily used, it is often challenging to identify clear arrival times, and many events are limited to recordings from only three stations. This makes precise localization challenging. However, since my objective is to associate these events with calving glaciers rather than to determine exact locations, the method is sufficient for my purposes.

So far, I have observed that the number of events has increased over time, but the data is significantly influenced by the availability of recording stations. Much like tracking reindeer across vast landscapes, identifying consistent patterns in event localization requires careful consideration of gaps and overlaps in the data. For a more accurate interpretation, I plan to analyze the subset of events recorded by specific station configurations. This will be the focus of my next steps.

ESR07 – Juliane Starke

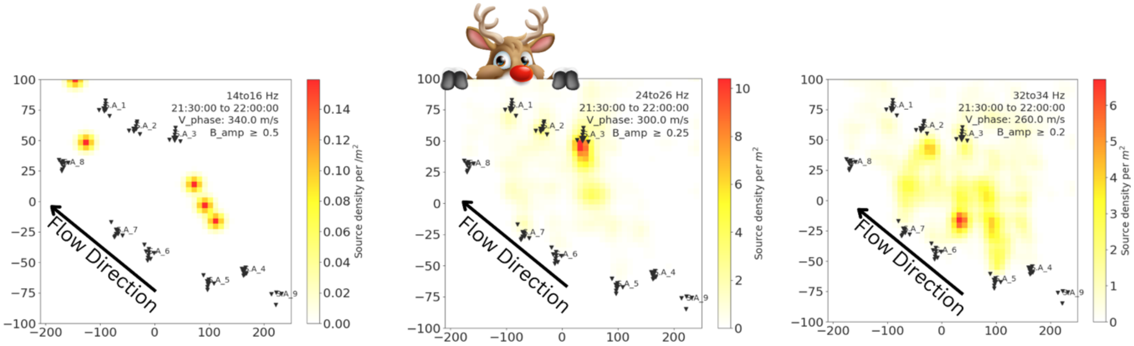
ISTerre, Grenoble, France

Juliane is analyzing data collected with the acoustic monitoring system. During the recording, a heavy rainfall occurred—though no snowflakes joined the mix, the conditions were exactly what she aimed to capture. However, the results raised questions about the system's performance, particularly regarding sensor coupling and the recording system's thermal sensitivity. Much like reindeer navigating through a winter storm, extensive laboratory testing has already been conducted to address these challenges, with further experiments planned for the future.

ESR08 – Samidha V. Revankar

IGE, Grenoble, France

Continuing my work with the 2019 Severaisse data, I am now looking at Beamforming outputs over different ranges of frequencies. These include the low frequency turbulence induced seismic signals and high frequency bedload induced signals. The beamformer outputs reveal interesting correlation between source location densities and signal frequencies as below:



Density maps for seismic sources at different frequencies reveal the relation between localisation and processes involved. Low frequency sources being less mobile (like boulders) are likely to have less spread in energy. And high frequency sources (like grain interactions) being highly mobile are likely to have more spread in energy.

I had the opportunity to present this work as a poster at the 2024 American Geophysical Union (AGU) conference in Washington, DC. It was a fantastic experience to share my findings and connect with others working in similar fields.

ESR09 – Amandine Missana

NTNU, Trondheim, Norway

This semester I have eventually finished all the courses that I had to take in the Norwegian PhD system. This has allowed me to finally start focusing only on my thesis project. I am now working on the mapping for my first paper, which will focus on the geomorphology of one of my sites. In parallel, I am working on the seismology, still receiving a lot of help from my co-supervisor, Eric Larose, and co-worker, Agnes Helmstetter, from ISTerre, France. Now that I have more time for it, seismology is starting to become more familiar to me. Getting to know a new scientific field makes my PhD challenging but really interesting!

ESR10 – Gwendal Léger

University of Seville, Seville, Spain

Since the last newsletter, I advanced on the non hydrostatic model.

I made several comparisons between hydrostatic and non hydrostatic models while changing the shape of the fixed interface, with the objective of trying to see if the non hydrostatic model is less dependant on the shape of this interface. The figures present such a test, with two shapes of interface (dashed line) that differ: a sloped interface (parallel to the bottom) and an "igloo" shaped interface. Figure 1 present the simulations 0.5 seconds after the initialisation. All results present very similar results, be it the shape of the avalanche-fluid interface (red continuous line) or of the water surface (blue continuous line). The number of iterations required to arrive at the time of the figure is also the same for each subfigure, here all simulations took 86 steps to arrive at time 0.5. On Fig.2 however, while the avalanche and the free surface look the same, the number of iterations is different between some simulations: the non hydrostatics model both took 8620 steps to arrive at time 50 as well as the "slope" hydrostatic simulation but the "igloo" hydrostatic simulation needed 8606 iterations. This illustrates the reduced dependency to the shape of the fixed interface of the non hydrostatic model compared to the hydrostatic model.

Otherwise I am preparing to go to Paris in January to work with Anne, Gladys and Enrique. This will be a good opportunity to (re)aclimate me in preparation for the reindeer-freezing cold of Abisko in April!

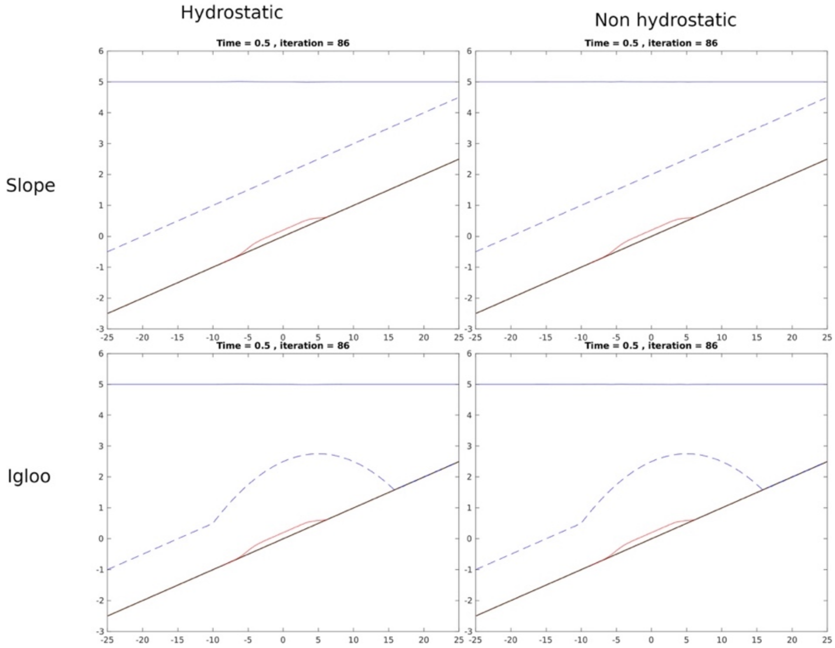


Figure 1

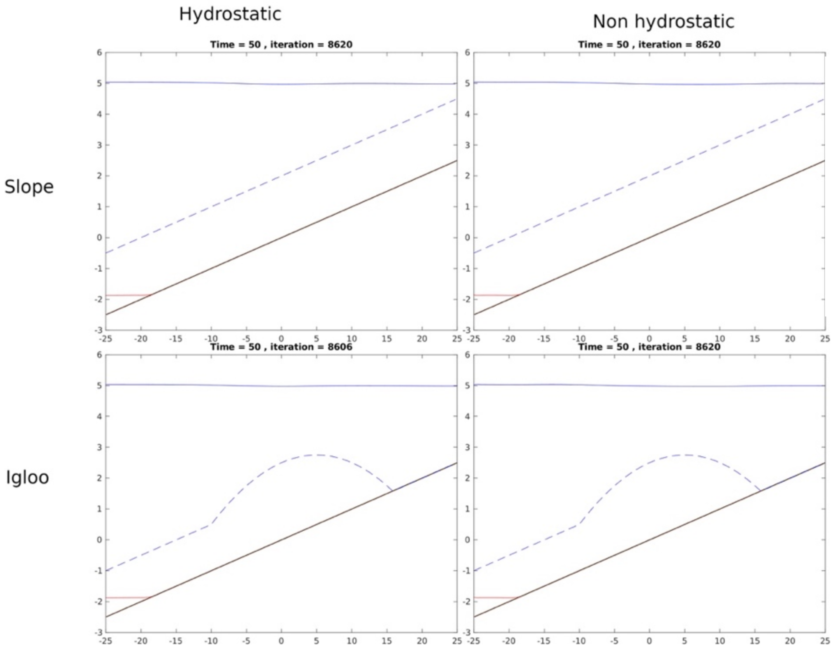
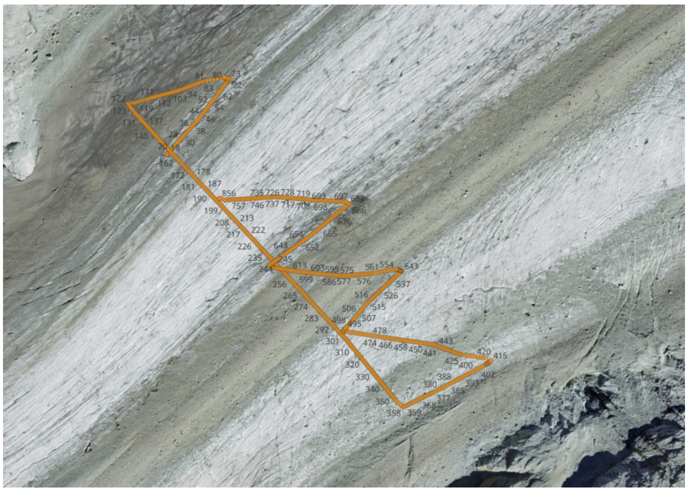


Figure 2

ESR11 – Eva Wolf
UNIL, Lausanne, Switzerland

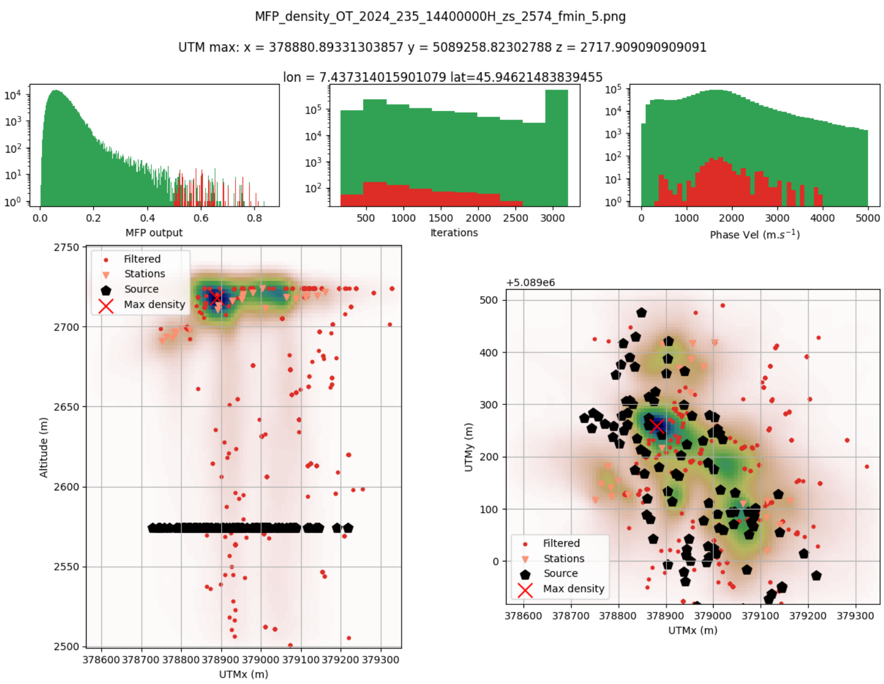
From Reindeer to Mole The last three months marked a stark shift—from carrying sledges across the ice of Otemma Glacier to delving into my fieldwork data, illuminated only by the glow of my screen. I started to analyse my data from this years fieldwork on Otemma Glacier.

My first task was to localize the fiber optic cable which we installed across the glacier surface. Therefore, we had done a tap test in the summer. Along the cable, we hit a metal plate several times using a hammer and recorded the timing and location. These hits can now be found in our seismic records and tell us where exactly which channel of the fiber optic cable is located. In October, I was looking deeper into this data, locating each hit and writing an algorithm to automatically detect and connect the channels.



Estimated channel locations of the fiber optic cable on Otemma Glacier, Valais, Switzerland.

After that, I went back into my work to locate the subglacial channel on Otemma glacier using the method of Matched field processing. We are now comparing the results of a rectangular array which we got in June with the ones from August, where we had three arrays (7 nodes) of triangular shape, arranged in a triangular setting. The next step is doing same using the seismic data from the fiber optic cable, which gives us the opportunity to have 875 input records instead of just 30. I am varying frequency bands and starting points to find a stable result.



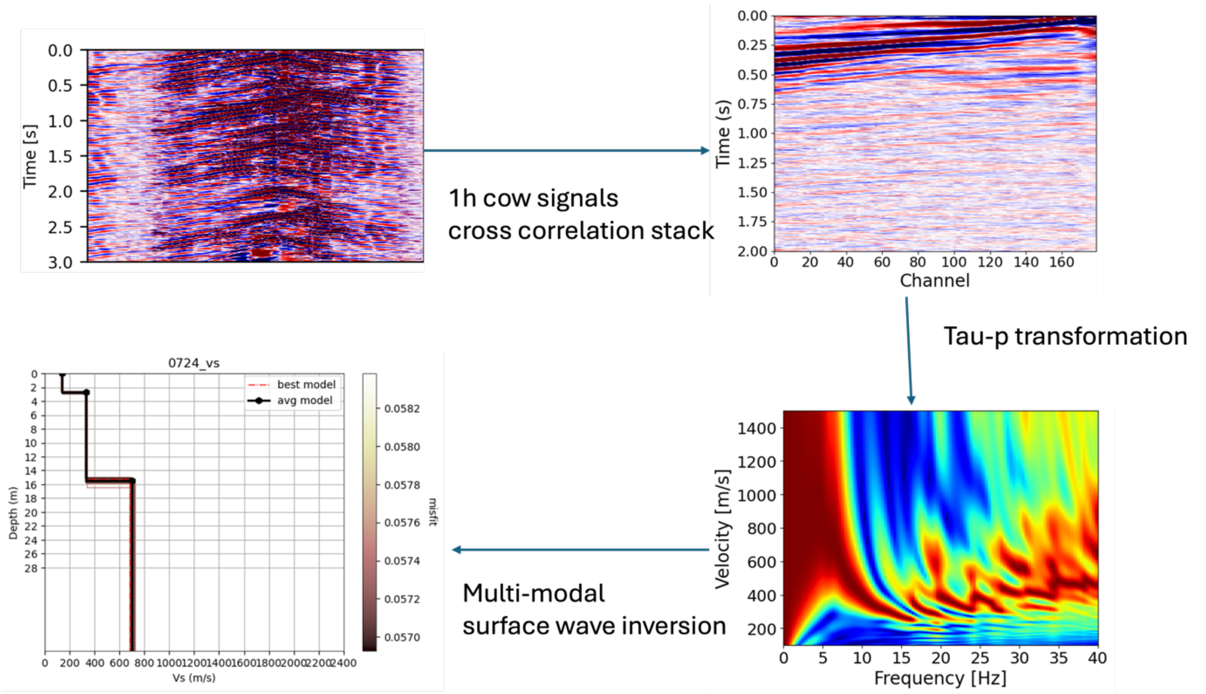
Work in Progress: Localisation of the subgalcial channel(s) using Matched Field Processing (following Nanni et al., 2021, Observing the subglacial hydrology network and its dynamics with a dense seismic array).

ESR12 – Jiahui Kang

WSL, Zurich, Switzerland

Over the past few months, I have been analyzing the DAS data record in the Napf-Emmental, a pre-alpine region of Switzerland. In the context of a changing climate, the frequency and intensity of precipitation events are predicted to increase, increasing the likelihood of landslides. In particular, shallow landslides are often triggered when rainfall or snowmelt infiltrates the soil, causing a significant increase in water saturation and groundwater levels.

We conducted surface wave analysis techniques to gain an understanding of soil layer thickness and daily variation of shear wave velocity as a proxy for soil moisture. For surface wave inversion, although we don't have reindeer at our site, Emmental cows are also a good source of signals! During summer time, they always get enough Vitamin D. And we were able to get a clear subsurface structure! I also went to the Photonic Seismology conference in Vancouver in October. It was a really nice conference and I learned a lot about different applications of DAS and enjoyed the views of the Canadian harbor.



Guest – Nicolas De Pinho Dias

IPGP, Paris, France

Since the last newsletter, I have been working on my paper which has been improved a lot. I believe it is ready to be sent.

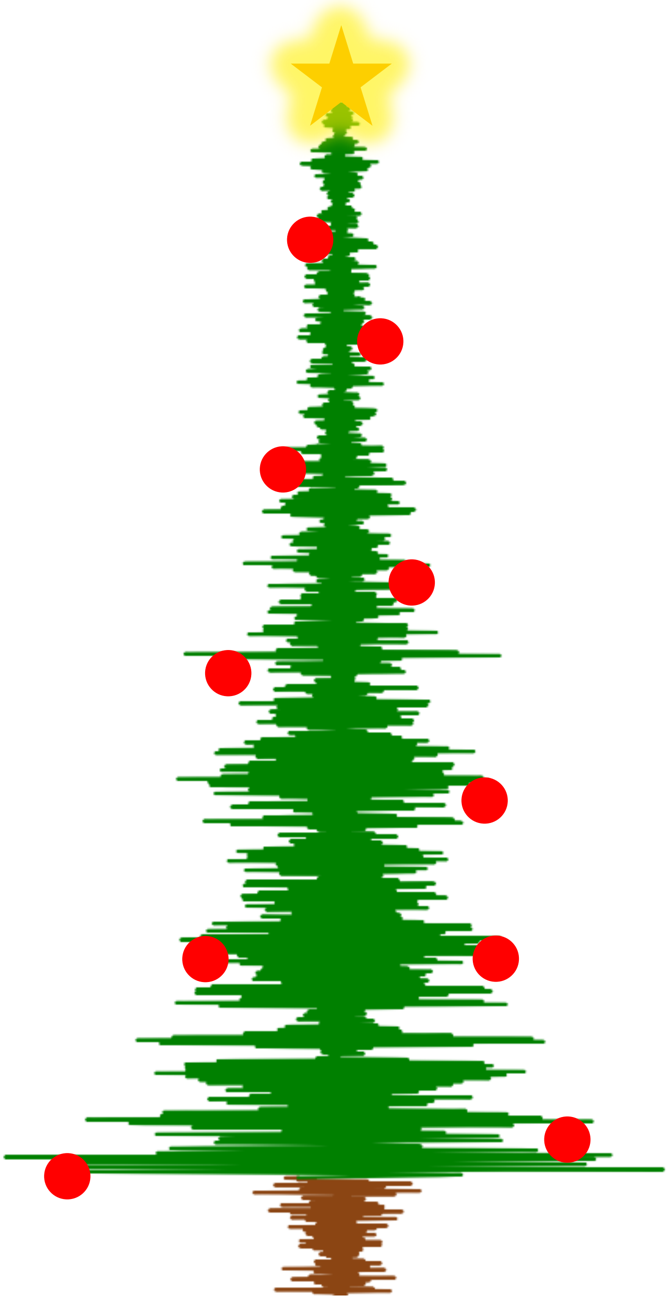
We have improved our force model which was limited to lab-scale cases but now works at any scale which is necessary for field-scale applications.

I attended a conference “les journées de l’hydrodynamique” in Ecole Centrale de Nantes where I presented the numerical methods used in my simulations. To this occasion, a paper was published in the conference proceedings and accessible via the following link if a french reader is interested (https://actesjh.ec-nantes.fr/images/19JH/Annexe/19jh-s12.htm).

I am now starting a collaboration with experimentalists to work on the forces acting during iceberg capsizes.

Somebody told me there will be a reindeer-riding activity at the next EnvSeis workshop so I am very excited about it. Looking forward to see everyone :)

Merry Christmas!



Earthquake seismogram meets holiday spirit! M6.2 earthquake on 2024-03-14 21:10:24 UTC, located at 29.797°N, 42.661°W (northern Mid-Atlantic Ridge), recorded at IVI station in Greenland.