



Snapshot from the ice-cave in Larsbreen, March 2018

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Interests: Arctic Geophysics, Classical and Ice Mechanics, Nonlinear and Fluid Dynamics

Thesis: Interaction of surface waves with sea-ice in marginal ice zone, investigation of floe-floe interactions

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Svalbard

Of all the places in the world, how did a former student of Theoretical Physics end up doing Arctic Geophysics in another master's on Svalbard?

The genesis of my adventures, the best tales alike, lies in the mystery of serendipity; a day of autumn 2015, between a exercise series of Cosmology and an article on Quantum Field Theory, I discovered online the possibility to charter a small sailing boat in the making, a floating home that two Swiss explorers where building for their common years to come. The deal was reflecting the exceptional conditions of this experience: in exchange for supporting their renovation, I could come and share their life for 2 weeks in their new home, the Svalbardian seas. This is how I landed in Longyearbyen in the summer 2016, embarking on a trip mostly led by the winds and spontaneous inputs of the captain.

Ny-Ålesund being not only the northernmost scientific station on Svalbard but also one of the northernmost inhabited places in the world, it still runs a bar hosted by the scientists-selves 2 days in the week: on Thursdays and Saturdays. We anchored the peer of this remote location on a Thursday exactly, and stumbled across a French speaker a few minutes after laying foot in the settlement; we were being greeted by the maintenance engineer responsible for the French-German research station in Ny-Ålesund. A few exchanges later, we were being toured into the aforementioned facility and I suddenly discovered, amidst the explanations, the laboratories, the work and lifestyle of those scientists, a direction of Physics so very far from what Geneva ever had to offer: Arctic Geophysics.



Onboard of the sailing boat Knut with 3 friends of mine, the Captain Benjamin and his second Melina, July 2016

I received this discovery like a new fuel for dreams: coming back here to study on Svalbard. This ideal was conjugating the opportunity of performing fascinating sciences with the anchorage of my activities in a meaningful milieu, at the forefront of many spectacular and rapidly changing phenomena. A night in the bar, speaking with further scientists, about their topics of work but also about their choices and aspirations, made me realize that this idea might just have been this missing piece in the puzzle of my future.

Back in Switzerland, I immediately started my investigation for a master's degree in Applied Physics and sent applications to the universities of Helsinki (*Finland*), Copenhagen (*Denmark*) and Trondheim (*Norway*). When I got accepted to all three of them, I had the luxury to pick among prestigious places working with and in the Arctic. My choice was finally made in favor of NTNU, knowing that the direct ongoing collaborations between the institution and UNIS could allow for potential projects to participate in.

Arriving in Trondheim in August 2017 already felt like a step towards the North, an intermediary stop before the Arctic, and I soon stood in our student's advisor's office with a determined master's project in mind: get inspired by the Air-Ice-Sea Interactions II-course at UNIS and work on ocean boundary layers, sea-ice growth and models. Little did I know, the Department of Physics at NTNU didn't have any direct collaborations with the groups of oceanography there and I was instead offered to design my degree on my own, picking the courses I personally thought valuable to my project.

Since UNIS naturally offered the course Air-Ice-Sea Interactions I (*AGF-211*) as well, I selected it as a preparation for its follow-up, together with the course on Snow and Ice Processes (*AGF-212*). And so began my second trip to Svalbard, this time as a student...



Discovering Svalbard through this lens certainly played a large emotional role in my choices, July 2016

Student life on Svalbard

With its peculiar human history, how does Svalbard fit into our contemporary understanding of an inhabitable place? When everything urges us to take action to limit the anthropogenic impact on our environment and its climate, how can we take advantage of a place like this archipelago at best?

Svalbard, for as long as human records go, certainly raises more questions than it brings answers. As fascinating as its nature is, its geopolitical situation has given rise to a social climate in which a former coal-mine has now become a typical Arctic town: despite its total population capping at 2500 inhabitants, the town of Longyearbyen strikes as an outpost of Norway in the high Arctic, with all the features also observable in Juneau (*USA*), Murmansk (*Russia*) or Nuuk (*Greenland*): a vast cultural offer gravitating around a big cultural centre, galleries, festivals, a large sports facility, a supermarket with a greater variety of products than in most places on the mainland, a parish, and certainly the most beautiful accomplishment among all: a university centre.

One has to properly differentiate seasons when living on Svalbard and for each of them, UNIS and its community bring a valuable support: a clever yet cosy architecture making students feel welcome to come for the lectures and stay beyond them, an ergonomic housing solution, either right next to the academy or in very inclusive barracks enhancing the communitarian everyday, a thoughtful and welcoming staff assisting the students for whatever questions we'd have during our stay, and finally, a both successful and creative Student Council.

Life in Longyearbyen generally is very human-scaled and one quickly realizes that, perhaps more than anywhere, things have a great potential of happening under one's own impulsion.



Driving back home after a semi-touristic and semi-diplomatic trip to Barentsburg, March 2018

As such, next to my semester of studies, I could attend to a lot of concerts, volunteer at the first edition of the fantastic Arctic Chamber Music festival, meet and get acquainted with locals either in art galleries, workshops, bars or shops, being invited over to have dinner with them, do sports together and exchange on our thoughts and ideas. I could also share my experience with friends visiting me from the mainland, as well as a French researcher in anthropo-geography for two weeks, assisting her for the framework of her project.

But the most valuable gain from the non-academical life on Svalbard to me were the students of UNIS-self. I met and bound with the most curious, active, bright and inspiring people, who tainted my adventures with profound and lasting colors. We spent long hours of the dark season inside, playing kayak-polo in the pool, climbing and setting new routes on the climbing wall, cooking and watching movies together, playing boardgames, training and becoming impatient for the outdoor-season to begin. As soon as the light started to shine from behind the horizon, we headed out into the Svalbardian nature, embracing the mountain through a lot of ski-touring, exploring and climbing in the ice-caves, occasionally driving around on yet very exciting snow-scooters. When the ice started to melt away, we swapped to sea-kayaks, hiking boots and cabin trips, too easily forgetting what time it was under the midnight sun.

I am immensely satisfied to have spent as much of my free-time as possible outside for the magic on Svalbard really starts beyond the boundaries of town. The acknowledgment of wildness and solitude, combined with an appropriate training and the immensity of the landscapes produced a rare feeling of absoluteness and holistic freedom; as an inhabitant of the place, the place slowly began to inhabit me...



Sighting of a majestic polar bear by the coast of Petuniabukta next to Pyramiden, May 2018

Studies and research at UNIS

What do studies at UNIS consist of, what is their aim and how do they transition into research? How did I decide on my final master's topic of studies?

I came to UNIS in January with the objective of both educating myself in Geophysics, which was a completely new topic to me, and preparing for the decisive course next semester: Air-Ice-Sea Interactions II. Preliminarily engaging in discussions on the latter with the responsible professor, desiring to find out where to enhance my focus and how to eventually start my research in advance, I got struck to find out that bad luck had hit providence this year; the Air-Ice-Sea Interactions II-course had been cancelled for the upcoming semester and with that, my initial wishes and ideas vanished immediately too. Back to ground zero, I started over my quest for the discovery of a great topic and thesis.

The reason courses are given at UNIS often also is the very same reason students enroll to follow them: the field-works. Every single course on Svalbard pertains to a field exercise that is conducted in relationship to current research led by a scientist at the university centre. This means that by participating in the field experiments of a course, a student not only gains very privileged knowledge of how to operate equipment out in the Arctic, but also gets an insight into the different and possible topics that professors would be involved with for their own works and publications. Needless to say, I was very much looking forward to both the adventures the Snow and Ice Processes- as well as the Air-Ice-Sea Interactions I-courses would offer.

The first of the two has a major focus on glaciers, and studies the most important components and processes of the Arctic terrestrial cryosphere. As such, we conducted field experiments on Blekum- and Tellbreen and I ultimately published a report on *Ice flux and velocity measurements using differential GPS*. The overarching subjects of the course being Cryophysics, Avalanche Dynamics and Physical Chemistry, I didn't find a topic charming enough there to trigger my curiosity for a master's thesis.



Setup of a weather station, a snow pit and mass-balance stakes on Tellbreen with AGF-212, March 2018

The second course establishes the interactions between the ocean and the atmosphere, in regions partially or totally covered with sea-ice. Sea-ice growth and climatic models are also discussed. For the field approach, the remarkable practical work took us out on a cruise expedition, both for sampling sections of fjords nearby Longyearbyen, but also to set up a field-lab on the sea-ice. In that frame, I worked and published a report on *Water masses and topographic steering*. The underlying topics of research of this course being Thermodynamics, Physical Oceanography and Meteorology, my interest was growing with every week of lecture. What the personal project however revealed was the very experimental scope that the local researchers had adopted, making me dearly miss the more mathematical and theoretical side of Physics.

I lastly took a brand-new course by the Department of Arctic Safety on Risk Assessment of Natural Arctic Hazards (AS-301), wanting to discover how natural sciences could merge with human sciences on topics immediately dealing with the environment. During the writing of my report *On oil spills and drift in sea-ice conditions* however, I discovered that no physicist was participating in the current projects of the research groups, and that my areas of interest there were therefore only treated superficially.

Encountering Aleksey Marchenko and his work realized itself with the accuracy of a coincidence, at a time where I knew what I wanted without finding it exactly. When I first read his papers, I stumbled upon a very balanced care for rigorous didactics and precise research. Meeting him shortly after revealed to bring together a comprehensive and global way of doing sciences: the possibility of a topic on sea-ice and dynamics combining theory, experimental lab- and field work as well as modeling. I couldn't have hoped for a better outcome ever since I laid foot on Svalbard for the first time, and am looking very much forward to my work with him and in the larger AOCEC-project this year.



Our cruise vessel Polarsyssel trapping itself into the sea-ice in Sankt Jonsfjorden, April 2018