

## Participant feedback report

Name	Inst. Country	Background - competence
Trygve Halsne (MSc, res. scientist)	Meteorological Inst. Norway	Remote sensing, data management, Sea ice algorithms
Joshua Jones (MSc, researcher III)	Univ. Alaska, Fairbanks, USA	Sea ice and hazards, CBM, AAOKH (linked to INTAROS)
Takuya Nakanowatari (researcher)	NIPR, Japan	Sea ice modelling and forecasting, Arctic navigation
Zeinab Jeddi (postdoc)	Univ. of Bergen, Norway	Seismology, earth quakes, data processing, works on INTAROS
Henrik Hellem (MSc student)	Univ. of Bergen, Norway	Processing and analysis of acoustic data
Bjørnar H. Røsvik (MSc student)	Univ. of Bergen, Norway	Processing and analysis of acoustic data
Jan Michalek (senior engineer)	Univ. of Bergen, Norway	Seismic data processing, visualization and management
Sascha Schjøtt (PhD student)	Aarhus Univ., Denmark	Marine ecosystems. Also at Greenland Inst. of Nat. Resources
Samantha Jones (PhD student)	Univ. Calgary, Canada	Lakes, rivers, ecosystems, hazards, CBM work
Oliver Bartlett (PhD student)	Univ. of Exeter, UK	Hazardous glaciers, remote sensing, GIS
Delphine Collin (MSc student)	Sorbonne Univ., France	Cross-disciplinary environmental studies, hazards, GIS,
Agata Grynczel (PhD student)	IOPAN, Poland	Oceanography, sea ice
Morgan Ip (PhD student)	Oslo School Arch. and Design, Norway	Ethnographic data, cultural landscape, data management tools
Thomas Tuesen (PhD student)	Univ. of Bergen, Norway	Natural hazards: flooding and slope failure, cross-disciplinary
Alexandra Meyer (PhD student)	Univ. of Vienna, Austria	Social scientist, working on the H2020 NUNATARYUK project

### Trygve Halsne, Norwegian Meteorological Institute

- *What do you think about the program and the inter-disciplinary approach in this research school?*

The interdisciplinary approach was interesting and useful - to some extent. It is interesting, and important, to see how other disciplines approaches topics in the cryosphere. And I guess the future needs inter-disciplinary work to close some of the gaps concerning unanswered questions in the arctic. However, there is a limit on how far one should go into

other branches in order to follow up on the development in your own branch.

- *Was the level of the presentations too low, too high or about right?*

In general, too low and about right. As far as I'm concerned, I think no presentations had too high level.

- *How was the balance between lectures and other work (exercises, practical demonstrations, etc.)?*

In my opinion, it would be more fun to do some work on the data. E.g. a lecture describing the data and the topic, and then a Jupyter Notebook (or similar) where you could run the code directly on your PC to get familiar with the data and the ways of analyzing. I guess in the latter part (ie. data analysis) there are overlaps across disciplines.

- *What has been the most interesting part of the research school for you?*

To me, the most interesting parts was to 1) get to know scientific groups within my field of expertise from other countries, 2) get more familiar with biological processes related to oil spills in the arctic.

- *If the research school had lasted for one more week, what do you suggest that the content of the second week should be?*

Hands-on work and cross-disciplinary work with follow-up lectures (30% lectures and 70% work). Not necessarily to do carry out measurements, but maybe work together on existing data from the field.

- *Did you get some new inter-disciplinary perspectives on your work?*

Yes. The strong coupling between the physical and biological processing taking place in the arctic sea ice.

- *General thoughts?*

As mentioned in the feedback session, reorganize the workshop to cover the various topics in single sessions/days. E.g. Data Management was smeared out throughout the week. One could instead have DM as topic on the last day with examples from each of the disciplines already presented.

### **Joshua Jones, University of Alaska, Fairbanks, USA**

1. I thought the interdisciplinary approach of the research school was really good. There were topics that I have not really ever had any training in or discussion of (seismology in the Arctic, tomography, some cultural aspects), and some that went farther in depth than I have been involved in (data management plans, satellite data processing). It was also very interesting to learn how community based observations take place and is supported in other places than Alaska.
2. The science oriented presentations were spot on. I think they were the right level for those of us with a scientific background, though not necessarily in the field being covered. The presentations from outside the scientific area seemed a little out of place, but did provide a good perspective on how non-scientists interact with the Arctic science community on many different

levels and how there is much enthusiasm for scientific and other operations in the region. Overall, all of the presentations were really good.

3. I think there could have been a little more work for the student participants to do relative to each topic that was presented. It just wasn't quite clear what was expected for some of the topics/modules. Maybe it was just the nature of the topic being presented that day that did not lend itself to having exercises or practical demonstrations, it just would have been helpful to know clearly what outcomes or products were required, or not required if that was the case.
4. There were many very interesting parts of the research school. The interdisciplinary focus was great. I really got a lot from learning about science that I'm not focused on, and from conversations with instructors and students whose work is in the Atlantic side of the Arctic while my research and work has been focused on the Pacific side.
5. If the school had lasted another week, I think spending more time on the topics presented in conjunction with some practical demonstrations and exercises would have been great. Additional topics that could have included more discussion could have been sea ice, other aspects of Arctic oceanography, weather and climate, and marine mammals and fisheries.
6. I did gain some more interdisciplinary perspectives. Specifically, how tomography is mapping physical characteristics of the Arctic Ocean and how our work might not necessarily be taken in the context we are expecting but provide some cultural aspect to a wider audience than just the scientific community.
7. In general, I thought the research course was great and I very much appreciate the opportunity to participate. I look forward to working more with UAK/INTAROS, and participating in or working on future research schools with these projects.

### **Takuya Nakanowatari, NIPR, Japan**

Through the comprehensive lectures provided by many lectures who have different backgrounds in the Arctic Science, I was able to obtain new knowledges on the Arctic science. The topics are natural hazard in Savard Island such as earthquake, risk management of ice and oil spill, the application of acoustic technology on the measurement of ocean temperature, citizen science and its activity in Longyearbyen during quite short period. Although the duration of science school is very limited, I feel that more exercises about data management and utilization of SAR data are helpful for us.

My research topic is to develop the Arctic navigation system based on operational sea ice forecast data, which highly depends on an ice-ocean model output for the detection of the sea ice thickness distribution and its predicted ice field. However, the model has about 10 km grid size and generally assumes viscoplastic rheology as dynamical process. Therefore, we need to use additional information for the safe navigation of vessels even if the vessel has an ability of ice-breaking. As additional information of small scale ice, high-resolution satellite data such as SAR image have a great potential to detect such small-scale ice. In this school, I was able to discuss with Pedro and his colleague on the possibility to use the SAR image data on Arctic Shipping route. In July 2014, an ice-blocked accident was occurred in the East Siberian Sea. Since the SAR image data are available in this period, we will diagnostically investigate the sea ice distribution derived from the SAR data and the relation to vessel speed.

According to the lecture, sea ice accident would not be necessarily decreased even if the sea ice cover has decreased, because the mobility of sea ice motion increases due to the decrease in sea ice thickness. This comment is very impressive for me and motivate me to investigate the influence of great Arctic cyclone on the medium-range predictability of sea ice distribution and its speed. Recent study pointed out that the number of Arctic cyclones has not changed during several decades (e.g., Koyama et al.

2017), but great size Arctic cyclones were found in 2012 and 2016 in summer. Such large-scale cyclone may lead to the serious accidents of commercial vessels and oil tankers as well as oil mines. Thus, we need to investigate the future projection of great Arctic cyclone as well as the sea ice thickness and distribution for the safe usage of Arctic Ocean as commercial purpose.

As for the improvement of atmospheric forecast skill, it was reported that the impact of additional radiosonde observation is effective on the extension of skillful forecast lead time through the improvement of initial condition of atmospheric forecast model (e.g., Inoue et al. 2015). Since, it is very difficult to access to the Arctic Ocean, it may be important for the additional radiosonde data to collaborate with commercial vessel in the Arctic Sea Route. The meteorological data even in one point would lead to the improvement of weather forecast in the same area, because the scale of atmospheric fluctuation is relatively small in high latitude. Thus, the voluntary meteorological observation by commercial vessel has a benefit on the improvement of atmospheric forecast skill not only in the downstream area, but also in own region. Since great Arctic cyclones were recently occurred in summer, there is possibility that severe accidents of commercial vessels occur in the Arctic Ocean. To avoid such severe accidents, the development of voluntary meteorological observing network is desirable in the future.

### **Zeinab Jeddi, Department of Earth Sciences, University of Bergen, Norway**

- *What do you think about the program and the inter-disciplinary approach in this research school?*

Being the first UAK research school, it covered a vast majority of different disciplines and it was very interesting to see the some common issues in data managements and community base information in different disciplines addressed quiet broadly. Though I think it was a bit compact.

- *Was the level of the presentations too low, too high or about right?*

It was really different. Student presentations were abstract and simple enough to get the main point. But lectures were quite different, some were really basic and some a bit high level information and many new terminology that could confuse if one is not in the that specific field. Also some of presenters had very short time to present themselves like EO data application. The tool seemed very useful but not that much time really to try it with guides.

- *How was the balance between lectures and other work (exercises, practical demonstrations, etc.)?*

Some subjects got less time than others (mentioned before). And I think exercises could be a bit more practical. Acoustic exercise was planned in a better stage to go through some information with guides, which I think should have been done for all other exercises. Although, for example in acoustics I wanted to learn a bit more how to take out data and try together with some of my own data (according to my proposal) during student work time. But due to change of plans there was not much time to focus on that.

- *What has been the most interesting part of the research school for you?*

Getting information about all disciplines and data managing was very interesting. But over all, I like the Thursday afternoon where we had a local community talks and workshop afterwords. I missed such discussion in small groups during other days.

- *If the research school had lasted for one more week, what do you suggest that the content of the second week should be?*

I would suggest after getting information on different disciplines in first week, continue second week in getting some real case scenario/real database to work on.

This also could be done by having a field trip. Or use some available data from previous field to go a bit in detail of what we learned in detail.

The other approach will be that we work on our own project using the ideas we got in the workshop, this might not work for all proposals since some are long term planning. But for some other will be very useful.

I would also like to visit a local community by just walking around the town, and visit some local people and management sectors.

- *Did you get some new inter-disciplinary perspectives on your work?*

I was thinking to look at acoustic data in the region I work, I got an idea where I should look for data, so I think this is the first thing I will do.

EO data application was interesting, but since it was compact, I need to back to presentations and contact with presenters to see if I can use it for my work somehow.

It was interesting to see how acoustic use speed for measuring temperature and similar with what with do with seismic velocity. A good idea was suggested to see if we can use earthquake as acoustic source to measure temperature in ocean and do some tomography. It is not clear how complicated is that, but definitely I will look at it in more details.

- *General thoughts?*

Very nice course though a bit compact and diverse. I would prefer to have a bit more focused, but still interdisciplinary workshop. Many thanks for the organisers and of course looking forward to next one.

### **Henrik Hellem, University of Bergen, Norway**

- *What do you think about the program and the inter-disciplinary approach in this research school?*

I found the program quite rewarding, and the inter-disciplinary approach intriguing. I have not spent much time in such settings earlier. So, the whole thing was an experience by itself.

- *Was the level of the presentations too low, too high or about right?*

The level of the presentations varied to some extent. Some presentations were a bit more technical in depth than needed be in my opinion. But despite this I did not feel that the level of the presentations was too high. Over all I felt that the level of the presentations was good.

- *How was the balance between lectures and other work (exercises, practical demonstrations, etc.)?*

I felt like there could have been more practical work or group discussions/activities. The presentations were interesting. However, it is limited how much knowledge one can bring away from a long day of presentations. I am left with the impression that the inter-disciplinary goal of the Research School would have benefited from more interaction between the attendants.

Although the afternoon sessions were intended for this it seemed that to some degree that either the presentation would drag on, or the practical exercises left everyone focusing on their own computer. This was not the case for all the sessions, but it was present throughout the week. Other than that, I felt that the program was good, and well structured.

- *What has been the most interesting part of the research school for you?*

In my opinion the most interesting part was the variety of educational background the attendants and lecturers had. In other words, the inter-disciplinary focus. In addition to this I felt that including both lectures from UNIS and interacting with the Longyearbyen Lokalstyre was captivating.

- *If the research school had lasted for one more week, what do you suggest that the content of the second week should be?*

As I still have some years before I will finish my master's degree it is a bit difficult for me to say. However, I was left with the impression that perhaps it would be meaningful to work together in groups, approaching some of the problems regarding Longyearbyen that emerged from the discussion during the session Thursday.

- *Did you get some new inter-disciplinary perspectives on your work?*

I got a broader perspective regarding the field of work I am currently pursuing in my on-going education. Some of the topics I felt could have applications for my future work would be the natural hazard part, and the remote sensing element of the research school.

- *General thoughts?*

The research school was a valuable experience and highly recommendable.

### **Bjørnar Hallaråker Røsvik, University of Bergen**

- *What do you think about the program and the inter-disciplinary approach in this research school?*

I think the inter-disciplinary approach was interesting. It gave a better understanding of all the different challenges that are present in the Arctic. If people only work with their own research field it can be difficult to see the whole picture. The fact that researchers attending were discussing and exchanging data was cool to see.

- *Was the level of the presentations too low, too high or about right?*

Most of the presentations was just about right I would say, even though some of them was a bit more technical. It was great to get some of the lighter presentations in between, like Sascha's from Greenland and Takuya's about the northern lights.

- *How was the balance between lectures and other work (exercises, practical demonstrations, etc.)?*

Personally, I feel like some of the lecture-sessions was a bit too long. Some of the presentations dragged out, and we had like two hours straight with new information. Here it could maybe been beneficial to have five minutes breaks every 45 minutes just to stretch our legs and get some air. These long sessions limited the group activity to some degree. People were working with the exercises and the group work that was intended from the first day, kind of disappeared.

- *What has been the most interesting part of the research school for you?*

I think learning about the new challenges the Arctic region is facing because of climate change was the most interesting. To look at the increasing hazard risks, both natural and human made. Also, the fact that it was so many bright minds from all over the world. To have discussions about problems and solutions with other students and researchers from different backgrounds.

- *If the research school had lasted for one more week, what do you suggest that the content of the second week should be?*

If it was one more week, I would suggest some more field work, even though I understand it is difficult with the logistics. Could maybe have been collecting acoustic data in Isfjorden, going all the steps with data collection, management and usage. We could also maybe go and watch the snow avalanche places or collect samples of sea ice.

- *Did you get some new inter-disciplinary perspectives on your work?*

I haven't been working with too much research yet, but I see how valuable collaboration can be. To bring different type of data together in to new ice and ocean models can be very important. Potentially working with marine measurement and control technology I think knowing about oil spill hazards can be smart.

- *General thoughts?*

The research school was fun, and I learned a lot that I will take with me further in my studies and later in my work life. It was well organised, and we always had everything needed.

### **Jan Michalek, Department of Earth Sciences, University of Bergen**

- *What do you think about the program and the inter-disciplinary approach in this research school?*

There is definitely need for doing inter-disciplinary workshops. There are being developed new environmental research infrastructures and researchers need to be informed about other research fields/topics to be able to use such infrastructures. I think the program was organized well. It was the first such meeting and people need to be informed about each discipline and the amount of information was just fine.

- *Was the level of the presentations too low, too high or about right?*

The level of presentations was varying a bit but a bigger challenge is how to design the presentation for group with heterogeneous knowledge of the subject which depends on scientific background of each participant. I, as a seismologist, would appreciate more details about processing of acoustic signals because this discipline is actually very close to seismology (mechanical waves). On the other hand, the presentation/exercise about processing of satellite images was too detailed and I was not able to absorb all the information in such short time. It would be great to have more time for such exercise.

- *How was the balance between lectures and other work (exercises, practical demonstrations, etc.)?*

For one-week workshop it was a good balance, I think. There could be more exercises if the workshop is longer. Practical demonstrations are nice and I like them but not sure if those are actually needed for the research as such. Might help to understand technical aspects of the research though. I think it would be nice to arrange one afternoon with various practical demonstrations also for non-participants of the workshop (public, researchers from hosting institution, students, representatives from municipality, ...).

- *What has been the most interesting part of the research school for you?*

To learn about other studies and methods people are using in the Arctic. For example problematics around oil spills or that temperature of sea can be measured by acoustics. Also, information about how the research activities are communicated to the public and how the public is perceiving research activities. Involving the community into solving the problems can break the barriers between science and public and actually increase the trust in science. Interesting were also the common dinners, of course, where I learned more the background stories leading scientists to various research fields.

- *If the research school had lasted for one more week, what do you suggest that the content of the second week should be?*

Having more exercises and work on individual projects.

- *Did you get some new inter-disciplinary perspectives on your work?*

From the perspective of natural hazard I realized that we should work towards a unified system for evaluation of risks across the disciplines. In Norway NVE is providing such service (<http://www.varsom.no/>) but it is not directly connected to observations of earthquakes. EQs can actually trigger other hazardous events.

I realized that monitoring of permafrost state in Arctic is very important. Building multi-parametric observation stations will definitely improve the knowledge, reduce maintenance costs (especially at remote places) and possibly increase the success rate for getting permission for installation on Svalbard.

I got an idea about new approach for passive monitoring acoustics using whales as signal source. Deploying devices on various whales simultaneously could provide dense coverage of crossing paths and can provide much better picture about the structure of the water column (salinity, water temperature). Thanks to multiple observations in small area the travel-time tomography of sea could be made. Precise time-stamps (micro seconds for resolution of 1 deg C) to the acoustic recordings have to be made and precise position need to be known which might be challenging. Precise time and position can be retrieved from GNSS but there is only short time for that when the device is above water. Charging battery might not be a problem but data transmission/retrieval can. I have some ideas for design of such device so please let me know if you think that this is something useful.

- General thoughts?

It would be great if presentations of individual projects will include list of topics/issues which will help them to develop further.

We collected very useful feedback about the Enlighten-web tool during the natural hazard session. The feedback was already provided to the developers (NORCE) so I believe there will be new improved version available for next workshop. If there will be another UAK workshop and there will be wish to use the Enlighten-web again, I would be pleased to join as member of the organization committee (contributor).

Thanks for organizing the research school. It was a lot of new information from different disciplines and also seeing my own discipline from a new perspective.

### **Sascha Schiøtt, Aarhus University**

The Research School provided insights in different methods in studying different topics regarding the Arctic, and provided important contacts, that will be very useful during my Ph.d. It was refreshing to get out of my project topic, and get to see what else is out there of research in the Arctic. It also gave me new ideas of what to include in my project, which I might have overseen before, or did not think of. It was good to talk to other Ph.D. students that works with a similar subject to my own



project, and to exchange new ideas, and how to deal with problems related to each of our own projects, and exchanging former experiences and knowledge regarding our topics.

The program was very inter-disciplinary, so I think 5 days is a little too short to get in depth with each topic, so it would have been nice to have more time to explore each area. The practical part of the topics would have also been nice to explore more in depth. Some subjects were challenging to understand, as I have a background in biology, with no former experience in seismology, geology or programming large templates, so more time would have provided me enough time to understand challenging areas.

I think it was fantastic that we got the chance to suggest a project together with Pedro about Sentinel-1 data, which I think will be very useful during my Ph.d. It would have been nice to see more of these types during the week, where each teacher or participant could suggest the option of collaboration and what they can contribute with in that collaboration. It would have opened up for important and useful collaborations.

One thing I would have liked to be included was a short field trip, as we travelled all the way to Svalbard and did not see much of the nature – but then it would have had to be during a different time of the year. But it made a huge impression to arrive to the polar night and actually see how dark it is, and what conditions animals and people live under, that high north. So that in itself was worth the trip up north, because you really have to be there yourself to see how dark it really gets.

The part about research data was also very useful, as I have never put that much thought into how my data should be, so it was good to know how important research data is, and how we can save our data better, and more accessible for other scientists. And also to find out that publishing data actually is a possibility. My overall experience from the week was good, and very good to hear about different subjects.

### **Samantha Jones, Department of Geography, University of Calgary**

Thank you for an excellent week of learning. The **interdisciplinary approach** was very useful in highlighting the linkages between the four themes of the research school. I was able to learn from researchers with different areas of expertise and identify opportunities to apply different approaches to my work. Exposure to all four themes highlighted some of the challenges that the changing Arctic faces now and into the future. The broad nature of the workshop equipped me with the awareness and confidence to discuss these issues with others and to start thinking about how they interface with my research. The appearance of some topics, like data management, throughout the program illustrated the importance of the subject to all disciplines. The balance between the lectures and the exercises was appropriate and the technical level was accessible to a non-specialist audience.

The **most interesting parts** of the research school were the sessions relating to citizen science. I would like to continue to learn about engaging local community members to develop project scope and collect data that can contribute to climate projects like my PhD research. I am interested to explore how the citizen science methods and approaches discussed at the research school translate to the community where I work. Understanding the differences between citizen science and community based monitoring and the potential overlap between the two frameworks will be helpful in identifying future opportunities to work with local residents. I also enjoyed the town hall session where we met and discussed challenges and future development with local residents.

The formal sessions and the informal networking and discussions during the research school have **inspired several new ideas** for my project including **interdisciplinary perspectives** on how to address some of the challenges associated with my PhD program. I will implement some of the data management strategies to organize and preserve the longevity of the data that I have already collected and implement an improved DMP for the remainder of my program. I will also follow up on options to publish and archive my dissertation data for reuse once I finish my graduate degree. I will create a terminology and semantics glossary for a literature data compilation that I am working on to

highlight equivalencies and document the assumptions involved in reusing published data and deriving new parameters. This addition, inspired by the discussions during the data management sessions, will improve clarity of my methods descriptions and improve reproducibility of my work. It will also provide a systematic framework that can guide collation of data from different sources.

During the five-day workshop, I discussed my ambition to incorporate citizen science contributions or local ecological knowledge into my PhD project. I was able to network with course instructors and participants to get ideas about how to best approach and recruit participants and how to frame the scope of work. During workshop program breaks, I worked on framing a small local knowledge-gathering project that I could implement during my fieldwork next year. The outcomes of this activity would provide novel perspectives on change in my study area and provide local context for anticipated vulnerabilities to future warming and change. Attendance at the research school allowed me to exchange ideas with faculty and participants to refine the scope of my proposed work and develop an action plan. The networking opportunities provided by the research school have strengthened my network and I look forward to working with these new colleagues in the future.

### **Oliver Bartlett, University of Exeter, UK**

I found the program to be broad in content and highly interesting and engaging. The inter-disciplinary approach was consistent throughout all the days of the school, with a large part of this benefitting from having participants from a variety of nations and disciplines. Having the school take place at UNIS I felt added to the program as it put all of the course content into a local context which I feel added to the learning as well as the engagement with the program.

I personally found the variety of subjects, and the linkages between them were communicated well and at a level that was both sufficiently advanced but also easy to comprehend for complete outsiders to the various disciplines. The presenters all delivered quite advanced information at the right level of difficulty. Furthermore, I felt that the presentations were conveyed engagingly and continually linked back to the interdisciplinary focus of the school.

There was possibly an imbalance between the amount of the lectures and other work. Whilst the lectures were great for setting the scene and delivering important information there could have been more time devoted to exercises to put the information into practice. Having the mornings as entirely lectures with the afternoon solely practical exercises would have helped to reinforce the learning from the lectures and enabled us to work on a task more comprehensively, drawing from the varied experience in each working group. Additionally, the jupyter notebook lesson would have been great if we were able to follow along with the live demonstration rather than just watch.

For me, the most interesting part of the school was the community-based content. As an earth scientist, it was interesting to be exposed the impacts of climate change and how my research fits in at the community level. It has helped me frame my research and the importance of it at a more local scale and inspired me to think more about my research from an impact perspective.

Should the school have lasted another week it would have been good to have time to work on some projects. On the Friday of the first week, we could select a project we liked as a group to work on for the entirety of week two. So if someone in our working group had designed a project we liked we could put all of our varied knowledge and skills into intensively working on the project with an outputs presentation on the final day of week two. From this, I feel it would encourage interdisciplinary research as well as cement opportunities for future collaboration and developing each project forward.

I certainly gained new interdisciplinary insights into my work. The talks and activities at the research school highlighted to me that there are many ways I can look at the data I use and produce and this will certainly enhance the quality of my PhD thesis.

Overall, my experience of the UAK research school was a great one. I enjoyed the varied content and the interdisciplinary approach to the school. It was fantastic to network and socialise with a broad range of participants in terms of nationality and expertise. Going forward I would very much like to be involved in the project and contribute my expertise in GIS and geospatial data analysis to projects from any of the disciplines, as I feel this school was brilliant at exposing me to how I might work with a hazards and monitoring based focus.

### **Delphine Collin, Sorbonne University, France**

I am currently in my first year of master in Geography. My principal field of study is the environment and natural hazards. I was interested in polar environment since a long time and when I did my application for the research school in Longyearbyen I was looking for an internship for the second semester as a part of my master. I thought each topic was related to geography and bring me a lot for my studies. Next year I will have to write a master thesis and I wanted to find a topic about the thawing of permafrost which triggers destabilization of environment and increasing risks. My teacher Emanuele Costard- Gautier is a specialist of the Lena in Siberia and had topics for me in Siberia. The first thing I have learned in the research school is that I want find an area in Svalbard or in Greenland, linked with the local population.

Furthermore thanks to the four different topics I learned various things :

**Natural hazards.** My master is about natural hazards and I also took a course about natural hazards in Utrecht University where I did an exchange last year. During the week we focused on hazards specially in the arctic and I learned that almost all type of hazards is occurring in Svalbard and in the arctic, like avalanches, landslides and earthquakes. I live in a big city therefore living for one week in a city which is enduring different types of hazards was interesting.

**Community based monitoring.** I was excited about this topic because it is fully a part of what we learn in geography. Geography makes the link between the environment and the society so we can draw a parallelism with the science which is a study of the environment and the local communities who are the society living in this environment. Geography therefore serves as the hinge linking these two. During my bachelor we talked a lot about empowerment of population but within developing countries dynamics. We studied American Indigenous people or women in South America for instance.

It was really interesting realizing that empowerment is also about communities in developed countries and making the link with politics and participation of citizens. Indeed, I learned a lot about citizen science. Nowadays population wants to take more and more control and to participate in their city-environment life. Politics is a key but also science and comprehension of the environment. The speech of Hilde Fålnum Strøm was really touching and it was optimistic to see people involved in their environment. Also as a young researcher it was reassuring to see that science is not in its ivory tower anymore and it participates to the operation of societies. Nevertheless, I saw that there is still some communication or motivation lacks because there was not a lot of people during the dialogue café with the local communities and it is important to therefore improve this side.

**Acoustics.** This topic was the furthest of my study area but it was one of the most interesting because totally new. I studied sound dynamics within a physical prism in high school, but it was interesting to see that researchers are working on this topic. I am a musician, I play the viola and I liked to way of teaching us this topic. I also saw a link with my internship in Laval University next semestre

because I will have to assess the quality of the Saint Laurent. Sounds is one aspect of the quality of environment I can assess. I therefore learned to use new tools.

**Data management.** It was really interesting and formative because bachelor is always more theoretical and learning how to collect data, use them and make them reusable is really interesting and useful for my thesis and my future. Indeed, I never studied how to deal with data. We are starting to study it more this year in master because we are starting to create our own data and using data of others scientists but never in a direct way.

Finally I learned that climate change is visible on a human scale and that the changes are faster in this part of the world. Climate change is leading to destabilization and therefore more hazards like avalanches and landslides. I did a hike after the research school and the guide showed me flows triggered by landslides that were not here last year. He also told me that flowers which grew on the mountain three years ago don't anymore because of the instability of the slope. To conclude it is important to share knowledge to mitigate the risks.

### **Agata Grynzel, IOPAN, Poland**

- *What do you think about the program and the inter-disciplinary approach in this research school?*

I think that the interdisciplinary program brings many benefits. Primarily, the opportunity of knowing the Arctic changes and hazards in the wider context. In addition, the interdisciplinary approach allows getting to know new data collections/database from other scientists and measurement campaigns. Which is extremely important from the point of view to understand the uniqueness of ongoing Arctic trends and put recent changes into a larger perspective and it presents projections for the future.

- *Was the level of the presentations too low, too high or about right?*

The research school has gathered scientists and people from various scientific fields, but in connection with the sufficient (right) level of presentations, the material was accessible and understandable.

- *How was the balance between lectures and other work (exercises, practical demonstrations, etc.)?*

Practical classes using available databases would bring more benefits. In my opinion, the program was overloaded with lectures, while not paid sufficient attention for practical exercises and work with datasets. Practical tasks could include data analysis (ice cover, oil spill, seismic, acoustic) from the Svalbard region in the Python or Matlab program.

- *What has been the most interesting part of the research school for you?*

The most interesting part of the research school was knowing about the seismological application/tool and investigating the possibilities of working on satellite SAR data applications for Arctic research. In addition, the conversation with the other participants allowed me to get to know new databases (for example: <http://osisaf.met.no/p/ice/index.html>) including the variability of sea ice in the of north of Svalbard region.

- *If the research school had lasted for one more week, what do you suggest that the content of the second week should be?*

I would suggest a more thematic division into groups and work on more specific issues. For example, groups dealing with the problem of decreased sea ice cover or the threat of oil spills could deal with the analysis of satellite data from available databases. On the basis of this analysis, we could try to investigate the potential of sea ice satellite products (like AMSR-E, MASAM2, SAR, Sentinel). At the same time, the creation of data analysis tools for the proposed changes (ice, spills) and it could help us to adapt satellite products for our needs. I would also suggest the possibility of performing acoustic measurements in the field.

- *Did you get some new inter-disciplinary perspectives on your work?*

As of today, my work focuses on analysis and explanation the sea ice variability along main pathways of the Atlantic origin water (AW) in Fram Strait and north of Svalbard, based on the hydrographic data of conductivity-temperature-depth (CTD). Inspired by the possibilities of acoustic measurements, in the next step of my analysis, I would like to focus on data from Lowered Acoustic Doppler Current Profiler (LADCP) and Vessel-Mounted Acoustic Doppler Current Profiler (VMADCP) from Fram Strait and north of Svalbard. In order to examine the structure of the West Spitsbergen Current and describe the variability of the baroclinic flow field.

- *General thoughts?*

I consider extremely interesting and needed a panel including collaboration and communication between academic research and local communities in Svalbard.

### **Morgan Ip, Oslo School of Architecture and Design, Norway**

I greatly appreciated participating in this research school, and learned a lot from the interdisciplinary model. The level of presentations was of high quality. However, as a designer and social scientist, the section on coding was lost on me, and it was very difficult to follow. I understood it better only through the exercise given afterwards with group participation and hands-on teaching. In this case, I would consider starting the lecture with active participation. On the other hand, learning about how low frequencies traverses waters, and the many variables that affect this in a lecture before seeing it in an exercise was incredibly clear and easy to follow. I would say, then, that the balance between lectures and workshops and exercises could have more strongly favoured the later.

Of particular interest was the workshop with community leaders and the discussion of how potential transdisciplinary datasets can influence evidence-based decision making. Although I understand that this is an on-going process, I think that this particular event should have been held on day one or two, so that there could have been greater back-and-forth between scientists and locals. Indeed, one more week would have greatly benefitted this community engagement and I suggest that the research group continue working with the community considering its particular relevance with the topics of climate and technological change.

There are a few logistical changes I would suggest for future local engagement and outreach activities. For example, how the working groups were delegated could have been pre-determined to persuade UNIS students who came for the lecture to participate in the workshops. I felt that there was confusion in the allocation of numbers and asking if people were staying individually that frightened some of them away. It might have been useful to present a series of questions that each working group could discuss, and have students and community members choose which to participate in. I understand that such workshops have to be adaptable, but by continued work on these events I am certain that future work in Longyearbyen can be more fruitful. Further, during these local

events, a synopsis of the hard physical data could be presented for greater awareness of the integration of the sciences and the holistic importance and relevance to the area.

As an Arctic urbanist, knowing more about the science that measures and documents the physical world is necessary to combine with the methods and discourses of socio-cultural research. Most importantly, how the combined datasets can be transmitted in a way that benefits both academic and real world, and that can determine how each supports the other is critical to ensure resilient and robust places for people to live. Knowing more about physical hazards in the Arctic is profoundly important for communities living in vulnerable conditions, and the lessons I learned in this research school will certainly carry on to my professional academic career in Arctic urban design, planning and architecture.

In general, I believe there is much potential in this research group that can continue with future endeavours and building a growing body of research as the Arctic undergoes massive changes. Maintaining Svalbard as a site of active local engagement will not only benefit the people of Longyearbyen, but set an example of good research ethics and principals throughout the region, and indeed across the globe.

### **Thomas Tuesen, Department of Earth Sciences, University of Bergen**

I had a very good impression of the research school all together, and I think that the program was very interesting. It was an eye-opener when I realized how different our research topics were, and not the least how focused one can become within his/hers own topic that you don't realize how many different types of science there are.

I will below go through each day as I experienced them, even though the scheduled changed a bit, I will address them as they are in the daily program of the research school. It's also important to know that I am seeing all the different topics from a geologists point of view, and of course my own subjective view.

#### *Monday – Natural hazards in the Arctic*

Not surprisingly, I found discussing natural hazards in the Arctic very interesting, and I realized how important it is to share and publish data. During our stay in Svalbard I managed to get a hold of LiDAR data from the Norwegian Polar Institute from their websites, however, the data shared had a resolution of 5x5 meters. When I contacted the institute and asked if they had more data from Longyearbyen, they replied and said that they had even higher resolution, down to 1x1 meters, which means it is 5 times better than what's publically shared. Just this small experience with data sharing that I had during the Svalbard stay, made me realize how important it is to actually share data, and make it publically available.

#### *Tuesday – Ice and oil spill related hazards in the Arctic*

This was a very interesting topic and I have not realized how the melting ice will lead to more hazards. Having oil activity in areas that previously was not possible due to ice, is somewhat sad to think about. Basically our use of fossilized fuels has made it possible to extract more fossilized fuels. This was a very interesting and important topic to discuss.

#### *Wednesday – The Ocean acoustic environment*

I thought that this was the most interesting topic next to my own topic (natural hazards). Understanding that sound can be used to estimate temperature was very cool, and I learned a lot that I never knew from listening to the talks, and having the workshop. I especially liked the workshop in this topic, it was interactive, allowed the users to work with data that was given, and even the part about metadata was very interesting! Well done.

#### *Thursday – Community-based observing and communication*

This day was a very good day. Involving the community so that the narrow field that we research can be used to deal with day-to-day problems that communities face, is the reason I do research atleast. I think it is very important that each researcher within hers/his field understands the applications of what they research.

If I were to add anything to this research school, I would very much like to include the local-community into the topics in a larger degree. I would very much like the local-community to specify a problem they have within Longyearbyen, and then the research group could come together and figure out solutions, or what to do next, in relation to that problem. I think that would make it very interactive, and very interesting as each person would need to apply their knowledge and way of solving a problem. That would be very interesting to see how people from different disciplines would approach a problem.