

May 2, 2024

To:

Ross Cloutier, Beat Steiner, and Mike Sadan (HeliCat Canada)
Joe Obad and Eirik Sharp (Canadian Avalanche Association)
Elias Ortner (Mike Wiegele Helicopter Skiing)
Gilles Valade, James Floyer, and Kevin Seel (Avalanche Canada)
Jeff Storck, Fabian Karg and Kevin Williams (Avalanche Canada Foundation)

RE: 2023/24 Supporter Update of SFU Avalanche Research Program

I would like to thank all Canadian supporters and collaborating operations for their continued support of the Simon Fraser University Avalanche Research Program (SARP). Our research would not be possible without your financial support and expert input. We are grateful for this support, and we are looking forward to continuing our work with the Canadian avalanche community.

The purpose of this document is to inform the Canadian supporters of SARP about the activities accomplished by the research team between May 1, 2023 and April 30, 2024 and to provide a brief outlook on the planned activities for the next twelve months.

1 Team

Over the last year, the core SARP team consists of the following personnel:

- Dr. Pascal Haegeli (team leader)
- John Sykes (PhD student in Geography)
- Dr. Florian Herla (PhD student in Geography, graduated in Oct. 2024)
- Dr. Stan Nowak (PhD student in SFU's Visual Analytics graduate program, graduated in Aug. 2024)

- Anne St Clair (PhD student in REM)
- Eeva Latosuo (PhD student in REM)
- Rosie Langford (MRM thesis student, graduated in Aug. 2023)
- Annelise Neweduk (MRM project student, graduate in Sept. 2023)
- Kelsea Krawetz (MRM thesis student)
- Griffin Slimkowich (MRM project student)
- Nick Rigby (Undergraduate research assistant)
- Zoe Cohen (Undergraduate research assistant, started in Sept. 2023)

In addition, SARP includes the following affiliate members:

- Dr. Patrick Mair, Harvard University (research associate, statistics)
- Dr. Simon Horton, Avalanche Canada (research associate)
- Grant Statham, Parks Canada (adjunct professor)
- Dr. James Floyer, Avalanche Canada (adjunct professor)
- Dr. Reto Rupf, Zurich University of Applied Sciences (research associate, tourism)

2 2023/24 Highlights

2.1 Research Projects

Over the last 12 months, the research efforts of SARP were focused on projects that can be grouped into six overarching themes.

2.1.1 Quantifying Exposure and Decision-Making in Mechanized Skiing

John Sykes (PhD) continued to explore ways to meaningfully examine the GPS tracks that the SARP team has been collecting over the last few years. He presented his research at the 2023 ISSW in Bend, OR, and he is currently finalizing his final study that examines possibilities for predicting runlist ratings based on terrain characteristics and hazard assessments. Note that John's research was mainly on hold between Nov. 2023 and May 2024, as he was working as an avalanche forecaster for the Chugach Avalanche Center in Alaska for the winter. John's PhD defense is scheduled for mid-August.

2.1.2 Avalanche Hazard Modelling in Support of Operational Avalanche Forecasting

Florian Herla (PhD) completed his PhD in the fall of 2023. His final project examined snowpack model derived avalanche hazard assessments with human assessments in Glacier National Park. The results of his study, which has been submitted to Natural Hazards and Earth System Science for publication, provide valuable insight into the strengths and weaknesses of both assessment approaches.

Simon Horton (Research Associate and Research Officer at Avalanche Canada) is our main point of contact at Avalanche Canada, regularly attends our group meetings, and continues to collaborate with us. He has been exploring ways to use the algorithms developed in our research group to cluster snowpack simulations and highlight areas where conditions are similar. Simon presented this research at the ISSW and is currently finalizing a paper for submission to Natural Hazards and Earth System Science.

Kelsea Krawetz (MRM – Thesis) has been working on a project examining how different precipitation products affect snowpack simulations. To do this, she compares the height of the snowpack and various other characteristics of the simulated snowpack (proportion of different grain types, number of persistent weak layers) to a reference simulation that is constrained with daily observed snowpack height. The precipitation products she examines include HRDPS (High-Resolution Deterministic Prediction System), a tweaked version of HRDPS currently used at Avalanche Canada, CaPA (Canadian Precipitation Analysis), and an experimental version of CaPA recently developed by the research group of Alexandre Langlois at the University of Sherbrooke. The results of Kelsea’s research will help forecasters better understand the impact of different precipitation products on snowpack simulations.

2.1.3 Examining and Supporting Operational Forecasting Procedures

Stan Nowak (PhD) finished his PhD in SFU’s Visual Analytics graduate program in August 2024. The focus of his research was on developing data visualizations to effectively support the hazard assessment process of public avalanche forecasters. This is particularly challenging due to the messiness of the dataset, the high degree of uncertainty, and the potential importance of individual observations. Hence, the focus of his work was on designing for ambiguity in sensemaking. Stan is now working at Avalanche Canada where his visual analytics skills contribute to various research and development efforts.

2.1.4 Avalanche Terrain Mapping

In addition to his analysis of the GPS tracks at CMH Galena, **John Sykes** (PhD) continued his collaboration with researchers from Norway and Montana State University as well as Grant Statham to improve a GIS algorithm for automatically mapping avalanche terrain according to the Avalanche Terrain Exposure Scale (ATES). The manuscripts that have come out of this work (Sykes et al., 2024; and Toft et al., in press) have recently been published in *Natural Hazards and Earth System Science*.

2.1.5 Public Avalanche Risk Communication

Over the last 12 months, we worked on several projects aiming to better understand recreational backcountry users and improve the effectiveness of avalanche risk communication and education.

Anne St Clair (PhD) continues to develop her framework that takes a detailed look at all the different factors that affect the effectiveness of avalanche risk communication and education initiatives. The objective is to provide a comprehensive and unifying foundation for the design and evaluation of avalanche awareness initiatives in different contexts. Anne presented a draft her framework at the 2023 ISSW in Bend, OR, and received considerable interest. She is now exploring three different case studies for applying her framework: a) promoting avalanche safety on Eastern Baffin Island (in collaboration with the Government of Nunavut); b) characterizing the professional avalanche safety community in central Europe (in collaboration with Wyssen Avalanche Control and Euregio avalanche warning services), and c) assessing the effectiveness of ATES (in collaboration with Parks Canada). Note that Anne’s research has been mainly on hold since October 2023 since she took on a part-time teaching

position at Alaska Pacific University. Anne aims to defend her PhD research proposal in the fall of 2024.

Rosemary Langford (MRM – Thesis) finished her research on in-field avalanche risk management practices of recreationists traveling in the winter backcountry and successfully defended her thesis on August 15, 2023. Her findings offer interesting perspectives on how recreationists assess risk in the backcountry, what cues, observations, and supports they use to inform their decisions in the field, and how they combine this information to make decisions. This research can offer useful insights for the design of avalanche information products and curricula that resonate better with the increasingly diverse backcountry user audience.

Anneliese Neweduk (MRM – Project) also completed research for her masters degree in the fall of 2023. The focus of her project was to develop a more comprehensive characterisation of backcountry users that not only includes information on backcountry activity, years of experience and avalanche safety education, but also incorporates information on recreationists' motivations and reasons for engaging in winter backcountry activities, experience level, trip planning practices, preferences for when and where they recreate, their terrain preferences, and basic socio-demographic information. Collectively, this information provides a much richer picture of recreationists' avalanche safety needs, spotlights whether existing practices are adequate for specific desired experiences, and identifies where, when, and how to best communicate with certain cohorts of recreationists. Anneliese used data from the Euregio and Swiss avalanche bulletin user research panel for this research.

Griffin Slimkowich (MRM – Project) continued with his research on avalanche awareness and risk management practices among snowshoers and winter hikers on Mt Seymour on the North Shore Mountains. After conducting only few intercept surveys during the winter of 2023, his 2024 campaign was much more comprehensive, and he and his team interviewed more than 500 snowshoers and winter hikers despite the challenging snow conditions on the North Shore Mountains. Luckily, his questions related to snowshoe practices in general and did not depend on the conditions at the time of the interview. The results of his research give valuable insights about the existing challenges in avalanche awareness among snowshoers and highlight opportunities for interventions.

Eeva Latosuo (PhD) continued her research collaboration with the Colorado Avalanche Information Center (CAIC), which focuses on the communication of uncertainty in public avalanche forecasts. To get a general understanding of forecast users' awareness and understanding of uncertainty in avalanche forecasts, she conducted a large-scale online survey, which was launched in early March. By the time of this writing, more than 1700 participants completed the survey. Eeva will now spend the summer analyzing the collected data and outlining the rest of her PhD research. Her objective is to defend her PhD research proposal in the fall of 2024.

In addition to supporting all the different student projects, **Pascal Haegeli** continued to collaborate with the Tyrolean and Swiss avalanche warning services to better understand their bulletin user community and the effectiveness of their bulletin products. Instead of conducting

a new survey this winter, his focus was on analyzing the data that was collected in previous years and developing strategies for continuing the forecast user research panel efforts in a sustainable way into the future. This was one of the primary focuses during his visit at the WSL Institute for Snow and Avalanche Research SLF during his study leave.

2.1.6 Updating of Canadian avalanche accident database

SARP is supporting Avalanche Canada in their SAR-NIF project for updating the Canadian avalanche accident database. The project started on April 1, 2023, and so far, SARP has primarily consulted on the design of the database and provided suggestions and advice to the accident analysts.

In addition, **Nick Rigby** (Undergrad Research Assistant) has been working on seasonal avalanche hazard summaries based on the content of Avalanche Canada avalanche bulletins. We now have seasonal avalanche hazard summaries for western Canada all the way back to 1996. These summaries will be integrated into the new avalanche accident database developed by Avalanche Canada.

Zoe Cohen (Undergrad Research Assistant) has started to assist the Avalanche Canada team with the manual transfer of data from the historic databases.

2.2 Pascal's study leave

After 8 years at SFU, Pascal is enjoying his first study leave during the 2023/24 academic year (Sept. 1, 2023, to Aug. 31, 2024). This means that he does not have any teaching or administrative responsibilities at SFU and can fully focus on research and student supervision.

The highlight of his study leave year are **two 2-month visits at the WSL Swiss Institute for Snow and Avalanche Research SLF in Davos, Switzerland**. His first visit was in November and December, and he is currently in the middle of his second stay from April 1 to May 31. These visits were supported by a WSL Fellowship, which covered travel and living expenses (14,000 CHF). The main objective of his stays in Davos is to exchange ideas with Swiss and European colleagues and strengthen existing collaborations.

Pascal was **back in Canada during the main winter months** and took the opportunity to visit various collaborating operations including the Banff NP safety team, Avalanche Canada, the Canadian Avalanche Association, Eagle Pass, Whistler Heliskiing, and Mike Wiegele Heliskiing. The objective of these visits was to strengthen SARPS's relationship with industry partners and collaboratively explore ideas for future research projects.

After returning to Vancouver from his second stay in Switzerland in mid-June, Pascal plans to spend **2-3 weeks in Boulder, Colorado**, visiting Julie Demuth at the National Center for Atmospheric Research. Pascal will return to his full academic responsibilities on September 1, 2024.

2.3 Data Collection and Infrastructure

During the 2023/24 winter season data collection efforts have included to the following efforts:

- **Collection of GPS tracks of professional terrain choices**
Due to Pascal’s absence at the beginning of the winter, we did not collect any new GPS tracks during the 2023/24 winter.
- **Euregio and Swiss Avalanche Forecast User Research Panel**
Recruitment for the Euregio and Swiss avalanche forecast user research panel was put on hold until a long-term strategy for this initiative has been developed with the involved warning services. Together, the combined panel of these two warning services currently includes approximately 8,000 community members interested in participating in avalanche risk communication research.
- **Colorado Avalanche Forecast User Research Panel**
The Colorado avalanche forecast user research panel ‘Snow Pool’ was launched by the Colorado Avalanche Information Center (CAIC) and the Friends of the CAIC in the fall of 2023 to support Eeva Latosuo’s PhD research. At the time of this writing, 1211 interested individuals have joined Snow Pool. See <https://avalanche.state.co.us/snow-pool> for more information.

2.4 Securing Additional Research Funding

Over the last 12 months, we were able to secure the following additional funding for our research program.

SARP secured the **second year of a multi-year research contract with the Colorado Avalanche Information Centre (CAIC)** for conducting avalanche forecast user research in Colorado. This is a collaboration with the CAIC and the Social Science Research Group at the US National Center for Atmospheric Research (NCAR) in Boulder, CO, that supports the PhD research of Eeva Latosuo.

HeliCat Canada provided \$40,000 of funding support for our research program for the academic year 2023/24. The goal of this one-year support is to continue with the existing research and collaboratively develop a strategy towards a more long-term funding commitment in 2024. Pascal will be presenting his ideas about how to best approach this at the HCC spring meeting in Penticton.

SARP submitted a **large proposal for mapping all of avalanche forecast regions in western Canada with autoATES** to the SAR-NIF program of Public Safety Canada. The proposal includes projects for a) further developing and locally validating the autoATES algorithm, b) applying the algorithm to maps all forecast regions in western Canada, c) developing the necessary infrastructure of efficiently hosting the maps at Avalanche Canada and making them accessible to third-party applications, and d) conducting research on recreationists’ understanding and use of ATES maps and related decision support tools. If successful, the project will provide approx. \$750,000 for research and development. The 3-year project is scheduled to start on Sept. 1, 2024.

SARP is currently also in discussion with **Wyssen Avalanche Control** and the **Government of Nunavut** about potential funding for projects related to Anne St. Clair's PhD research.

2.5 Outreach

2.5.1 Peer-reviewed Publications

We submitted/published a total of **4 academic peer-reviewed papers** over the last 12 months:

1. Herla, F., Haegeli, P., Horton, S., and Mair, P. (under review). A quantitative module of avalanche hazard—comparing forecaster assessments of storm and persistent slab avalanche problems with information derived from distributed snowpack simulations. Published by Natural Hazards and Earth System Science as a discussion paper on April 23, 2024. doi:10.5194/egusphere-2024-871.
2. Herla, F., Haegeli, P., Horton, S., and Mair, P. (in revision). A large-scale validation of snowpack simulations in support of avalanche forecasting focusing on critical layers. Published by Natural Hazards and Earth System Science as a discussion paper on April 12, 2023. doi:10.5194/egusphere-2023-420.
3. Toft, H, Sykes, J., Schauer, A., Hendrikx, J., and Hetland, A. (in print). AutoATES v2.0: Automated avalanche terrain exposure scale mapping. Accepted for publication in Natural Hazards and Earth System Science. doi:10.5194/nhess-2023-114.
4. Sykes, J., Toft, H., Haegeli, P., and Statham, G. (2024). Automated Avalanche Terrain Exposure Scale (ATES) mapping – Local validation and optimization in Western Canada. Natural Hazards and Earth System Science, 24, 947–971, doi:10.5194/nhess-24-947-2024.

Several additional research articles are currently in preparation and close to submission.

2.5.2 Masters and PhD theses

We had several masters and PhD students graduate in the last 12 months:

- **Stan Nowak (PhD)**
Thesis: Designing for ambiguity in sensemaking: Visual analytics in risk analysis and prediction
available at https://avalancheresearch.ca/pubs/2023_nowak_thesis/
(defended on August 3, 2023)
- **Florian Herla (PhD)**
Thesis: Improving the applicability of large-scale distributed snowpack simulations for operational use in avalanche forecasting
available at https://avalancheresearch.ca/pubs/2023_herla_thesis/
(defended on Oct. 5, 2023)
- **Rosemary Langford (MRM)**
Thesis: How do recreationists manage avalanche risk when travelling in the winter backcountry? Centering the stories of recreationists to identify, characterize, and contextualize avalanche risk management decision-making

available at https://avalancheresearch.ca/pubs/2023_langford_thesis/
(defended on Aug. 15, 2023)

- **Anneliese Neweduk (MRM)**

Thesis: Characterizing an Increasingly Diverse and Growing Backcountry Community: A Holistic and Informative Approach Using Audience Segmentation
available at https://avalancheresearch.ca/pubs/2023_neweduk_thesis/
(defended on Sept. 21, 2023)

John Sykes (PhD), Kelsea Krawetz and Griffin Slimkowich (both Masters) are expected to graduate before the end of 2024.

2.5.3 Publications in Community Journals

Over the last 12 months, the SARP research team did not publish any articles in community journals.

2.5.4 Presentations at Academic Conferences

Our main focus this year was the 2023 ISSW in Bend, OR, where our group presented **13 conference papers** (6 oral presentations and 7 poster presentations). We did not attend any other academic conferences during the last 12 months.

1. Horton, S., Haegeli, P., Statham, G., Shandro, B., Clark, T., Nowak, S., Towel., M., Hordowick, H., and Herla, F. (2023). Is it a problem? Takeaways from research into the use and effectiveness of avalanche problems. Oral presentation at the 2023 International Snow Science Workshop in Bend, OR, October 8-13, 2023, 26-31. Proceeding paper available at <https://arc.lib.montana.edu/snow-science/item/2849>.
2. Haegeli, P., St. Clair, A., McNeil, K., Mannberg, A., and Hetland, A. (2023). Reflections on how to improve the contribution of social science research to avalanche safety practices. Oral presentation at the 2023 International Snow Science Workshop in Bend, OR, October 8-13, 2023, 72-79. Proceeding paper available at <https://arc.lib.montana.edu/snow-science/item/2856>.
3. Sykes, J., Haegeli, P., Atkins, R., Mair, P., Bühler, Y. (2023). Quantitatively capturing decision-making practices of mechanized ski guides using GPS tracking, avalanche terrain modeling and Bayesian network. Oral presentation at the 2023 International Snow Science Workshop in Bend, OR, October 8-13, 2023, 86-93. Proceeding paper available at <https://arc.lib.montana.edu/snow-science/item/2858>.
4. Herla, F., Haegeli, P., Horton, S., and Mair, P. (2023). How many snow profiles can you process? Making the wealth of information included in large-scale snowpack simulations more accessible for operational avalanche forecasting. Poster presentation at the 2023 International Snow Science Workshop in Bend, OR, October 8-13, 2023, 212-217. Proceeding paper available at <https://arc.lib.montana.edu/snow-science/item/2878>.

5. Nowak, S., Haegeli, P., and Bartram, L. (2023). Designing digital tools to support handoff at shift changes in avalanche forecasting. Poster presentation at the 2023 International Snow Science Workshop in Bend, OR, October 8-13, 2023, 280-286. Proceeding paper available at <https://arc.lib.montana.edu/snow-science/item/2888>.
6. Haegeli, P., Mitterer, Ch., Stucki, Th., Walcher, M., Rupf, R. (2023). Insights on how avalanche forecast users combine danger ratings with steepness to assess the avalanche risk of individual slopes during trip planning. Poster presentation at the 2023 International Snow Science Workshop in Bend, OR, October 8-13, 2023, 366-372. Proceeding paper available at <https://arc.lib.montana.edu/snow-science/item/2902>.
7. Herla, F., Haegeli, P., Horton, S., Mair, P. (2023). A quantitative module of avalanche hazard—comparing forecaster assessments of avalanche problems with information derived from distributed snowpack simulations. Oral presentation at the 2023 International Snow Science Workshop in Bend, OR, October 8-13, 2023, 532-539. Proceeding paper available at <https://arc.lib.montana.edu/snow-science/item/2929>.
8. Haegeli, P., Mitterer, Ch., Stucki, Th., Walcher, M., Rupf, R. (2023). A research system for a more integrated and responsive contribution of social science research to avalanche safety information product design and evaluation. Poster presentation at the 2023 International Snow Science Workshop in Bend, OR, October 8-13, 2023, 915-922. Proceeding paper available at <https://arc.lib.montana.edu/snow-science/item/2987>.
9. St. Clair, A., and Haegeli, P. (2023). Toward improved effectiveness of public avalanche safety services: a framework for asking constructive questions. Poster presentation at the 2023 International Snow Science Workshop in Bend, OR, October 8-13, 2023, 950-954. Proceeding paper available at <https://arc.lib.montana.edu/snow-science/item/2992>.
10. Latosuo, E., and Haegeli, P. (2023). Attributes of avalanche airbag owners – insights from the Euregio and Swiss avalanche forecast research panels. Poster presentation at the 2023 International Snow Science Workshop in Bend, OR, October 8-13, 2023, 1323-1327. Proceeding paper available at <https://arc.lib.montana.edu/snow-science/item/3053>.
11. Horton, S., Haegeli, P., Klassen, K., Floyer, J., and Helgeson, G. (2023). Adopting snowpack models into an operational forecasting program: successes, challenges, and future outlook. Poster presentation at the 2023 International Snow Science Workshop in Bend, OR, October 8-13, 2023, 1544-1549. Proceeding paper available at <https://arc.lib.montana.edu/snow-science/item/3095>.
12. Hetland, A., Hetland, R., Mannberg, A., Skille, T., Haegeli, P., St. Clair, A., McNeil K. (2023). A systematic overview of peer-reviewed research on the human factors in avalanche decision-making. Oral presentation at the 2023 International Snow

- Science Workshop in Bend, OR, October 8-13, 2023, 80-85. Proceeding paper available at <https://arc.lib.montana.edu/snow-science/item/2857>.
13. Neweduk, A., and Haegeli, P. (2023). Characterizing an increasingly diverse and growing backcountry community: A holistic and informative approach using audience segmentation. Oral presentation at the 2023 International Snow Science Workshop in Bend, OR, October 8-13, 2023, 645-652. Proceeding paper available at <https://arc.lib.montana.edu/snow-science/item/2945>.

2.5.5 Technology Transfer

Over the last 12 months, core SARP members gave **13 online and in-person technology transfer presentations** to avalanche safety practitioners and researchers in Canada, the United States and Europe. In total, an estimated 530 avalanche professionals were reached with these presentations (1600 if each presentation is counted individually). Due to Pascal's study leave, we have had a much strong presence in Europe than in other years.

1. Latosuo, E., Haegeli, P., Demuth, J., and Greene, E. (2024). Users' knowledge of uncertainty in public avalanche forecasts. Online presentation at spring meeting of Colorado Avalanche Information Center, April 30, 2024 (size of audience: approx. 40).
2. Haegeli, P. (2024). Von Therwil in die Lawinenforschung in Canada. Spring Staff Social of Wyssen Avalanche Control AG in Reichenbach, Switzerland, April 26, 2024 (size of audience: approx. 50).
3. Haegeli, P. (2024). How are avalanche forecasts used, understood, and applied? Colloquium at WSL Swiss Institute for Snow and Avalanche Research SLF, Davos, Switzerland, April 23, 2024 (size of audience: approx. 80).
4. Herla, P., Horton, S., Haegeli, P., and Mair, P. (2024). Making large-scale snowpack simulations more useful and relevant for avalanche practitioners. Colloquium at WSL Swiss Institute for Snow and Avalanche Research SLF, Davos, Switzerland, April 17, 2024 (size of audience: approx. 80).
5. Haegeli, P. (2024). Wie werden Lawinenprognosen verstanden und benutzt? Oral presentation at the monthly meeting of the Austrian Avalanche Association (OeGSL Semmelnar) in Innsbruck, April 8, 2024 (size of audience: approx. 80).
6. Haegeli, P., and Statham G. (2023). Reflecting on 10 years of operational use of the conceptual model of avalanche hazard: Successes, challenges, and opportunities. Online CPD workshop for Canadian Avalanche Association, December 5, 2023 (size of audience: approx. 45).
7. Haegeli, P. (2023). Reflections on user groups and how to optimize avalanche safety products and services for them. Online workshop for 2023 Parks Canada Forecaster Fall Training. November 16, 2023 (size of audience: approx. 35).

8. Herla, F., Haegeli, P., Horton, S., and Mair, P. (2023). Validating Snowpack Simulations for Critical Layers. Spring Meeting of Canadian Avalanche Association in Penticton, May 4, 2023 (size of audience: approx. 200).
9. Sykes, J., Haegeli, P., Atkins, Roger, and Welch, M. (2023). Characterizing the 2023 Guiding Season – from the guide on the ground and from GPS and avalanche terrain data. Spring Meeting of Canadian Avalanche Association in Penticton, May 4, 2023 (size of audience: approx. 200).
10. Langford, R., and Haegeli, P. (2023). How do Winter Backcountry Recreationists Make Avalanche Risk Management Decisions? Spring Meeting of Canadian Avalanche Association in Penticton, May 3, 2023 (size of audience: approx. 200).
11. Neweduk, A., and Haegeli, P. (2023). More Holistic and Informative Approach for Characterizing Backcountry Community. Spring Meeting of Canadian Avalanche Association in Penticton, May 3, 2023 (size of audience: approx. 200).
12. Haegeli, P. (2023). Facilitating a more user-centered design of avalanche safety products and services. Spring Meeting of Canadian Avalanche Association in Penticton, May 2, 2023 (size of audience: approx. 200).
13. Horton, S., and Haegeli, P. (2023). Insights from research on avalanche problems: Where do we go next to improve hazard assessments. Spring Meeting of Canadian Avalanche Association in Penticton, May 2, 2023 (size of audience: approx. 200).

Due to Pascal’s absence in November/December and the graduation of a substantial number of students, SARP did not contribute to any forecaster and guide’s trainings in the fall of 2023. This will be a focus again in the upcoming fall.

2.5.6 Public Outreach

Due to Pascal’s absence in November/December and the graduation of a substantial number of students, SARP did not contribute to any public avalanche awareness events during the last 12 months. This will be a focus again in the upcoming fall.

We continue to strengthen the **SARP Instagram channel** at [sfu_avalancheresearch](https://www.instagram.com/sfu_avalancheresearch). Our objective is to make our work more accessible by frequently sharing information about our research. We are currently at 80 posts and 840 followers.

2.6 University Teaching

Thanks to Pascal’s study leave, he did not have any teaching responsibilities during the last 12 months.

2.7 Other Relevant Activities

2.7.1 Justice, Equity, Diversity and Inclusion (JEDI)

We continue our efforts to actively contribute to a more just, equitable, diverse and inclusive society. You can find our positionality statement with tangible action items on our website at <https://www.avalancheresearch.ca/jedi/>.

2.8 Awards and Distinctions

In addition to the successful graduation of four SARP students, the work of SARP members was recognized with the following awards and distinctions:

- **Pascal Haegeli**
Recipient of 2023 Gordon Ritchie Service Award of Avalanche Canada “In recognition of your leadership in research, innovation, and the exceptional contributions you have made to public avalanche safety in Canada.”
- **Anne St. Clair**
Recipient of 2023 Avalanche Diva Award at 2023 International Snow Science Workshop in Bend, OR.
- **Anneliese Neweduk**
Recipient of Young Snow Science Professional Award at 2023 International Snow Science Workshop in Bend, OR (all conference expenses).
- **Rosie Langford**
Honouree at 2022-23 Faculty of Environment Excellence in Graduate Research and Engagement Event.

2.9 Challenges

In my opinion, the main operational challenges for my program remain:

- Maintaining a continuous and meaningful connection with supporting organizations and practitioners to ensure the research we work on is meaningful to the community; and
- Providing my students with the training they need to allow them to start a promising career in the avalanche community.

To address the first issue, we are currently talking with HeliCat Canada about establishing a steering committee of industry representatives interesting actively participating in the design and implementation of research projects related to the mechanized skiing industry. Avalanche Canada’s approach with a formal research officer, who is actively involved in our projects and regularly joins our research meetings is working well.

In addition, I am in conversation with Avalanche Canada about creating opportunities for students to join their Vancouver Island/South Coast field program to complement their academic skills with field experience.

Any additional guidance on how to best address these challenges would be welcome.

3 Outlook for Next 12 Months

3.1 Context

Pascal’s study leave will continue until Sept. 1, 2024, when he has to return to full university duties at SFU. This will include teaching two full courses each year, which is a slightly reduced teaching load due to his role as Chair of the REM undergraduate programs.

Pascal's main focus for the remainder of his study leave will be on supporting his students, writing papers, and recharging.

3.2 Personnel

Over the next 12 months, the following students are expected to graduate:

- John Sykes (PhD)
- Kelsea Krawetz (Masters)
- Griffin Slimkowich (Masters)

We will also have following new students joining the program on Sept. 1, 2024:

- Martin Perfler (PhD in Geography)
- Paola Riezler (Masters in REM)
- Nick Rigby (Masters in REM)

In addition, we are excited that Florian Herla and John Sykes will continue in SARP as part-time PostDocs (details depend on available funding). This will result in an overall SARP team of 2 PostDocs, 3 PhD students, 2 Master students, and 1 undergraduate research assistant.

3.3 Priorities

The main properties for the next twelve months are summarized under the four headings research, funding, and outreach.

3.3.1 Research

- Finalize research projects and successfully graduate John, Kelsea and Griffin. This includes the submission of their research for publication.
- Finalize and successfully defend PhD research proposals with Anne and Eeva.
- Onboard new students and develop ideas for their research projects with the entire team and industry partners.
- Strengthen collaborations with international academic and non-academic partners (SLF, Tyrolean AWS, Wyssen, Government of Nunavut)
- Publish past and current research results in academic journals including Henry, Heather, and Anneliese's research. This also includes the results of survey studies conducted in collaboration with the Swiss and Tyrolean avalanche warning services.
- Establish long-term strategy for avalanche forecast user panels of Euregio and Swiss Avalanche Warning Services.
- Support Avalanche Canada in their research and development objectives (e.g., operational snowpack modelling, user panel, estimating size of backcountry user community, avalanche accident database SAR-NIF, etc.).
- Strengthen communication about research project development and implementation with research partners (e.g., HeliCat Canada).

3.3.2 Funding

- Establish research priorities and long-term funding arrangements with HeliCat Canada as well as individual operations (e.g., Mike Wiegele Heliskiing, CMH).

- Discuss continued funding for research collaboration with Swiss and Euregio avalanche warning services.
- Explore possibilities for SSHRC funding opportunities and collaboration with international partners in the risk communication space.

3.3.3 Outreach

- Potentially present SARP risk communication research at the 2024 Natural Hazards Researchers Meeting in mid-July in Boulder, Colorado.
- Present the SARP research at the 2024 International Snow Science Workshop in Tromsø, Norway (October 2024). We have submitted 4 abstracts to the conference! Due to the high cost of the conference, Pascal will be the only SARP member attending the conference.
- Likely not attend the 2024 Annual Meeting of the Society for Risk Analysis (December 2024) as the amount of travel is becoming too much.
- Continue to build a research network outside of traditional avalanche research fields within SFU (e.g., big data, visualization) and beyond (e.g., risk communication).
- Further strengthen public outreach with brief research videos on social media, practical resources on the website, presentations, and articles published in the Avalanche Journal and presentations. Participating in public avalanche awareness events and forecaster/guide's trainings should be a major focus again.

4 Questions

If you have any question about SARP's research activities, please contact Pascal anytime either by email (pascal_haegeli@sfu.ca) or phone (778-782-3579 or 604-773-0854).