

May 3, 2025

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 Catherine Angus (Avalanche Canada)  
Jeff Storck and Fabian Karg (Avalanche Canada Foundation)

## **RE: 2024/25 Supporter Update of SFU Avalanche Research Program**

We 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 is only possible because of your financial contributions and expert input. We are grateful for your support and are looking forward to continuing our work with the Canadian avalanche community.

This document summarizes the SARP team's activities from May 1, 2024, to April 30, 2025, and outlines planned activities for the coming year.

## **1 Team**

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

- Dr. Pascal Haegeli (team leader)
- Dr. Florian Herla (Postdoctoral Fellow)
- Dr. John Sykes (PhD student in Geography, graduated in Aug. 2024, continued as Postdoctoral Fellow)
- Anne St Clair (PhD student in REM, left program without graduating in Nov. 2024)
- Eeva Latosuo (PhD candidate in REM)

- Martin Perfler (new PhD student, started in Sept. 2024)
- Kelsea Krawetz (MRM thesis student, graduated in Oct. 2024)
- Griffin Slimkowich (MRM project student, graduated in Oct. 2024)
- Nick Rigby (new MRM thesis student, started in Sept. 2024)
- Paola Riezler (new MRM thesis student, started in Sept. 2024)
- Zoe Cohen (Undergraduate research assistant)
- Kristin Anthony-Malone (project manager)

In addition, SARP includes the following affiliate members:

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

## 2 2024/25 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) completed his PhD with a study examining run list decisions at CMH Galena and exploring possibilities for the development of operational decision support tools. The main challenge of this work is how to meaningfully describe the characteristics of ski runs and combine this information with avalanche hazard information to provide useful guidance. John employed three different modelling approaches to capture the run list decision-making process (Bayesian Network, Random Forest, and Extreme Gradient Boosting) and achieved overall prediction accuracies of 84.6 %, 91.9 %, and 93.3 %, respectively. John graduated with his PhD in the fall of 2024 and will not further pursue this research direction. However, a new PhD student (Jacopo Borsotti) will be joining the SARP research team this fall to continue this work.

#### 2.1.2 Avalanche Hazard Modelling in Support of Operational Avalanche Forecasting

The core research team in this area consists of Florian Herla (PostDoc), Martin Perfler (new PhD student) and Kelsea Krawetz (Master's student). We continue to work closely with Simon Horton (Research Associate and Research Officer at Avalanche Canada), who regularly attends our group meetings and collaborates on all projects.

**Kelsea Krawetz** (MRM – Thesis) completed her master's research project examining how different precipitation products affect snowpack simulations. To do this, she compared 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. Kelsea's results show that while all precipitation data sources result in an overestimation of height of the snowpack (HS) relative to the observed values across the entire dataset, the experimental version of CaPA is the closest overall. However, there are large regional variabilities and differences between study sites. Observed structural differences in the simulated snowpacks are consistent with differences in HS. The results of this study can help Canadian avalanche forecasters better understand the strengths and weaknesses of different precipitation products for snowpack simulations.

**Florian Herla** (PostDoc) rejoined the research program as a Postdoctoral Fellow to continue his snowpack modelling research. He continues to be involved with the AWSOME project (an open-source software distribution for snow cover modelling; see <https://gitlab.com/groups/avalanche-warning/-/wikis/home> for more details), and the Norwegian avalanche warning service where he helped implement an operational snowpack modelling chain. These international collaborations are extremely valuable for our research program and snowpack modelling in Canada in general.

We recently secured a 2-year Mitacs Elevate Fellowship for Florian in collaboration with Avalanche Canada. The main objectives of Florian's 2-year fellowship are a) curating avalanche activity data and designing regional-scale validations of snowpack simulations; b) developing a Python package to efficiently parse and manipulate large simulation datasets; and c) exploring probabilistic hazard assessment forecasting based on ensemble weather inputs. The results of Florian's research projects will contribute to advancing the snowpack modelling capabilities and their operational value in Canada and beyond.

**Martin Perfler** (PhD) joined us last fall as a new PhD student in the snowpack modelling group. Prior to coming to Vancouver, Martin worked for the Tyrolean avalanche warning service and was heavily involved in the AWSOME project. He is currently in the process of writing his PhD research proposal, which he hopes to defend early fall. The overarching objective of his research will be to complete the avalanche hazard model chain by developing and validating algorithms to extract avalanche problem characteristics and avalanche danger ratings from simulated weather and snowpack information.

**Simon Horton** (Research Associate and Research Officer at Avalanche Canada) continues to be our main point of contact at Avalanche Canada, Simon regularly attends our group meetings and continues to collaborate with us on many projects. In collaboration with Florian and Pascal, Simon recently published a paper on clustering snowpack simulations to highlight areas where conditions are similar.

### 2.1.3 Avalanche Terrain Mapping

**John Skyes** (PostDoc) has started to work on the first objective of the autoATES SAR-NIF project. The goal of this objective is to further develop the autoATES mapping algorithm and validate its output in different snow climate zones across Western Canada. We are working

with several ATES mapping experts (Cam Campbell, Mike Conlan, Eirik Sharp, and Grant Statham) to provide John with local terrain expertise to validate and fine-tune the output of the algorithm. The results of this research will provide us with the necessary confidence to apply the autoATES algorithm at large scales across western Canada.

In addition, we have started to work with Avalanche Canada to design the necessary back-end IT infrastructure for hosting the resulting ATES maps and associate layers at Avalanche Canada.

**Paola Riezler** (MRM – Thesis), also funded by the SAR-NIF autoATES project, aims to examine how European backcountry recreationists use and understand the Skitourenguru (<https://skitourenguru.ch/>), a sophisticated online trip planning tool for backcountry skiing that combines avalanche forecast information with terrain characteristics to compute trip-specific risk ratings. We are working with Günter Schudlach, the developer of the website, and we will use an online survey to poll its users. The results of this research will provide valuable insights for the development of similar tools in Canada.

#### 2.1.4 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.

**Griffin Slimkowich** (MRM – Project) finished his research on avalanche awareness and risk management practices among snowshoers and winter hikers on Mt Seymour on the North Shore Mountains. Griffin’s research found that all study participants exposed themselves to some avalanche terrain, despite their general lack of avalanche awareness, formal training, or use of avalanche information like the public avalanche forecast. Most participants believed that they did not expose themselves to avalanche terrain, highlighting that initiatives raising awareness of what constitutes avalanche terrain, how to recognize it and when it is safe to travel into, are key starting points for increasing avalanche safety among snowshoers and winter hikers. See Griffin’s master’s thesis for more details.

**Anne St Clair** (PhD) continued the development of her framework that takes a detailed look at all the factors affecting 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. Pascal and Anne explored different practical opportunities for applying their framework and organized a workshop on characterizing the contexts and educational needs of European avalanche commissions and safety services at the 2024 ISSW in Tromsø, Norway. In November, however, Anne decided to leave the program and not further pursue her PhD studies. We are exploring possibilities to still publish our framework as we believe it has considerable value for the community.

**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. In addition to successfully defending her PhD research proposal, Eeva’s

first focus this year was on analyzing the survey data we collected on recreationists' understanding and response to uncertainty information in public avalanche forecasts, which we collected during the 2023/24 winter season. Eeva presented the results of this research at the 2024 ISSW in Tromsø, and Pascal and her are currently in the process of writing a manuscript for publication in a peer-reviewed academic journal. This winter, Eeva conducted semi-structured interviews with more than 30 public avalanche forecasters (CAIC and Avalanche Canada) to get their perspective on uncertainty in avalanche forecasting and how to communicate the associated challenges to users. Together with the survey results, the knowledge gained from these interviews will offer valuable insights for the development of new communication approaches that offer users information on uncertainty in ways that resonate with their capabilities and needs.

In addition to supporting all the different student projects, **Pascal Haegeli** continued to collaborate with Avalanche Canada, the CAIC, and the Tyrolean Avalanche Warning Service to better understand their forecast user communities and the effectiveness of their forecast products. The current focus is on helping the collaborating agencies to run smaller but more frequent questionnaires to produce results more quickly without the big overhead of academic studies. While we are still hosting the forecast user research panels for the CAIC and the Tyrolean Avalanche Warning Service, we have been assisting Avalanche Canada with the development and launch of their own user research panel.

### 2.1.5 Estimating winter backcountry use

The lack of reliable estimates of recreational winter backcountry use is one of the key missing links for better understanding the audience of avalanche safety products and services and long-term trends in avalanche mortality. To address this issue, **Nick Rigby** (MRM - Thesis) is currently developing a research proposal to explore several approaches to produce reasonable estimates of the magnitude of regional winter backcountry use in cost-effective ways. Our intent is to conduct a pilot study in the 2025/26 winter to provide Avalanche Canada with guidance on how the explored approaches could be applied at a country scale.

### 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 is now in its final year. Our contributions have included support for the design of the database, assistance with data entry and quality control, the development of an R package for accessing accident data for analysis purposes, and preliminary data analyses. **Zoe Cohen** (Undergrad Research Assistant) has assisted the Avalanche Canada team with data entry and validation full-time since the beginning of the year. Over the summer, Zoe will conduct several statistical analyses to provide insights into the trends and patterns in avalanche accidents over the last 25 years.

## 2.2 Pascal's study leave

Pascal finished his first study leave on August 31 and resumed his full academic responsibilities at SFU on Sept. 1, 2024. He completed his second **2-month visits at the WSL Swiss Institute for Snow and Avalanche Research SLF in Davos, Switzerland** at the end of May 2024. This visit was

supported by a WSL Fellowship, which covered travel and living expenses. The main objective of his stays in Davos was to exchange ideas with Swiss and European colleagues and strengthen existing collaborations.

After returning to Vancouver in the second half of June, Pascal planned to spend **2-3 weeks in Boulder, Colorado**, visiting Julie Demuth at the National Center for Atmospheric Research. However, ongoing severe back issues prevented Pascal from travelling to Boulder. Instead, he spent the last part of his study leave in Vancouver supporting his students.

### 2.3 Data Collection and Infrastructure

The data collection efforts during the 2024/25 winter season included the following efforts:

- **Collection of GPS tracks of professional terrain choices**  
We did not collect any new GPS tracks during the 2024/25 winter. The intent is to redefine the research objectives over the summer of 2025 and restart the GPS tracking efforts in a more targeted way during the 2025/26 winter.
- **HeliCat Incident Reporting and Exchange (HIRE)**  
SARP continues to support the mechanized skiing industry with HIRE, a system for recording and tracking guest and staff incidents and injuries. Since the system's introduction during the 2017/18 winter, 10 HCC member operations use HIRE operationally, and we now have more than 950 incident records in the database.
- **Euregio Avalanche Forecast User Research Panel**  
No further recruitment efforts took place over the 2024/25 winter. However, we continue working with the Tyrolean avalanche warning services to support their efforts to increase their understanding of their forecast users.
- **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. Recruitment efforts by the CAIC continue, and at the time of this writing, 1398 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 **third of four years of a multi-year research contract with the Colorado Avalanche Information Centre** (US\$40,000/yr) for conducting research on uncertainty communication in public avalanche forecasts in Colorado. This collaboration with the CAIC and the Social Science Research Group at the US National Center for Atmospheric Research (NCAR) in Boulder, CO, supports the PhD research of Eeva Latosuo. Pascal is currently in conversations with the CAIC about extending their financial contributions to the program beyond Eeva's PhD project.

We are excited to report that **HeliCat Canada committed to support the research program for another 5 years with \$50,000 per year (2024/25 to 2028/29)**. We are extremely grateful for this support and are looking forward to working closely with operators and practitioners to conduct relevant research for the mechanized skiing industry.

SARP was able to secure a **\$629,854 grant from the SAR-NIF program of Public Safety Canada to map all of avalanche forecast regions in western Canada with autoATES**. The project objectives include a) further developing and locally validating the autoATES algorithm, b) applying the algorithm to map all forecast regions in western Canada, c) developing the necessary infrastructure for 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. This project supports a Postdoctoral Fellow (John Sykes), several Master's students (so far only Paola Riezler), a project manager (Kristin Anthony-Malone), as well as several external consultants and IT developers.

Finally, we secured a **\$120,000 grant from Mitacs in collaboration with Avalanche Canada** to fund a 2-year Postdoctoral Fellowship for Florian Herla. This allows Florian to continue with his snowpack modelling work in collaboration with Simon Horton (Avalanche Canada) and PhD student Martin Perfler. Florian's Postdoctoral fellowship is further supported with **\$22,500/yr from the Norwegian Water Resources and Energy Directorate** (Norwegian avalanche warning service).

## 2.5 Outreach

### 2.5.1 Peer-reviewed Publications

We submitted/published a total of **9 academic peer-reviewed papers** over the last 12 months:

1. Slimkowich, G., and Haegeli, P. (submitted). Understanding exposure to avalanche terrain and avalanche information product use of snowshoers and winter hikers: Insights from Mount Seymour Provincial Park, British Columbia, Canada. Submitted for publication in *Journal for Outdoor Recreation and Tourism* on March 21, 2025.
2. Neweduk, A., and Haegeli, P. (revisions submitted). Exploring Motivations of Winter Backcountry Recreationists for Avalanche Risk Communication, Education, and Product Development. Revisions submitted for publication in *Journal for Outdoor Recreation and Tourism* on March 1, 2025.
3. Sykes, J., Haegeli, P., Atkins, R., Mair, P., and Bühler, Y. (2025). Development of operational decision support tools for mechanized ski guiding using avalanche terrain modelling, GPS tracking, and machine learning. *Natural Hazards and Earth System Science*, 25, 1255–1292. doi: 10.5194/nhess-25-1255-202510.5194/nhess-2024-147.

4. Herla, F., Haegeli, P., Horton, S., and Mair, P. (2025). A quantitative module of avalanche hazard—comparing forecaster assessments of storm and persistent slab avalanche problems with information derived from distributed snowpack simulations. *Natural Hazards and Earth System Science*, 25, 625646, doi: 10.5194/nhess-25-625-2025.
5. Horton, S., Herla, F., and Haegeli, P. (2025). Clustering simulated snow profiles to form avalanche forecast regions. *Geophysical Model Development*, 18, 193-209, doi: 10.5194/gmd-18-193-2025.
6. Herla, F., Haegeli, P., Horton, S., and Mair, P. (2024). A large-scale validation of snowpack simulations in support of avalanche forecasting focusing on critical layers. *Natural Hazards and Earth System Science*, 24, 2727-2756, doi: 10.5194/nhess-24-2727-2024.
7. 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.
8. Van Tilburg, C., Paal, P., Strapazzon, G., Grissom, C. K., Haegeli, P., Hölzl, N., . . . Brugger, H. (2024). Wilderness Medical Society Clinical Practice Guidelines for Prevention and Management of Avalanche and Nonavalanche Snow Burial Accidents: 2024 Update. *Wilderness & Environmental Medicine*, 35(1), 20S-44S. doi: 10.1016/j.wem.2023.05.014.
9. Toft, H., Sykes, J., Schauer, A., Hendrikx, J., and Hetland, A. (2024). AutoATES v2.0: Automated avalanche terrain exposure scale mapping. *Natural Hazards and Earth System Science*, 24, 1779–1793. doi: 10.5194/nhess-24-1779-2024.

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

### 2.5.2 Master's and PhD theses

We had 1 PhD and 2 master's students graduate in the last 12 months:

- **John Sykes (PhD)**  
Thesis: Building the quantitative foundation of decision-support tools for backcountry snow avalanche risk assessment using avalanche terrain modeling, GPS tracking, and machine learning  
available at [https://sfuarp.ca/publications/2024\\_sykes\\_thesis/](https://sfuarp.ca/publications/2024_sykes_thesis/)  
(defended on August 19, 2024)

- **Griffin Slimkowich (MRM)**  
Thesis: Understanding exposure to avalanche terrain and avalanche information product use of snowshoers and winter hikers: Insights from Mountain Seymour Provincial Park  
available at [https://sfuarp.ca/publications/2024\\_slimkowichthesis](https://sfuarp.ca/publications/2024_slimkowichthesis)  
(defended on Oct. 1, 2024)
- **Kelsea Krawetz (MRM)**  
Thesis: Assessing the impact of precipitation inputs on snowpack simulations in Western Canada  
available at [https://sfuarp.ca/publications/2024\\_krawetz\\_thesis/](https://sfuarp.ca/publications/2024_krawetz_thesis/)  
(defended on Oct. 8, 2024)

### 2.5.3 Publications in Community Journals

Eeva Latosuo and Pascal recently published the following article in the American Avalanche Association's The Avalanche Review. The same article is currently in press in the CAA's Avalanche Journal and the inaugural English version of bergundsteigen, the mountain safety magazine of the German speaking Alpine Clubs (Austria, Switzerland, Germany, South Tyrol).

1. Latosuo, E., and Haegeli, P. (2025). Users' awareness and response to uncertainty information in public avalanche forecasts. The Avalanche Review, 43.4, 34-36.

In addition to this article, SARP's risk communication research was featured in a long interview in the Winter 2023/24 issue of analyse:berg, the biannual magazine of the Austrian Curatorium for Alpine Safety. See <https://alpinesicherheit.at/lawinenprognosen-interview-mit-pascal-haegeli/> for the full interview in German.

### 2.5.4 Presentations at Academic Conferences

Our main focus this year was the 2024 ISSW in Tromsø, Norway, where members of our group presented **7 conference papers**.

1. Latosuo, E., Haegeli, P., Demuth, J., and Greene, E. (2024). Users' awareness and response to uncertainty information in public avalanche forecasts. Oral presentation at the 2024 International Snow Science Workshop in Tromsø, Norway, Sept. 23-29, 2024, 1618-1625. Proceeding paper available at <https://arc.lib.montana.edu/snow-science/item/3360>.
2. St. Clair, A., Haegeli, P., Steinkogler, W., Winkler, M., Gasperi, A., and Schwartz, J. (2024). Differentiating contexts across European avalanche commissions to support future development: An invitation to unify efforts. Poster presentation at the 2024 International Snow Science Workshop in Tromsø, Norway, Sept. 23-29, 2024, 1389-1394. Proceeding paper available at <https://arc.lib.montana.edu/snow-science/item/3326>.
3. Krawetz, K., Horton, S., and Haegeli, P. (2024). Assessing the impact of precipitation inputs of snowpack simulations in Western Canada. Poster presentation at the 2024 International Snow Science Workshop in Tromsø, Norway, Sept. 23-29, 2024, 484-

492. Proceeding paper available at <https://arc.lib.montana.edu/snow-science/item/3178>.
4. Horton, S., Herla, F., and Haegeli, P. (2024). A clustering technique to identify spatial patterns in snow cover model output. Oral presentation at the 2024 International Snow Science Workshop in Tromsø, Norway, Sept. 23-29, 2024, 58-64. Proceeding paper available at <https://arc.lib.montana.edu/snow-science/item/3112>.
  5. Slimkowich, G., and Haegeli, P. (2024). Understanding exposure to avalanche terrain and avalanche information product use of snowshoers and winter hikers: Insight from Mount Seymour Provincial Park. Poster presentation at the 2024 International Snow Science Workshop in Tromsø, Norway, Sept. 23-29, 2024, 484-492. Proceeding paper available at <https://arc.lib.montana.edu/snow-science/item/3365>.
  6. Mannberg, A., Johansson, M., and Latosuo, E. (2024). Is it a man's world? Gendered professional experiences in snow and avalanche safety. Oral presentation at the 2024 International Snow Science Workshop in Tromsø, Norway, Sept. 23-29, 2024, 1465-1472. Proceeding paper available at <https://arc.lib.montana.edu/snow-science/item/3338>.
  7. Perfler, M., Binder, M., and Mitterer, Ch. (2024) Unveiling spatial patterns in avalanche bulletins: Clustering analysis of microregions using SNOWGRID. Poster presentation at the 2024 International Snow Science Workshop in Tromsø, Norway, Sept. 23-29, 2024, 101-105. Proceeding paper available at <https://arc.lib.montana.edu/snow-science/item/3119>.

Together with Andrea Mannberg and Philip Ebert, Pascal is currently serving as the managing editor team for the 2024 ISSW special issue in the Journal of Outdoor Recreation and Tourism.

In addition to the above papers, we also organized the following practitioner workshop at the ISSW on the topic of European avalanche commissions and safety services:

1. St. Clair, A., Haegeli, P., and Steinkogler, W., Winkler, M., Gasperi, A., Schwartz, J. (2024). The state of avalanche commissions and safety services. Workshop during 2024 International Snow Science Workshop in Tromsø, Norway. Sept. 23, 2024 (size of audience: approx. 60).

Thanks to Eeva Latosuo for moderating the workshop together with Walter Steinkogler when Pascal could not travel to Norway due to his back issues.

While Pascal submitted abstracts to several other conferences (49<sup>th</sup> Annual Natural Hazards Research and Applications Workshop in Boulder, CO; SRA Annual Meeting in Austin, TX), his back issues unfortunately prevented him from attending these conferences.

### 2.5.5 Technology Transfer

Over the last 12 months, core SARP members gave **10 in-person technology transfer presentations** to avalanche safety practitioners and researchers in Canada, the United States and Europe. In total, an estimated 610 avalanche professionals were reached with these

presentations (1310 if each presentation is counted individually). Thanks to Pascal's extended stay at the SLF in Switzerland, SARP also had a presence in Europe.

1. Slimkowich, G., and Haegeli, P. (2024). Understanding Exposure to Avalanche Hazard and Avalanche Information Product Use of Snowshoers and Winter Hikers: Insights from Mt Seymour Provincial Park. Spring Meeting of Canadian Avalanche Association in Penticton, May 9, 2024 (size of audience: approx. 200).
2. Sykes, J., and Haegeli, P. (2024). Automated Run List Coding – Combining GPS Tracking, Avalanche Terrain Modelling, and Operational Data to Predict Daily Run Lists. Spring Meeting of Canadian Avalanche Association in Penticton, May 9, 2024 (size of audience: approx. 200).
3. Latosuo, E., Haegeli, P., Demuth, J., and Greene, E. (2024). Users' knowledge of uncertainty in public avalanche forecasts. Spring Meeting of Canadian Avalanche Association in Penticton, May 8, 2024 (size of audience: approx. 200).
4. Krawetz, K., Haegeli, P., and Horton, S. (2024). Assessing the Impact of Precipitation Inputs on Snowpack Simulations in Western Canada. Spring Meeting of Canadian Avalanche Association in Penticton, May 7, 2024 (size of audience: approx. 200).
5. Sykes, J., and Haegeli, P. (2024). Automated Run List Coding – Combining GPS Tracking, Avalanche Terrain Modelling, and Operational Data to Predict Daily Run Lists. Spring Meeting of HeliCat Canada in Penticton, May 6, 2024 (size of audience: approx. 120).
6. Haegeli, P. (2024). Wie werden Lawinenprognosen verstanden und benutzt? Oral presentation at the annual meeting of the Austrian avalanche warning services in Wieselburg, Austria, May 14, 2024. (size of audience: approx. 40)
7. Haegeli, P., Latosuo, E., Demuth, J., and Greene, E. (2024). Users' awareness and response to uncertainty information in public avalanche forecasts. Wyoming Snow and Avalanche Workshop in Jackson Hole WY, October 18, 2024 (size of audience: approx. 200).
8. Slimkowich, G., and Haegeli, P. (2024). Understanding Exposure to Avalanche Terrain and Avalanche Information Product Use of Snowshoers and Winter Hikers: Insights from Mount Seymour Provincial Park. Avalanche Canada fall staff training in Revelstoke BC, Nov. 14, 2024 (size of audience: approx. 50).
9. Haegeli, P., Latosuo, E., Demuth, J., and Greene, E. (2024). Users' awareness and response to uncertainty information in public avalanche forecasts. Avalanche Canada fall staff training in Revelstoke BC, Nov. 14, 2024 (size of audience: approx. 50).
10. Haegeli, P., and Sykes, J. (2024). Large-scale Avalanche Terrain Exposure Scale (ATES) Mapping for Mountainous Regions in Canada. Avalanche Canada fall staff training in Revelstoke BC, Nov. 14, 2024 (size of audience: approx. 50).

### 2.5.6 Public Outreach

SARP contributed to three public avalanche awareness events (2 in person and 1 online) during the last 12 months, where we reached approximately 850 backcountry recreationists.

1. Latosuo, E., Haegeli, P., Demuth, J., and Greene, E. (2024). Users' knowledge of uncertainty in public avalanche forecasts. Colorado Snow and Avalanche Workshop, Breckenridge, CO, Oct. 18, 2024 (size of audience: approx. 400).
2. Haegeli, P. and SARP Research Team (2024). What we know about what works in public avalanche forecasts and what does not. Wyoming Snow and Avalanche Workshop in Jackson Hole WY, Oct. 19, 2024 (size of audience: approx. 250)
3. Slimkowich, G., and Haegeli, P. (2024). Understanding Exposure to Avalanche Hazard and Avalanche Information Product Use of Snowshoers and Winter Hikers: Insights from Mt Seymour Provincial Park. BC Adventure Smart Winter Webinar Series, December 11, 2024 (size of audience: approx. 200).

We have updated our website at [avalancheresearch.ca](http://avalancheresearch.ca) and 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 933 followers.

### 2.6 University Teaching

Pascal taught his course on **avalanche risk management** (REM427/627) for the third time in the spring term of 2025. The popularity of the course continuous to increase, and we had 21 students in the course this year (18 undergraduate, 2 graduate students, and 1 auditing student). See <https://sfuarp.ca/rem427/> for a detailed overview of the course content.

We thank Wren McElroy (BC MoTI Hope), Andrew Jones (Glacier National Park), Erin Tierney (Whistler Heliskiing), Bret Shandro (6 Point Engineering), Nicole Koshure (Whistler-Blackcomb), and Ryan Buhler (Avalanche Canada) for acting as industry contacts for the final group project in the course. Pascal also thanks Martin Perfler for supporting him while he was recovering from his back surgery.

Pascal will teach this course again in Spring 2027. To further expand the reach of the course, he is planning to talk to other programs at SFU (e.g., physical geography, earth science, environmental science) to see whether the course could be included as an elective. In addition, he would like to explore whether the course could also be offered to UBC students, there the pool of potentially interested students is much larger (e.g., civil engineering, earth science, physical geography).

### 2.7 Other Relevant Activities

#### 2.7.1 New practitioner engagement strategy

For several years, we have expressed challenges about connecting to practitioners in more meaningful ways. To build a closer connection to avalanche professionals that facilitates the design of relevant research and strengthens the transfer of research results to operational use, we are in the process of developing a **new SARP engagement strategy for the practitioner**

**community.** In addition to our existing strong relationships with organizations (CAA, HCC, Avalanche Canada, Mike Wiegele Heliskiing) and individual research collaborators (e.g., Simon Horton, Stan Nowak, Roger Atkins, Grant Statham), we are adding the following two components:

- **Practitioner advisory committee**

The purpose of this committee is to provide industry input at a strategic but also practical level. The individuals in this group should be involved in operations but at a high enough level that they have a good understanding of the bigger (long-term) picture. They should also act as champions of the research, who can help with the transfer of research results to operational tools. This group should provide opportunities for the development of new research collaborations with individuals and/or operations.

- **Industry segment specific frontline worker research forums**

We intent to have several of these industry segment specific groups (e.g., mechanized skiing, highways, ski areas) depending on existing needs. The purpose of these groups is to provide practical feedback and ideas from “the trenches.” These groups are less formal than the advisory committee and members join and leave as they wish.

We formed an initial practitioner advisory committee and had a kick-off meeting in late April to discuss objectives and next steps. The current members of the practitioner advisory committee include:

- Mike Sadan (HeliCat)
- Erin Tierney (WHS, CSGA)
- Jenny Citherlet (MWHS)
- Scott Thumlert (CMH, CAA Tech Com)
- Marc Piche (HCC Inspector)
- Geoff Osler (ACMG)
- Grant Statham (Parks Canada)
- Wren McElroy (MoTI Hope)
- Nicole Koshure (Whistler-Blackcomb)

We will further develop our engagement strategy with the support of the new practitioner advisory committee over the summer and fall. We aim to have the first practitioner forums next winter.

### 2.7.2 Increasing student opportunities for practical training

Providing SARP students with the practical (i.e., non-academic) training they need for starting a promising career in the avalanche safety community has been another significant concern for Pascal in the past. To address this issue, Avalanche Canada offered to explore including qualified SARP students in their field teams. During the last winter, Martin Perfler (new PhD student) joined the Vancouver Island field team for one trip on the Mainland each month. Big thanks to Avalanche Canada and their field team for providing this opportunity. We will discuss

the outcome of the first winter with Avalanche Canada over the summer and explore possibilities for next winter.

Pascal has also been in conversation with Nicole Koshure (Whistler-Blackcomb) to explore opportunities for stronger, mutually beneficial collaborations that could give students access to practical avalanche safety experience and offer research support for Whistler-Blackcomb at the same time.

### 2.7.3 Long-term research capacity building

There has been considerable interest from the professional avalanche safety community (particularly the engineering segment of the community) to (re-)strengthen snow science-focused avalanche safety research in Canada. Building on the existing research capacity, Pascal and Joe Obad (Canadian Avalanche Association) have developed a proposal for a **strategy towards establishing a second avalanche safety related research chair at a Canadian university**. The proposal is currently being shared with community stakeholders to get feedback and gather support.

### 2.7.4 British Columbia Injury Prevention Alliance (BCIPA)

The BCIPA is an independent strategic alliance of organizations in British Columbia (e.g., government agencies, health authorities, research institutions, and non-profit organizations) that work collaboratively to reduce preventable injuries. Chaired by the BC Centre for Disease Control (BCCDC), the alliance aims to create coordinated leadership and action across the province in injury prevention, focusing on advising and assisting each other on research, policies, and programs, and identifying and promoting evidence-based priorities. Pascal has been attending the biannual meeting for the last two years and has provided detailed presentations on Canada's avalanche safety community and his research program.

### 2.7.5 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://sfuarp.ca/jedi/>.

## 2.8 Awards and Distinctions

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

- **Eeva Latosuo**  
Recipient of 2024 Avalanche Diva Award at 2024 ISSW in Tromsø, Norway.
- **Kelsea Krawetz**  
Recipient of 2024 ISSW travel award from American Avalanche Association.
- **Florian Herla**  
Recipient of 2024 Graduate Dean's Convocation Medal Award from the Faculty of Environment for his PhD dissertation, Simon Fraser University.

## 2.9 Challenges

We have taken significant steps towards addressing the two main challenges highlighted in this section in the past:

- 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.

See Section 2.7 for more details on our efforts in these areas.

The biggest challenges for the last 12 months were a) Pascal dealing with severe back issues which resulted in back surgery in later February, and b) Anne St. Clair quitting the program. While research program always continued, these challenges affected the research program substantially, and we are not as far as we wished in several research projects.

## 3 Outlook for Next 12 Months

### 3.1 Context

On Aug. 1, 2025, Pascal will start a 3-year term as the Director of SFU's School of Resource and Environmental Management. This is a 50% appointment with a reduced teaching load (1 course per year instead of 3). Pascal will still have time for conducting research and supervising graduate students, but his new role will represent a significant shift in Pascal's workload and will require considerable support from the rest of the team for keeping the research productivity at the same level.

### 3.2 Personnel

Over the next 12 months, we do not expect any students to graduate, but we will have four new students join the program on Sept. 1, 2025:

- Jacopo Borsotti (PhD in REM)
- Robyn Anderson (Masters in REM)
- Declan Knies (Masters in REM)
- Zoe Cohen (Masters in REM)

This will result in an overall SARP team of 2 PostDocs, 3 PhD students, 4 Master students, and 1 project manager.

### 3.3 Priorities

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

#### 3.3.1 Research

- Finalize and successfully defend PhD research proposals with Martin.
- Design and successfully execute research projects with Nick and Paola.
- Analyse and publish quantitative and qualitative research with Eeva.

- Complete trend and pattern analyses for Avalanche Canada’s avalanche accident database.
- Onboard new students and develop ideas for their research projects with the entire team and industry partners.
- Strengthen international collaboration and research infrastructure for avalanche forecast user research and evidence-based product development (Tyrolean AWS, CAIC, Avalanche Canada).
- Publish past and current research results in academic journals more efficiently. This includes the results of survey studies conducted with the Swiss and Tyrolean Avalanche Warning Services as well as Henry, Heather, Rosie, and Kelsea’s research.
- Establish long-term strategy for avalanche forecast user panels of Euregio Avalanche Warning Services and the CAIC.
- 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.).

### 3.3.2 Funding

- Secure Mitacs funding for Nick Rigby.
- Finalize continued funding for research collaboration with Euregio Avalanche Warning Services and Colorado Avalanche Information Center.
- Secure continued funding for Florian from Norwegian Avalanche Warning Service.
- Explore funding opportunities with other Canadian community stakeholders (e.g. Canadian Avalanche Association, Mike Wiegele Heliskiing).
- Explore possibilities for SSHRC funding opportunities and collaboration with international partners in the risk communication space.

### 3.3.3 Outreach

- 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, public health).
- Completely update SARP website and have a stronger and more consistent presence on Instagram.
- 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.
- Participate 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](mailto:pascal_haegeli@sfu.ca)) or phone (778-782-3579 or 604-773-0854).