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# Permafrost Data Systems

## RCOP 2021 Data Workshop Report

Joint 2021 Regional Conference on Permafrost (RCOP) and 19th  
International Conference on Cold Regions Engineering (ICCRE)

**Nick Brown,  
Hannah Macdonell,  
Emilie Stewart-Jones,  
Stephan Gruber**

[www.permafrostnet.ca](http://www.permafrostnet.ca)



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## Summary

A data workshop session was held as part of the 2021 Regional Conference on Permafrost. The aims of the session were to (1) connect researchers and practitioners actively involved in the production, curation, and dissemination of permafrost data; (2) to identify current problems and limitations; and (3) to recommend how efforts can be better connected or coordinated. This report summarizes workshop results for items (2) and (3), and records the interactions and discussions.

Previous permafrost workshops have highlighted the need to make permafrost data more accessible, and the need for support at all steps in the data life cycle<sup>1,2,3</sup>. Most recently, the [2020 NSERC PermafrostNet data workshop](#) highlighted the importance of continued communication and collaboration in the permafrost data space to develop connections between data collectors, managers and users<sup>4</sup>.

The following set of challenges and recommendations summarize the workshop discussion and activities:

### Challenges

- The resources, capacity and services needed for permafrost data management mostly do not exist at present, but are required, for example, for (co-)development, documentation, development of standards, governance, and technical support.
- No international standards for permafrost data exist.

### Recommendations

- Make data readable by humans and computers, and traceable to the original state.
- Understand and meet the needs of diverse user groups, e.g., scientific data users, practical data users, data collectors, and managers.
- Take iterative small steps to balance the needs for fast progress (acting immediately with few standards) and high quality (broad consultation with detailed standards).
- A permafrost data management ecosystem should simplify data standardization and publication process so that contributions can be recognized and cited; and allow for different types of data, backward compatibility, and import of legacy data.
- While a customized system is not available, seek support for publishing and archiving of data with generic standardization advice from data librarians.

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<sup>1</sup> Pan-Territorial Permafrost Workshop

[https://www.northernadaptation.ca/sites/default/files/pan-territorial\\_permafrost\\_workshop\\_report\\_0.pdf](https://www.northernadaptation.ca/sites/default/files/pan-territorial_permafrost_workshop_report_0.pdf)

<sup>2</sup> Towards a Canadian Permafrost Network:

[https://carleton.ca/permafrost/wp-content/uploads/WorkshopPermafrostNetworkOttawa2017\\_-Report.pdf](https://carleton.ca/permafrost/wp-content/uploads/WorkshopPermafrostNetworkOttawa2017_-Report.pdf)

<sup>3</sup> Pan-Northern Meeting on Permafrost Hazard Mapping

[https://northernadaptation.ca/sites/default/files/summary\\_report\\_final\\_compressed.pdf](https://northernadaptation.ca/sites/default/files/summary_report_final_compressed.pdf)

<sup>4</sup> Permafrost Data Workshop Final Report <https://doi.org/10.22215/pn/10120001>

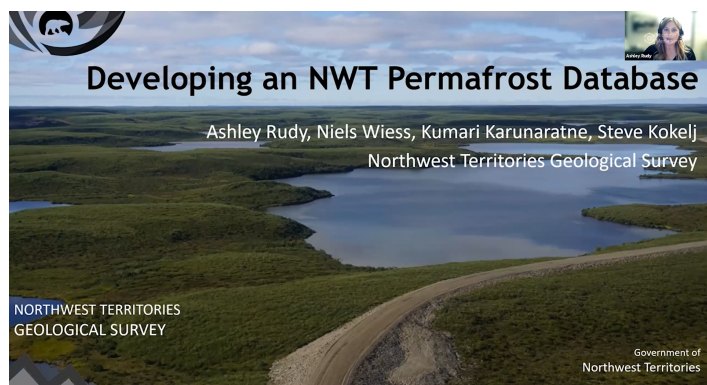
This workshop report was authored by members of the NSERC funded strategic partnership network NSERC PermafrostNet, Nick Brown, Hannah Macdonell, Emilie Stewart-Jones, and Stephan Gruber who all took part in the workshop.

## Workshop Description

The workshop was divided into two activities; expert presentations followed by group discussion. The session began with invited speakers Ashley Rudy and Jeanette Nötzli presenting on behalf of organizations responsible for the collection, standardization and dissemination of permafrost data.

## Presentations

### *Developing an NWT Permafrost Database - Ashley Rudy, NTGS.*



The Northwest Territories Geological Survey (NTGS) has developed a database that holds 537 ground temperature datasets and geotechnical data from over 4,700 boreholes, sourced from a range of academic and government institutions and industry. The next step is to make the database publicly accessible through the NTGS website. Challenges exist around motivating data sharing, quality control and navigating the government system.

A centralized database makes data available to all stakeholders (indigenous, territorial, and federal departments or organizations, the public, engineers, and consultants), for informing adaptation planning, assessing infrastructure performance, and improving northern governance.

### *Processing and management of (mountain) permafrost data - Jeanette Nötzli, PERMOS*

The Swiss Permafrost Monitoring Network (PERMOS) database contains data from the Swiss Alps, including ground temperature, ground ice content, rock glacier velocity, a rock fall database, and meteorological data. The data acquisition process can be broken down into two parts: the field measurements, and the data management system. Three principles are followed for the data management system: (1) treat metadata as data and carefully document it, (2) regularly assess data quality and homogeneity, and (3) prioritize accessibility and the use and



interpretation of data. A focus of the presentation was on the PERMOS method for processing ground temperature data. The cycle, amplitude, and variability of temperature data changes with depth, therefore temperature data processing is depth-dependent.

## Discussion

In the second part of the workshop, the participants were invited to take part in two rounds of discussion. In the first round participants were provided five breakout rooms to facilitate small group discussion. Discussion was prompted by asking each group to identify apparent paradoxes or competing priorities in the permafrost data space. Breakout groups reported back to the plenary session with their top selections from their list (Figure 1):

### Competing Interests for Permafrost Data

- It is great to have standards and templates for new data, but what happens with old data, or changing standards?
- Striking a balance between having too few standards so that the data is not interoperable, and too many standards so that it limits the use and value of the data.
- A lot of documentation, standards and technical support are required for data management, but this takes time and resources.
- We want the data to be readable by humans, but also by computers
- We want a data system to allow for different types of data, but we also want it to be standardized
- We want to create a system that combines the needs of data users, collectors and managers
- We want data to be publicly available, but we also want to be recognized for our data contribution
- Providing data that is not overly modified from its original state, but that is still usable
- Challenges of back compatibility for archived data vs time constraints to do it
- Acting immediately vs consulting everyone on what to do: where do you draw the line?

**Figure 1:** Responses from workshop breakout groups. Participants were asked to identify apparent contradictions or paradoxes in the permafrost data space.

The second round of discussion was held in the plenary session and invited participants to identify challenges, solutions and opportunities for permafrost data management. The discussion raised a variety of important issues that can be organized along four major themes; standardization, policy, variability, and technological systems. The key points identified by workshop participants are listed in Figure 2:

## Standardization

- There are not any international standards for permafrost data.
- Use librarians to meet the first level of standardisation. There are librarians whose job is to meet standards. These standards may cross disciplines and boundaries and could benefit from the broad experience of librarians.
- Adopting data format templates, and standards to use for measurement has benefits and allows data to be comparable. But what happens to old data?
- We need to strike a balance between having so few standards that the data is not interoperable, and having so many standards that the use and value of the data is limited.
- For data standards to be valuable, they require a lot of documentation. This takes time and resources beyond what is necessary to actually standardize the data.

## Policy

- How can we motivate people to share data?
- Research grants or federal departments increasingly require data produced by funded projects to be openly available (top-down approaches)

## Technological Systems

- Develop systems for moving data from the acquisition stage to data storage. As a first step, this could mean achieving a minimum viable product for a data collection system.
- Develop a system for easily converting permafrost data from human-readable to computer-readable forms

## Variability

- Different disciplines use multiple types of data. How can we analyse different types of data from different domains together in a coherent way?
- How to combine different types of data.
- There are different needs for different groups: consider the data user and the data manager.
- What are the needs of these different groups? How can we discover, meet and combine the needs?

**Figure 2:** Challenges, solutions, and opportunities in permafrost data that were identified by workshop participants. Items have been grouped into four major themes.

## Conclusion

This workshop identified current problems and limitations with permafrost data systems, and participants recommended some approaches to connect or coordinate data better. The first round of discussion highlighted a variety of challenges that helps the permafrost data community of practice to take steps to resolve or accommodate these competing interests, such as having enough standards to make data interoperable but not too many to limit the use and value of the data. The second round of discussion raised a wide range of issues with permafrost data, some of which are technical and some that relate to resource availability and people's needs. The discussion also provided suggestions for ways to address these problems, such as engaging with librarians to develop standards or developing an initial data collection system that would enable data to be moved from acquisition to storage.

## **Follow-up and next steps**

The challenges and competing objectives in permafrost data could be used to identify priorities for next steps in the development of a collaborative permafrost data ecosystem. The formation of a working group either formally, through the International Permafrost Association for instance, or informally could use the items in Figure 2 as a starting point to select objectives and priorities.

## **Authors**

Nick Brown, NSERC PermafrostNet; Hannah Macdonell, Carleton University; Emilie Stewart-Jones; Carleton University; and Stephan Gruber, Carleton University.

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