Improving accessibility of geophysical permafrost monitoring data with a Canadian permafrost electrical resistivity survey database: Applications in Northern communities

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What is ERT?

Electrical resistivity tomography (ERT) uses sensors at the ground surface to produce an image of the earth's electrical resistivity. ERT is a great way to understand subsurface conditions without drilling or otherwise disturbing the environment.

What can ERT tell us about permafrost?

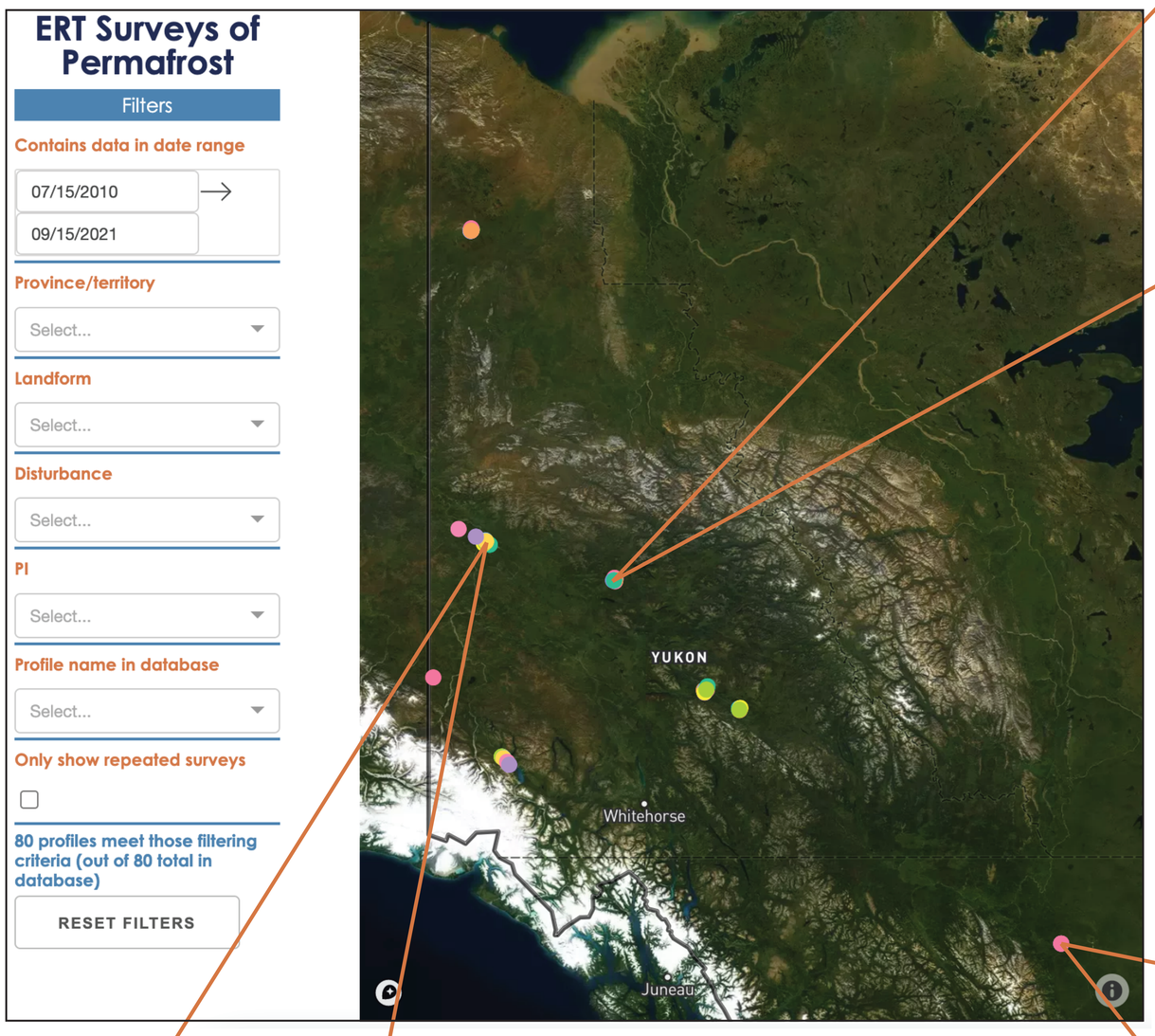
Ice has a much higher electrical resistivity than water. This means that earth materials are usually much more resistive when they are frozen, especially if there is a lot of ice! Permafrost is often visible in ERT images as a high resistivity zone (shown in blue on the images below).

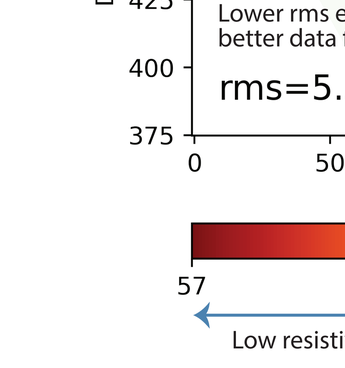
Why do we need a database?

Our database will enable standardized sharing of ERT data, both recent and historical, so that it is accessible to everyone. Our goal is to facilitate collaboration between scientists, engineers, and Northerners in order to better understand permafrost conditions and how they are changing over time.

How will people use the database?

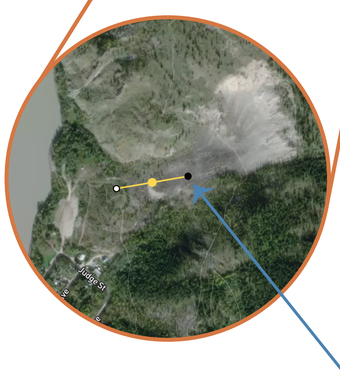
We are working on a website that shows where ERT surveys have been carried out. The website will allow users to search for datasets that meet different criteria and easily plot the ERT survey results (with no specialized software needed). Here, we show snapshots of the website with some examples of how ERT data can be used in Northern communities.





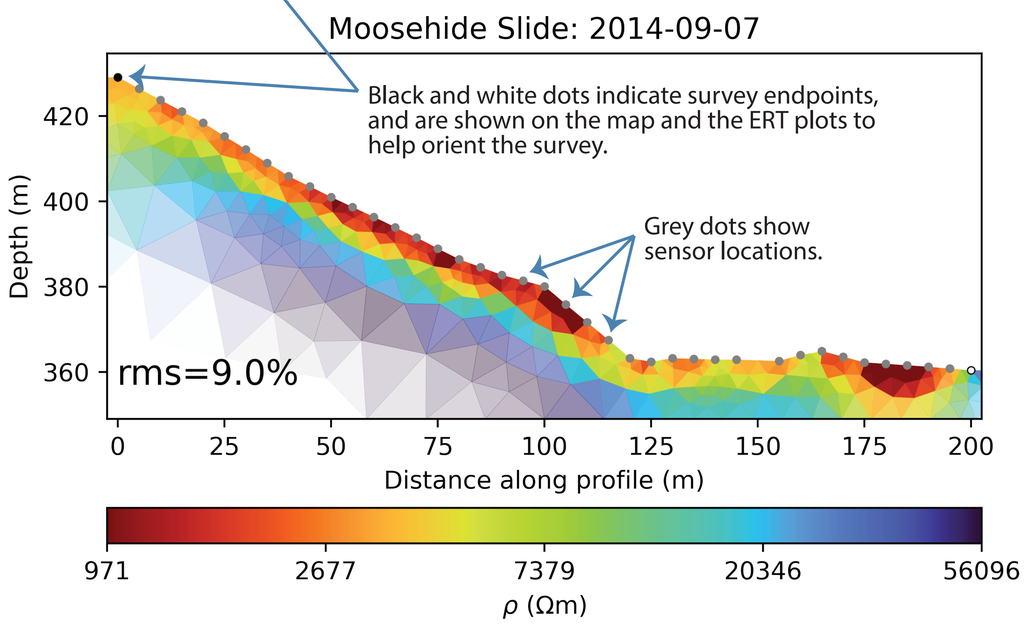
Assessing infrastructure

Man-made infrastructure often causes the underlying earth to warm. If ice-rich permafrost thaws beneath a road or building, the resulting ground settlement can cause major structural issues. This ERT profile, collected at the Mayo airport in 2010, shows where permafrost has thawed adjacent to the airstrip (in red). This end of the strip has undergone subsidence and cracking, undoubtedly due to permafrost thaw - an obvious safety concern.



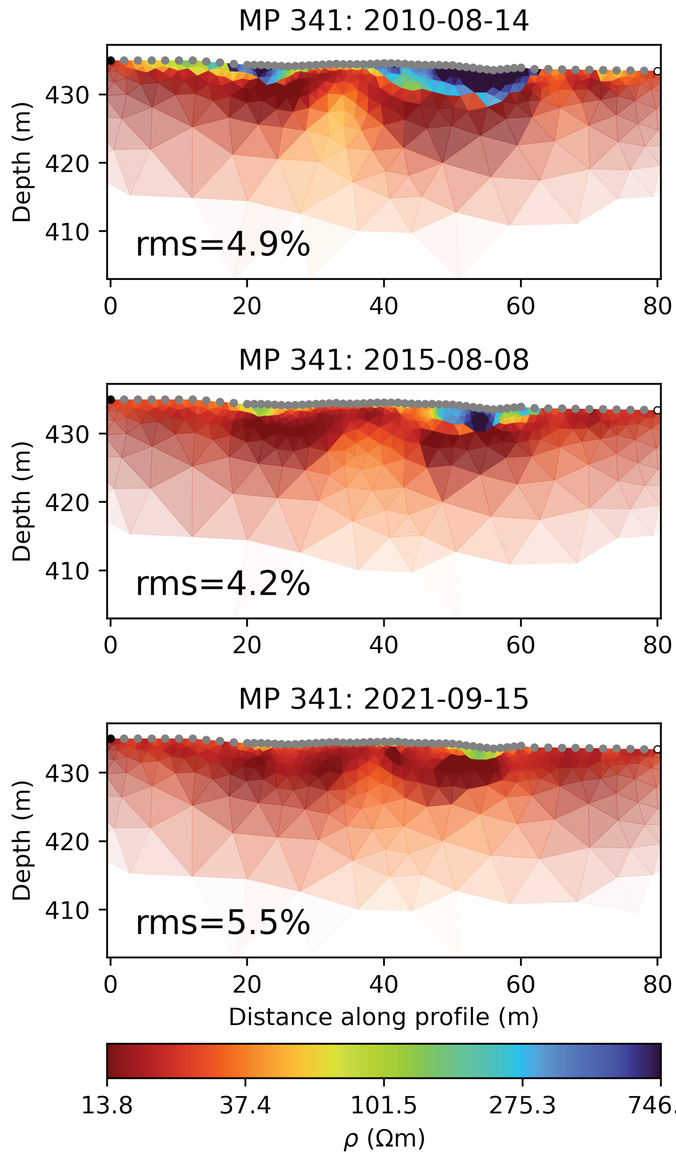
Mapping landforms and hazards

ERT can be used to better understand the internal characteristics of permafrost landforms. This landslide near Dawson City occurred long ago, but slow movement is still occurring today. An ERT survey at this site shows a deep active layer (in red) and very resistive permafrost (in blue), indicating the permafrost is ice-rich.



Studying the impacts of climate change

Repeated ERT surveys can indicate how permafrost conditions are changing over time. This is especially important for understanding the impacts of climate warming. At this site, ERT data are collected using a permanent survey line during field visits every summer. The extent of the thin permafrost layer (shown in blue) has diminished over the ~10 year monitoring period. Frost probing confirmed that only a small patch of permafrost remains at this site.



Want to learn more?

Scan here to visit our website, where you can learn more about this project and browse the interactive map of ERT survey locations (best viewed on a desktop computer). You can also find instructions on how to contribute your data to the database.

Acknowledgements

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