

Creating a Geothermal Atlas of the WCSB

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Summary

As a research assistant and GIS specialist in the Earth and Atmospheric Sciences Department at the University of Alberta, one of my main projects is to create an online database and framework for a Geothermal Atlas of the Western Canadian Sedimentary Basin. I will present an overview of the processes involved in gathering the necessary data, organizing it, and using various software to create an interactive visual representation of all data relevant to the development of geothermal energy projects in Alberta.

This product we are creating is a technology that will not only fill a void where no other competing technology exists, but also has the potential for cascading effects throughout the oil and gas industry, governments, academia, and the general public. There are currently no inexpensive or accessible ways to do preliminary research into the development of geothermal energy projects.

Some of the features that will be included in the web map application are:

- Searchable features including location, formation/field/area names
- Geothermal gradients at varying depths
- Geological, petrophysical, geochemical, depths, and temperature ranges
- 3D models of formations and structural boundaries
- Hydrology of specific reservoirs
- Basic modelling capabilities that will be accessed in the form of customized widgets
- Favourability maps that show the geographic areas that fall within a set of parameters that would make the area ideal for geothermal use

Methods and Workflow

The largest portion of the work is data management. The long history of the oil and gas industry in Alberta has provided us with downhole data from tens of thousands of wells. Such a large data set requires a high level of data management. To manage all the data and create the maps and programs, I have been using programs such as Microsoft Excel, ArcGIS Desktop, ArcGIS Online, ArcGIS WebApp Builder, and geoScout. The bulk of data which is exported from geoScout is then organized and formatted for use within the various ESRI software that will actually generate the maps required for the website. We will be working with the Alberta Geological Survey over the summer to expand our current database and populate our maps with accurate data.

After all of the data has been organized and formatted, I create a visual representation of the the wells and the reservoirs they represent, then link them to down hole data such as

temperature. I begin with creating the well locations in ArcGIS Desktop with all of the associated data. Using custom scripts using the ESRI Model Builder, I aggregate the well point files into polygons that represent reservoirs such as the Swan Hills and Leduc reefs.

From ArcGIS Desktop, I am able to export the files to an organization's profile in ArcGIS Online. Once the files are in the ArcGIS Online database, I can create a WebMap with all of the point files and shapefiles with the relevant metadata and symbology. The next stage is to create a WebApp using more ESRI software and linking the WebMap to the WebApp to serve as the base GIS data for the application.

This WebApp builder is customizable and has out-of-the-box widgets that are useful in keeping the data organized. There are also options for custom widgets with the Developer Edition which we intend to utilize for creating modelling widgets that will be able to generate flow models and economic models such as the Monte Carlo simulation that other members of our team are working on.

There will be searchable and selectable layers that represent different reservoir characteristics such as temperatures at specific depths and pop-ups relating more data.

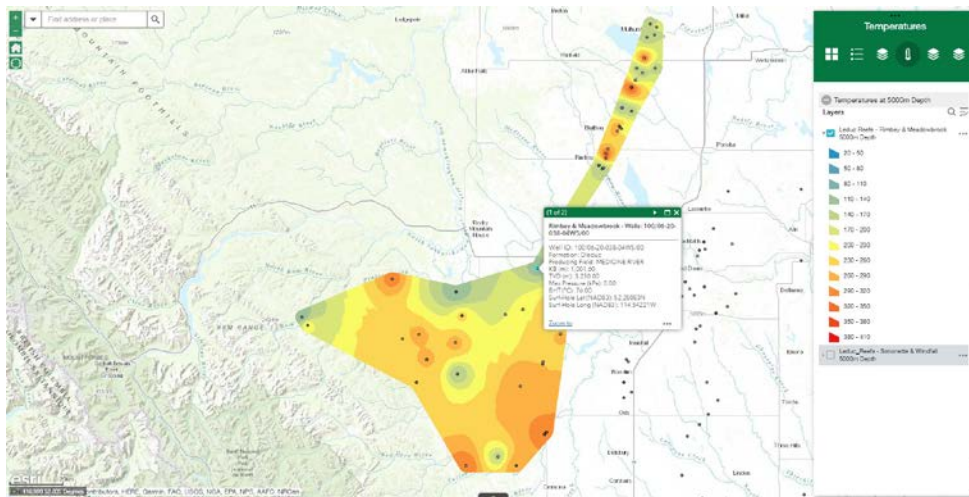


Fig 1. A reef in the Leduc Formation with reservoir temperatures and data pop-up.

Conclusions

We are currently still in the early stages of this project that will be ongoing as continue to develop and map more geothermal reservoirs within the Western Canadian Sedimentary Basin. This interactive online database will encourage the development of a geothermal energy industry in Canada by providing accessible resources and information that are relevant to resource exploration and investment. This is an important step forward for our province in meeting carbon emission goals as well as expanding and diversifying our economy.