



STAR Fellowship Summer Internship 2019

Geothermal Research Department



SAND2019-8448PE

PRESENTED BY

Darion C. Vosbein – Moriarty High School

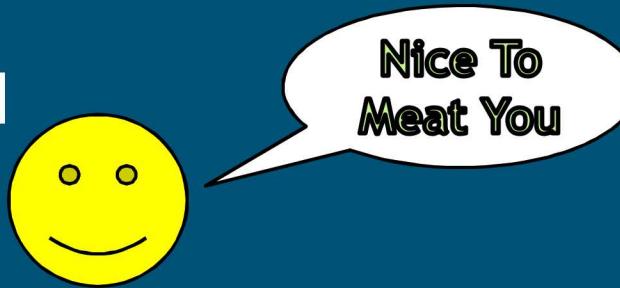
MENTORED BY

Thomas Lowry – Org. 8866

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A Little About My Background



Intended Major: Dual Degree of Electrical and Mechanical Engineering

In the next 5 years I plan to be out of high school and be in the final stage of obtaining my bachelor's degree if not already completed.

The majority of my current engineering experience is from a variety of courses including welding, auto and robotics as well as several other technical courses.

Some hobbies include fishing, hiking, and videogames.



Outline

1. Hawthorne, Nevada Deep Direct use Geothermal Energy

- Explore the feasibility of using local geothermal resources for heating and cooling.
 - Calibrated groundwater heat transport model
 - Visualization

2. Direct Sub-Surface Measurements Through Precise Micro Drilling

- Develop capabilities to detect and monitor borehole integrity issues.
 - FFT analysis

3. Computer Programs Used & What For

- A list of the different programming systems I utilized, how they helped to progress the work, and what specific projects they were used for.

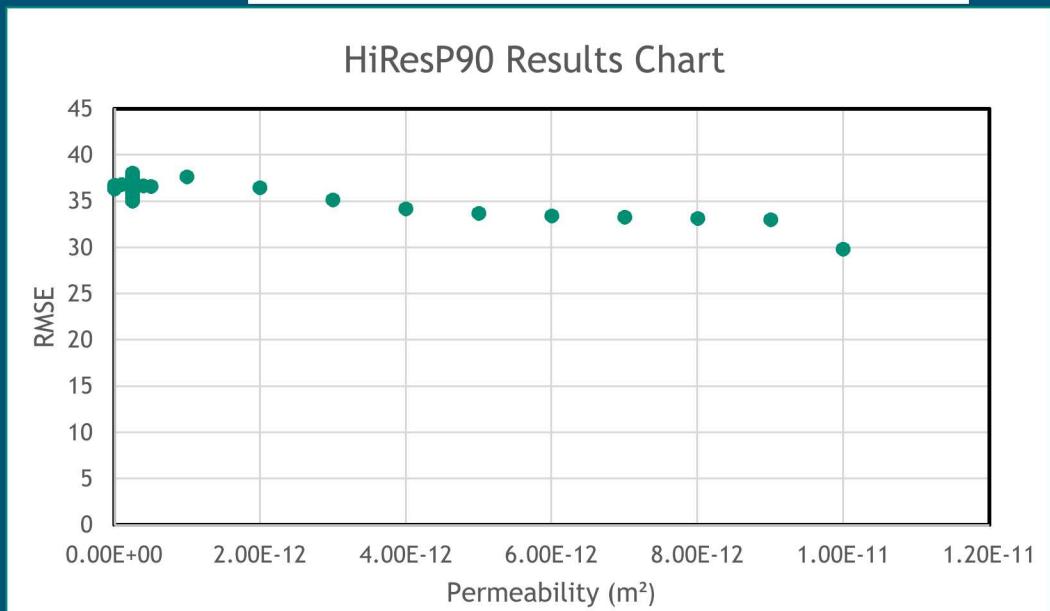
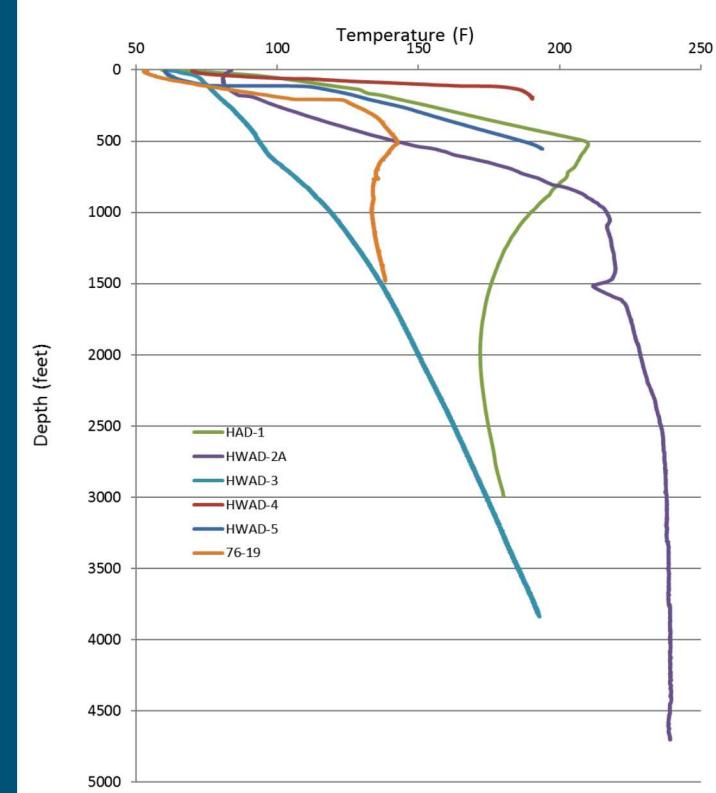
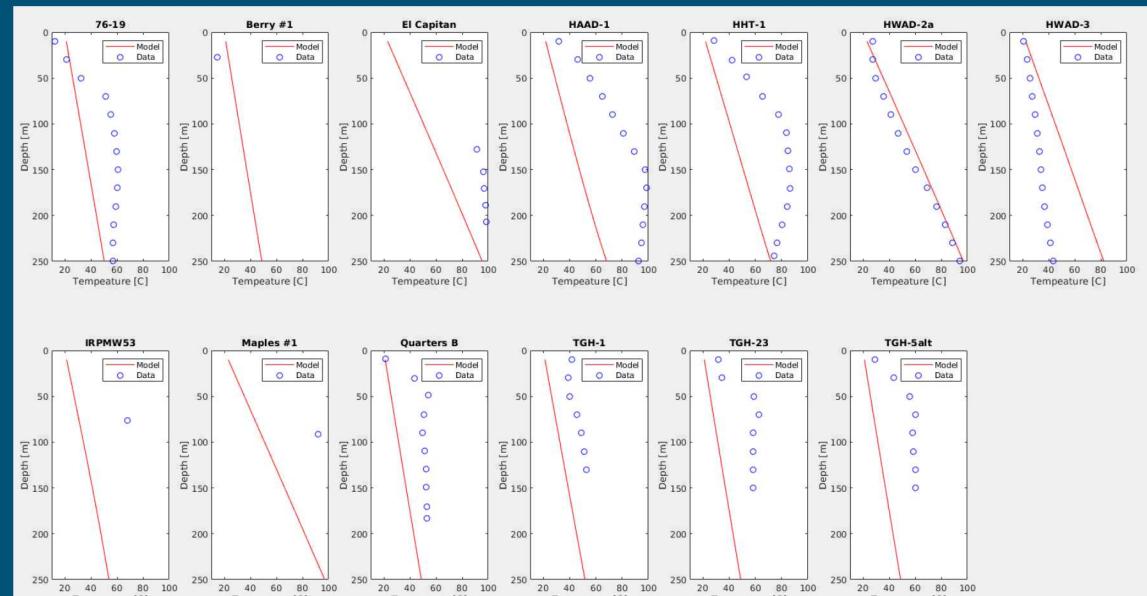
Hawthorne Nevada Project

Calibrated Groundwater Heat Transport Model

Objective: Calibrate numerical flow and heat transport model to vertical temperature profile well data

My Job: Run simulations to minimize the RMSE between the simulated and observed data by modifying a variety of input variables. Verified results visually.

Results: Despite numerous tests, the reduction in the RMSE was limited though the well fits varied by location.



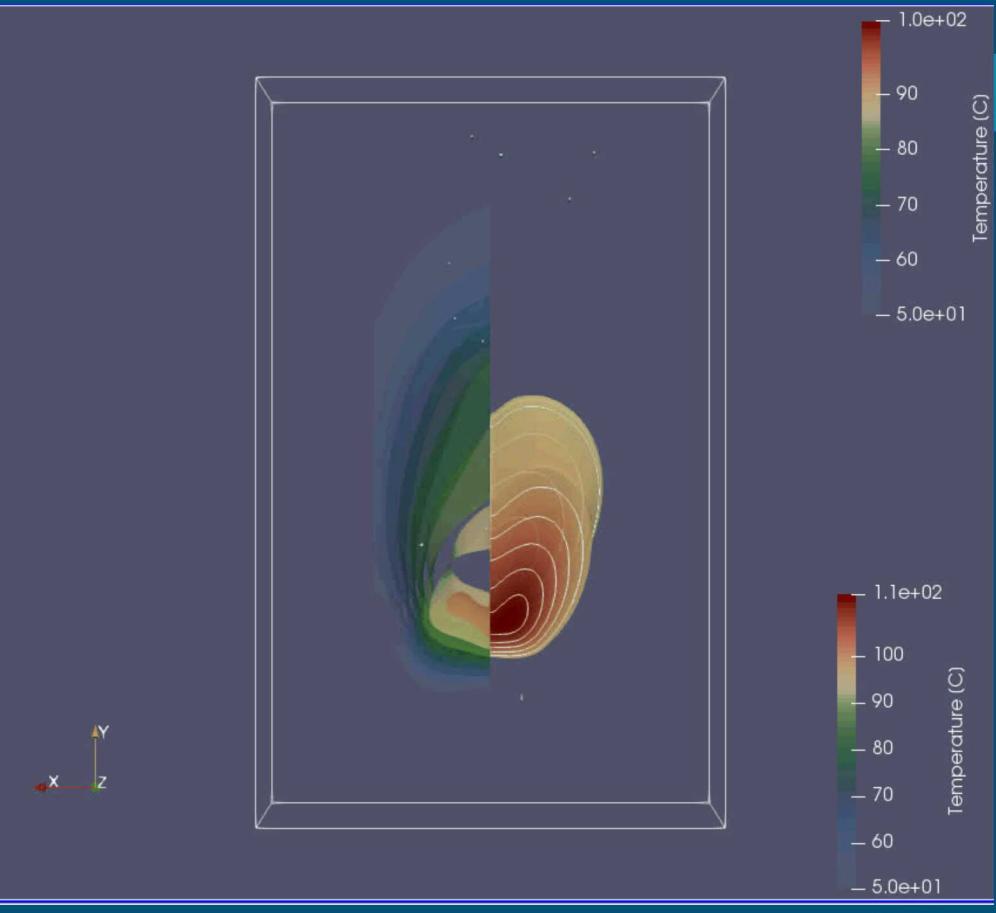
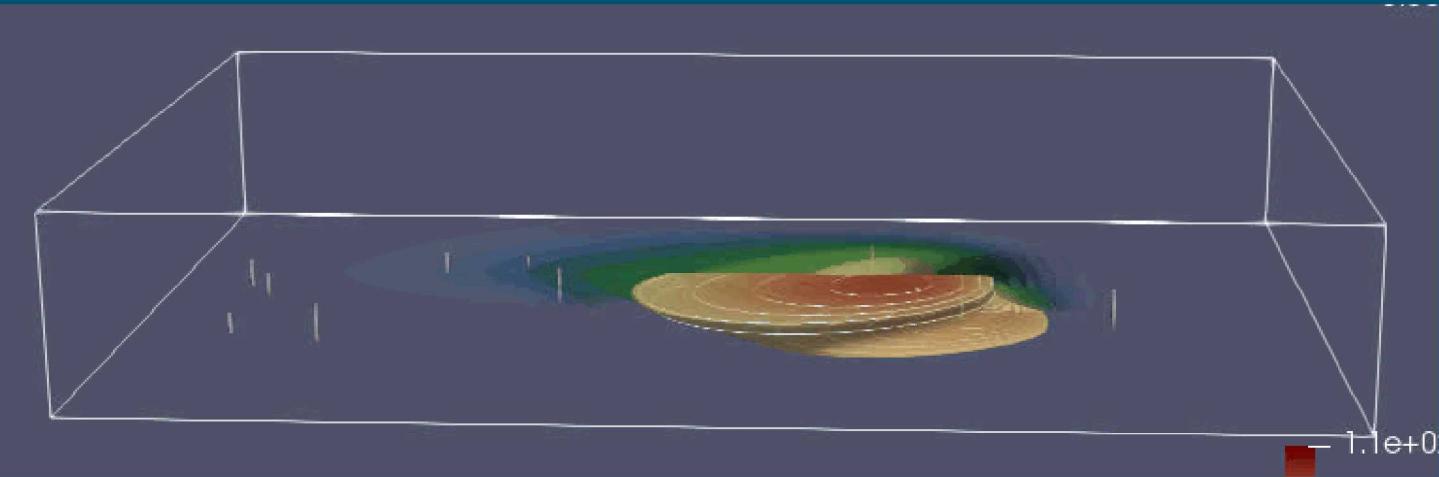
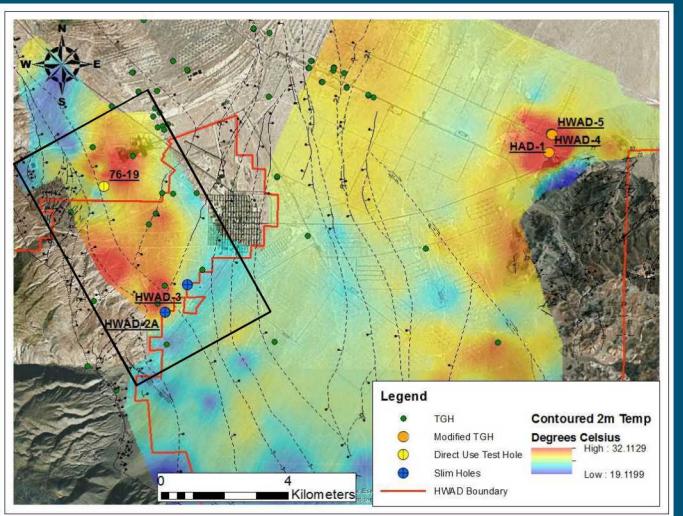
Hawthorne Nevada Project

Water Temperature Modeling

Utilized existing PFLOTRAN flow and heat transport model to visualize temperature drawdown due to pumping.

My Job: Visualize the results and improve their presentation.

Results: Several visual and functional improvements were made but more still needs to be done.



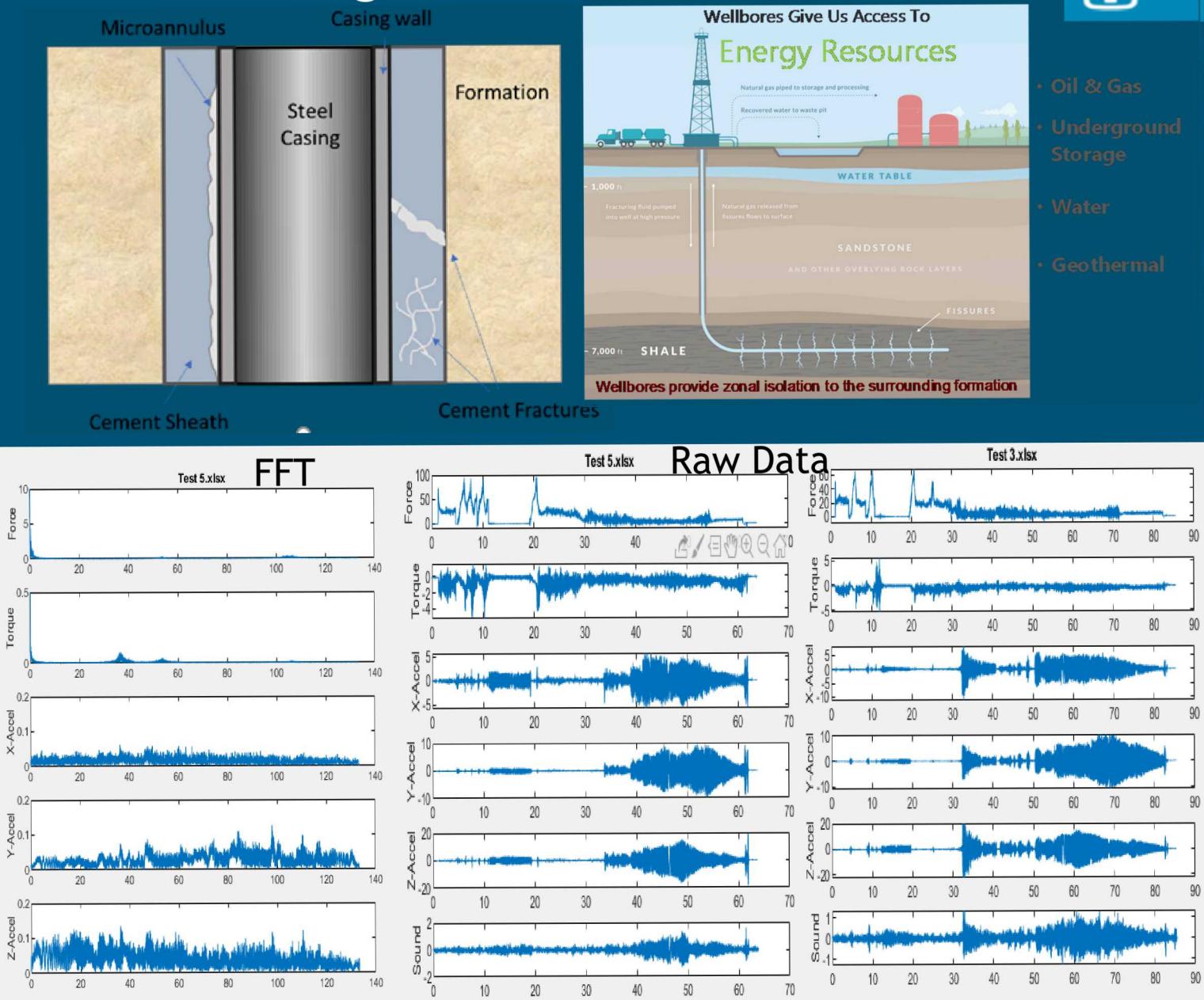
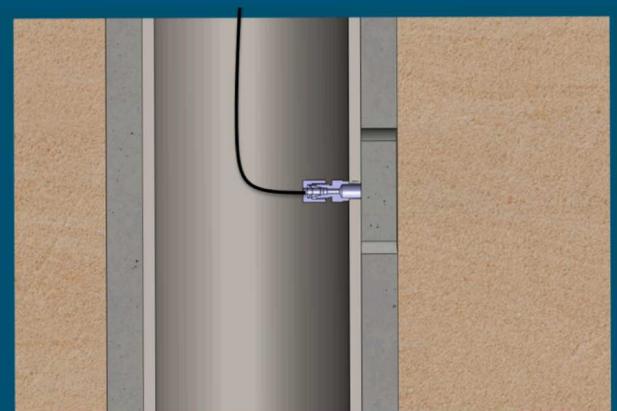
Direct Sub-Surface Measurements Through Precise Micro Drilling



Objective: To develop a method of monitoring borehole integrity in wells by drilling small diameter holes in which sensors can be placed.

My Job: Find patterns within raw drilling data using FFT to determine if an accurate algorithm could be made to identify the substance being drilled through.

Results: Without additional trials and the collection of additional types of data, the distinction between materials was minimal.



Programs Used & What For



MATLAB is a programming platform and language designed to for tactical computing, data analysis, and simulations.

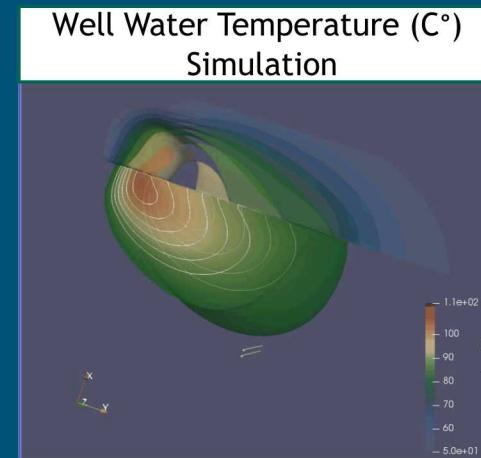
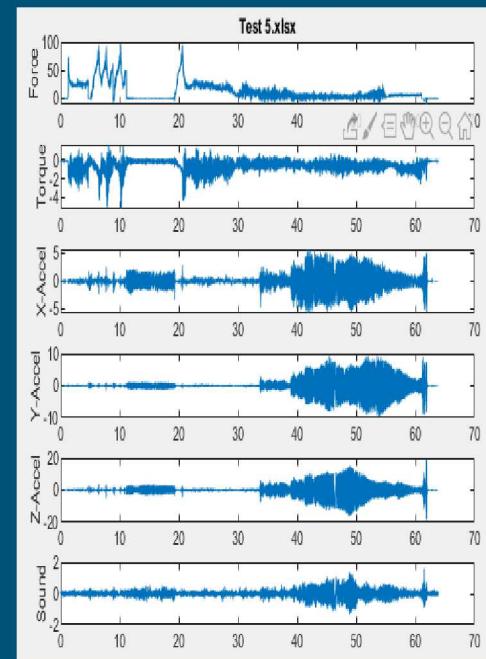
MATLAB was used to conduct the FFT analysis on the micro-hole drilling data.

It was also used to calculate the RMSE for the Hawthorne Nevada Project model.



ParaView is a software that allows the conversion of data into complex 2D and 3D models for visualization.

ParaView's modeling software was used to visualize the Hawthorne model output.



Thanks For Your Time

ARE THERE ANY QUESTIONS?