Modeling Velocity of Seismic Waves

Zoe Schlossnagle

College Park Scholars – Science & Global Change (CPSG250)
Physics & Computer Science Minor
zschloss@terpmail.umd.edu

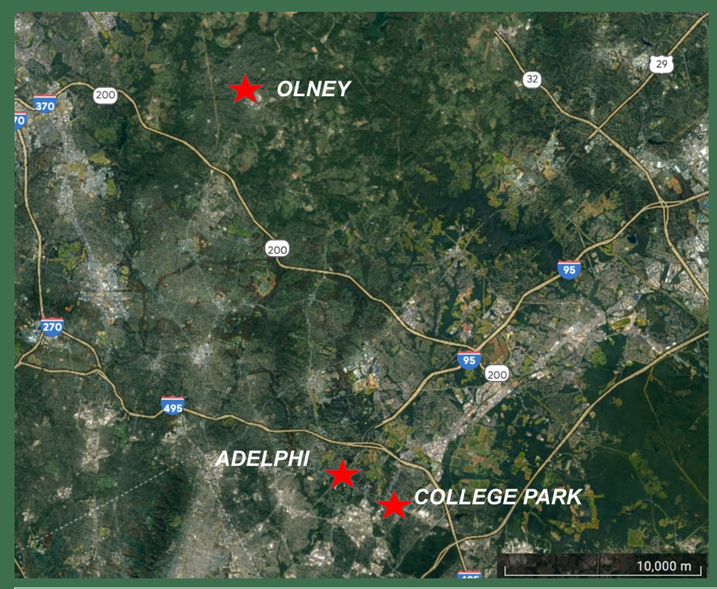
College Park Scholars Academic Showcase, May 5, 2023

Introduction:

For the past year, I have joined Dr. Mong-Han Huang and the Active Tectonics Lab, attempting to model seismic wave velocity in near surface surveys, and how different materials change the velocity of those waves. This was part of a larger project to determine the effects of weathering around the Anacostia river from upstream to downstream.

The site mission:

The group conducted field work at a variety of different locations, including everywhere from Adelphi Mill to people's backyards to right here in College Park. This data was then analyzed and discussed back at home-base: the UMD Geology Building.



Above is a map of the general area we worked around, with the Olney and Adelphi locations marked, as well as College Park.

Locations varied from long (120 yd) surveys in places like Dr. Ann Wylie's backyard (right) to short surveys on rocky outcroppings in creeks like the woods behind Trinity Church off Rt 198 (left)

Methods & Materials:

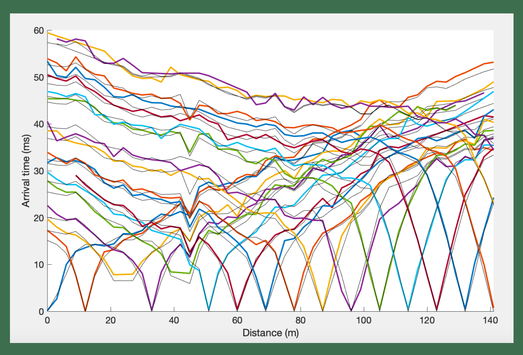
To gather data: a group would go out to a location, set up the geophones in a survey line connected to the computer. We would then place a large metal plate near a geophone and hit it with a sledgehammer 4 or 5 times to trigger a seismic signal. This signal propagates and is received by the other sensors in the survey line. We gather the data on the computer connected to the survey line cable and take it home to analyze. Analysis done using MATLAB code.

Impact:

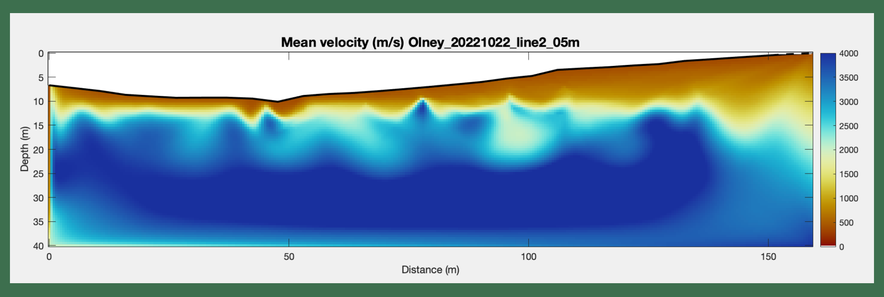
The project is not complete but has the intended impact of better understanding how the Anacostia watershed area weathers and how that varies from upstream to downstream.

Data and Results

Long Line Data – Line 2 @ Dr. Ann Wylie's House in Olney, MD

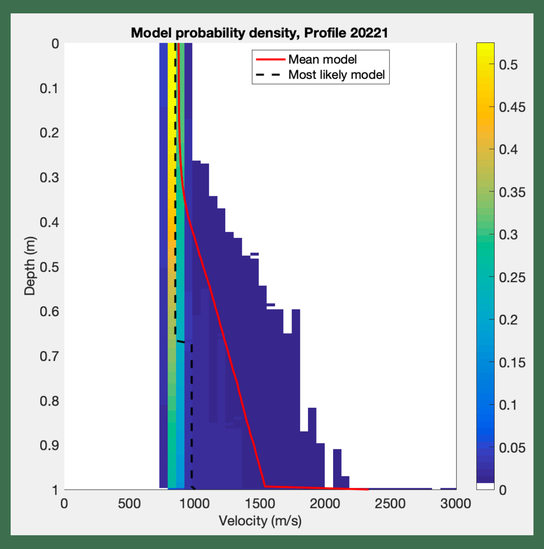


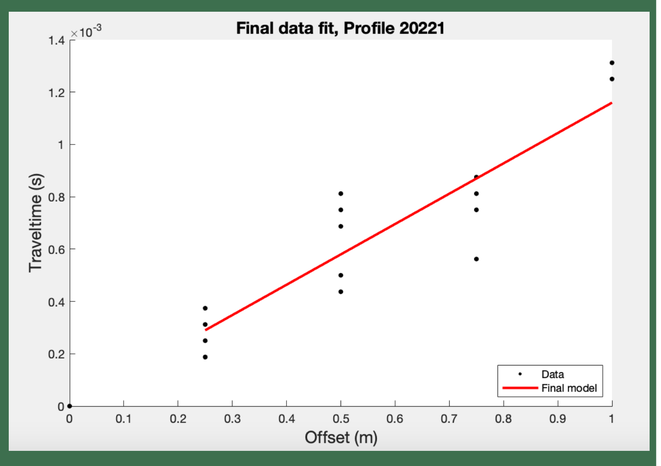
On the top, a travel time curve (arrival time vs. distance). On the bottom, mean velocity plotted in color on a depth versus distance graph.



Short Line Data – Line 2 @ Adelphi Mill in Adelphi, MD

Below are the model probability density (left) and final data fit (right) for a 1-meter geophone line at Adelphi Mill park. The density graph plots the velocity versus depth and scales the probability with the color indicated by the scale on the right. The fit graph plots the time versus the source offset.





SCIENCE AND GLOBAL CHANGE

Acknowledgments:

This project could not be done without my research advisor Dr. Mong-Han Huang, the Active Tectonics Lab members, Dr. Holtz and Dr Merck, and the UMD Geology and Physics Departments.