CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Anthony J. Becerra

Project Number
J0901

Project Title
Recreating a Geyser Story

Abstract

Objectives/Goals
My objective was to recreate a geological geyser and determine whether the depth of the geyser's vent would have an affect on the frequency and duration of the geyser's eruption. My hypothesis was if the vent was shorter then the geyser would erupt more frequently with shorter duration. I decided to investigate this after visiting Yellowstone National Park watching Old Faithful erupt. The park personnel were able to predict approximate schedules of eruption time throughout the day.

Methods/Materials
In order to recreate the geyser I used different lengths of 5mm glass tubing, ErlenMeyer Flask,Scientific ring stand, a plastic pitcher, plumbers putty and electric buffet plate as a heating source, stopwatch, water and food coloring. After connecting the tubing to both the flask and pitcher. I filled the flask and pitcher with cool water, started the heat source and timed the eruption cycles using 1 foot, 2 foot and 3 foot lengths of glass tubing to represent varied depths of the vent. I placed food coloring in the plastic pitcher (above) to show how the water at the earth's surface is drawn back into the vent to reset the eruption cycle. I recorded the number eruption cycles, start and end time of eruptions, duration of each and time between each eruption.

Results
My experiment showed that the longer the tube the greater number of eruptions occurred and the duration and time between each was consistent. The shorter the length of tubing resulted in fewer eruptions which were inconsistent in duration of time. In fact, the 3 foot tubing resulted in a maximum of 11 eruptions that were approximately 43 seconds long and occurred approximately every 3 minutes.

Conclusions/Discussion
My hypothesis was incorrect. After recording all the data I found that the deeper the vent the more consistent the the duration of eruption were, and I was able to predict approximately when the next eruption would take place. This experiment helped me understand how eruption cycles are able to be predicted at geysers such as Old Faithful in Yellowstone National Park and others around the world. This knowledge enables visitors at such places to consistently guarantee that they will witness such a fabulous geological event.

Summary Statement
I found that the greater depth of a geyser's vent enabled me to predict duration of and time between eruptions.

Help Received
Mrs Berstein, my science teacher for reviewing my project and my Father, Steve Becerra for acting as safety officer during the project. In addition, the Synopsys Outreach Foundation for providing the posterboard for our sceince fair.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Francisco C. Catanzaro

Project Number

J0902

Project Title

Detecting Gopher Tunnels Using Ground Penetrating Radar

Abstract

Objectives/Goals

This project attempts to use a Ground Penetrating Radar (GPR) system to detect the location of a gopher tunnel underground. The GPR sends electromagnetic waves into the ground. Objects in the ground (air, rocks) have properties (dielectric constant) that are different than the surrounding dirt, causing a reflection. The difference in dielectric properties causes the wave to reflect back towards the GPR. The goal is to use the strength of the returning signal to detect the tunnels underground.

Methods/Materials

I used an Open Source RADAR designed by MIT for all of my experiments. This RADAR is a simple Doppler RADAR centered at 2.44 GHz. To characterize the signal from a gopher tunnel, I created an artificial tunnel and buried it in a six foot by three foot by two foot hole. After comparing a control (no tunnel) and the experiment (tunnel present), I confirmed I could distinguish the control from the experiment. Then I identified gopher holes in our front lawn and created two areas to scan with the RADAR. I took 176 RADAR measurements for each area by carefully moving the RADAR and controlling its orientation and distance to the ground. After analyzing the signals for tunnels, I dug up the front lawn to compare the GPR detected tunnels with the actual tunnels.

Results

I compared the GPR detections with the presence of tunnels for two areas of the front lawn. I tracked the number of times the detection was correct and the number of times it was incorrect. The errors in detection were further separated into false positives (detecting a tunnel when one does not exist) and false negatives (not detecting a tunnel when one does exist). The false positive rate was: FP = 12 / 158 = 7%. The false negative rate was: FN = 9 / 18 = 50%.

Conclusions/Discussion

My hypothesis was correct because in all three experiments the GPR could #see# the tunnel underneath the soil. The inexpensive MIT RADAR can be used as a GPR system. The MIT RADAR can be used to detect gopher tunnels as deep as 12 inches. The FP rate is relatively low. The FN rate indicates it missed many of the areas with tunnels. However, where the RADAR missed a tunnel, those areas are adjacent to areas that the RADAR did correctly identify a tunnel. Therefore if you dig in all the areas that indicate a tunnel you won#t miss a tunnel because all the places that were missed by the RADAR are next to the areas you would be digging.

Summary Statement

I showed that Ground Penetrating Radar can detect the difference between soil and air and correctly identify a gopher tunnel by the difference in dielectric constant in the different materials.

Help Received

I showed that Ground Penetrating Radar can detect the difference between soil and air and correctly identify a gopher tunnel by the difference in dielectric constant in the different materials.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Mia H. Chou

Project Number
J0903

Project Title
Radon: The Silent Killer in Your House

Abstract

Objectives/Goals
To find if there is a correlation between radon levels and building ages

Methods/Materials
Materials:
2 Corentium QRI Home Radon Digital Monitor
10 houses (measured radon level for a week each), some re-measured for repeatability.
Method:
Placed both radon monitors in each house for a week; one in a well-ventilated area and another in a non-ventilated area.
Record the measurements at the end of the week and gave feedback to homeowner.
Compared results to age of the house and then to location

Results
Project showed no direct relationship between building age and radon levels.

Conclusions/Discussion
After further analysis, I did find a link between radon levels and the location of the house. In future work, I would continue to take more samples to verify this correlation and analyze the relationship between the radon levels and the soil's geological makeup that produces the radon levels.

Summary Statement
After measuring 10 different houses for radon levels, I showed that the radon level does not correlate to the age of the house, but to the physical location.

Help Received
My parents purchased the 2 radon monitors and helped solicit homeowner volunteers. I then contacted the homeowners, set up the monitors in each house, collected the data, and performed the analysis.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Samantha C. Gaiera

Project Number
J0904

Project Title
Does Salinity Affect Ocean Acidification?

Abstract

Objectives/Goals
The purpose of this experiment was to investigate if freshwater or saltwater around the Earth was becoming more acidic due to increased carbon emission produced by humans.

Methods/Materials
A model was made to simulate earth's atmosphere and oceans. Distilled water with different salinity levels was exposed to CO2 gas. The pH of the water was measured every five minutes with a digital pH meter for 30 minutes.

Results
The hypothesis that if the salinity of water increases and the solutions are exposed to CO2 then the difference between initial and final pH of the solution will also increase was supported. The average change in pH was the highest with 36 ppt (1.33) and lowest with plain distilled water (1.0).

Conclusions/Discussion
This experiment is important because it shows that saltwater absorbs more CO2 than freshwater. My research suggests that in places of higher salinity, CO2 will be absorbed in greater amounts resulting in greater impact to those areas. As humans continue to increase carbon emissions, fresh water will be taking in less CO2 than the ocean.

Summary Statement
This experiment shows that as salinity of water increases, the amount of CO2 absorbed also increases.

Help Received
I designed and built the simulator by myself and my mother helped me collect materials.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Maxwell P. Gross

Project Number

J0905

Project Title

Mitigating Liquefaction

Abstract

Objectives/Goals

My goal is to find the best way to alleviate liquefaction. Liquefaction is a property of soil where when it's saturated with water and it comes under stress, such as an earthquake, it behaves like a liquid. I want to alleviate liquefaction by adding things to or changing the soil in some way.

Methods/Materials

There were four repetitions each, where the soil was mixed with sand, mixed with gravel, packed down, and with plain, loose soil (control) completed. I shook a tub with the soil or soil mixture on a track. I put a weighted plastic container as a structure on the soil and a ping-pong ball, representing a sewer, in the soil.

Results

Of the three mitigations, packing the soil down had the best results. I found that the structure on top of the soil sank the least, which was an average of 2.4 cm, and the ping-pong ball within the soil rose the least, which was an average of 2.5 cm. The control structure sank an average of 4.5 cm and the ping-pong ball rose an average of 3.9 cm.

Conclusions/Discussion

From this I can conclude that people in a high-risk liquefaction zone should build their structures and utilities on or in packed soil instead of loose soil, gravel-, or sand-rich soil.

Summary Statement

Finding the best way to reduce the effects of liquefaction by testing different modifications to the soil.

Help Received

My mother helped me type my report and supervised the tests, purchased any materials necessary, and taught me about liquefaction.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Gillian M. Healey

Project Number
J0906

Project Title
How Saturated Is Saturated?

Abstract

Objectives/Goals
To determine and compare the different saturation points and absorption ability of three soil textures; sand, sandy loam, and clay.

Methods/Materials
Scale, oven, beakers, water, sheet trays, glass containers, water bottles, rubber bands, coffee filter, one 400g and 150g sample of each: sand,sandy loam, clay.
Experiment #1- Three different soil textures were dried, weighed and saturated with water. The data was calculated to determine the saturation point of each texture as well as how the saturation points of the different textures compared to each other.
Experiment #2- Three different soil textures were dried, weighted, and placed into inverted water bottles. Bottles were placed over beakers and the same amount of water was added to each and allowed to percolate through. Measurements were taken to determine the amount of water percolated vs. amount of water absorbed.

Results
Clay had the highest saturation point and the highest absorption ability compared to sand and sandy loam.

Conclusions/Discussion
Clay absorbs and retains the greatest amount of water compared to sand and sandy loam. This is due to its particulate size, shape, and chemical adhesion to water. Clay is made up of small, tightly fit together disc like particles that create greater surface area for water absorption. This results in expansive and contractile seasonal properties of the soil. These fundamental properties are integral to Geo-technical engineering.

Summary Statement
I tested three different soil textures and showed that clay has the highest saturation and absorbtion ability compared to sandy loam and sand.

Help Received
I designed and performed my experiments myself. My science teacher and my father challenged me to futher research how my findings could be applied to the outiside world..

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Amanda Li

Project Number
J0907

Project Title
Effect of the Santa Ana Winds on Carbon Dioxide Concentrations over the Los Angeles Basin

Abstract

Objectives/Goals
The objective of this experiment was to examine the effects of wind patterns on carbon dioxide concentrations by using data showing the effect of the Santa Ana winds on the LA Basin.

Methods/Materials
Weather data of the data set presenting the effect of Santa Ana winds on the LA Basin were obtained from a DAVIS Vantage Pro 2 while CO2 data was gathered from a Picarro Isotopic CO2 Analyzer. This data was transferred to Excel where it was then averaged hourly and graphed, thus showing the inconsistencies in its standard patterns. These inconsistencies, days where there was Santa Ana winds, were then compared to days without Santa Ana winds.

Results
The graphs showed that the carbon dioxide levels did not increase as they normally would have. Instead, while the Santa Ana winds were blowing, the graph showing the carbon dioxide concentrations plateaued.

Conclusions/Discussion
The Santa Ana winds brought very significant decreases in CO2 levels that were very dramatic at times. Based on the sample group, when monitoring greenhouse gases, wind patterns play a crucial part in the changes of CO2 concentrations. The origins of the winds as well as the speeds of the wind show how it will affect the carbon dioxide concentrations over a specific region.

Summary Statement
I showed that based on the origin and speed of different wind patterns, they had a large impact on carbon dioxide concentrations.

Help Received
I worked in Dr. Sally Newman's lab to collect the data. I designed the experiment and analyzed the experiment myself.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Kyle D. Lowery

Project Number
J0908

Project Title
Does Fracking Cause Earthquakes?

Abstract

Objectives/Goals
The objective of this project is to build a device that models earthquakes caused by fault slippage and determine the effect of fracking on the number and magnitude of earthquakes.

Methods/Materials
A brick covered with sandpaper was pulled across a rough surface by an attached elastic cord. The distance the brick moved was measured with a ruler, the force required to move the brick was measured with a force gauge and the maximum volts of the seismograph was recorded with a geophone. To replicate natural conditions, these measurements were made with direct contact between the brick and the rough surface. To mimic the effect of fracking, the measurements were repeated with Nordic Ice, Salty water and Soapy water placed between the brick and the rough surface.

Results
When the Nordic Ice was tested, the force required to move the bricks a similar distance to the Control decreased by 53%. In contrast, when the Saltwater and the Soapy water was tested, the force required to move the bricks was similar to the Control but the distance the bricks moved increased by at least 63%. In all cases, the average maximum volts observed in the seismographs decreased by at least 50% relative to the Control.

Conclusions/Discussion
My hypothesis was correct in stating that chemicals introduced into the ground by fracking will cause the frequency of earthquakes to increase since the friction between rock layers will be decreased. The experiments showed that the friction was decreased since either the force required to move the bricks decreased relative to the control or the bricks moved further with the same force relative to the control. In addition, the experiments showed that the damage from the earthquakes would be decreased since the magnitude of the quake was reduced significantly. Overall the experiments could discern a difference between the control condition (no solutions) which mimics the stress a fault is normally under and the three conditions that used a lubricating solution that would decrease the friction between the rock layers along a fault.

Summary Statement
I tested the impact of fracking on earthquakes and showed that the frequency of earthquakes would increase but their magnitude would decrease.

Help Received
I built and performed the experiments myself. My parents taught me how to use the geophone.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Luke R. Merickel

Project Number
J0909

Project Title
It's My Fault, I Couldn't Handle the Pressure: Compression Obsession

Abstract

Objectives/Goals
The purpose of this experiment was to understand geological folding patterns of different earth materials while under the stress of lateral compression. I focused on continent-to-continent convergent plate collisions that create fold mountains. I tested the height of anticline folds, distance of first overturned folds and total number of folds? My hypothesis was that diatomaceous earth would result in the highest anticline fold and create the quickest overturned fold. I believed that sand would produce the most folds.

Methods/Materials
I built a "compression box" that pushed a wood plate forward. As this lateral compression moved forward I recorded data at 10, 20 and 30 centimeters. I used diatomaceous earth, sand and pea gravel (independent variables). Data was recorded for the height of anticline folds, distances of overturned folds and for how many folds were created at 30 centimeters (dependent variables). The rate of compression, distance of compression and volume of material used were my controlled variables.

Results
My experiment revealed that diatomaceous earth made the highest anticline folds at 10, 20 and 30 centimeters with average heights of 9.28, 10.25 and 11.11 centimeters respectively. The further the compression plate moved forward the closer in height all three materials became. Diatomaceous earth's anticline height at 10 centimeters was 2.72 centimeters higher than sand and 2.53 centimeters higher than pea gravel. However, at 30 centimeters the height of diatomaceous earth's anticline fold was only 0.36 centimeters higher than sand and 0.65 centimeters higher than pea gravel. Diatomaceous earth's variability was greater at 10 centimeters of lateral compression and less at 30 centimeters while pea gravel's variability was the opposite - smaller at 10 centimeters and larger at 30 centimeters of lateral compression. Diatomaceous earth resulted in the first overturned fold at an average distance of 16.79 centimeters. Diatomaceous earth was the only material to create multiple folds at 30 centimeters of lateral compression.

Conclusions/Discussion
Understanding geological folding patterns of our earth's crust is important. We can improve our understanding of concepts such as climate change and responsible harvesting of natural resources. I believe geoscientists would benefit mostly from my experiment's data. My experiment also clearly shows what is happening beneath the surface of our crust.

Summary Statement
Using lateral compression, my project tests different earth materials to determine the height of anticline folds, the distance of the first overturned fold and the total number of folds created.

Help Received
I designed and carried out this project by myself. My neighbor provided assistance and supervision with the construction of the compression box.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Akayah D. Smith

Project Number
J0910

Project Title
Effect of Solar Radiation on Water and Land

Abstract

Objectives/Goals
The goal of this project was to examine the ways in which solar radiation affects the heat of two different surfaces, land and water. The purpose of my experiment was to answer the testable question, "What effect does solar radiation have on land or water and how does it increase the temperature of each surface?"

Methods/Materials
To conduct this experiment, I selected two identical plastic containers, two scientific digital thermometers, distilled water, clean sand, and a stop watch. I filled one container with two inches of water and the other container with 2 inches of clean sand. I placed each container in direct sunlight at the same time of the day in the same location to take temperature reading in 10 minute intervals over a 30-minute period of time. I recorded the results and plotted the data on a graph.

Results
A review and evaluation of data collected from all trials (10) supported the idea that the solar radiation causes water to warm quicker than land. Data examined also indicated that water warms faster but land stays warmer longer.

Conclusions/Discussion
Overall, the review of the data collected during the experiment answered the original testable question, "What effect does solar radiation have on land or water and how does it increase the temperature of each surface?" My hypothesis was proven that water surfaces will warm faster that land surfaces. These findings are similar to other research studies showing how solar radiation affects different parts of the Earth's atmosphere, land, and oceans. Some surfaces heat up faster and some materials absorb more radiation and holds it longer. In reality, this has an impact on our daily lives, agricultural produce, and length of growing seasons.

Summary Statement
Solar Radiation affect land and water surfaces in different ways.

Help Received
Ms. Kristin Lucas, City Tree Christian School, 7th grade teacher; and my grandfather. There was no University assist with this project.