CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Kathleen V. Abadie

Project Number
J0601

Project Title
Ready, Set, Flow! Calculated Permeability of Coarse Sand, Fine Sand, and Soil

Abstract

Objectives/Goals
My project has two objectives. The first is to calculate the permeabilities of coarse sand, fine sand, and soil. The second is to find out how the calculated permeability of each sand or soil differs with each different liquid run through it: water, soybean oil, and isopropyl alcohol.

Methods/Materials
Cut nine, 20 cm lengths of plastic tubing and attach a piece of cloth to one end of each tube. Fill three tubes with coarse sand, three tubes with fine sand, and three tubes with soil. Run water through one coarse-sand tube, soybean oil through another coarse-sand tube, and isopropyl alcohol through the last coarse-sand tube. Do the same for fine sand and for soil. Measure the time it takes for a known volume of each liquid to run through each sample, calculate the flow rates for each liquid flowing through each sample, and calculate the sample permeabilities.

Results
The coarse sand had the greatest calculated permeability for all liquids, the fine sand calculated permeability was intermediate for all liquids, and the soil had the lowest calculated permeability. For both sand samples, water gave the highest calculated permeability, soybean oil gave the next highest, and isopropyl alcohol gave the lowest. For soil, I calculated the highest permeability with soybean oil, the next highest with isopropyl alcohol, and the lowest with water.

Conclusions/Discussion
My hypothesis that coarse sand would have the greatest calculated permeability, fine sand would have the next greatest, and soil would be the least permeable was correct. This is because the spaces between the grains in the coarse sand are larger than in the fine sand and the soil. My hypothesis that I would calculate the highest permeabilities for each material with soybean oil, the next highest with isopropyl alcohol, and the lowest permeabilies with water was correct for soil but wrong for both sands. Water gave the highest permeability for both sands, not the lowest. A possible reason why I calculated the lowest soil permeability with water could be because the clay in the soil absorbed the water, expanded, and plugged up the pore spaces, thus, decreasing the soil permeability with water.

Summary Statement
I calculated the permeabilities of coarse sand, fine sand, and soil based on measuring the flow rates of water, soybean oil, and isopropyl alcohol through each of the three materials.

Help Received
Father helped think of experiment and helped with Microsoft Excel; various family members assisted in parts of my experiment that required two people (i.e. worked stopwatch); mother helped paste papers onto backboard.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Joshua M. Adler

Project Number
J0602

Project Title
Did Temperature Affect the Salt Formation in the Dead Sea?

Abstract

Objectives/Goals
My project was to determine if the temperature at the Dead Sea affected its salt formation. If it was located in a cooler climate would it have still remained as salty?

Methods/Materials
I compared how salt crystals would form at different temperatures that would be models for four locations around the world: freezing, cool, moderate and warm climates. I made seed crystals from a supersaturated salt solution, which I then immersed in four separate jars containing additional supersaturated salt solutions. I repeated this step three times, each time adding more salt until the seed crystals did not dissolve in the solutions. I placed the jars at different temperatures and measured the width, height, and depth of each crystal everyday. I calculated the volumes of each crystal, made graphs of the growth of the crystals over time and calculated the best-fit line, correlation coefficient, and slope using Excel.

Results
The correlation coefficients were all large, 0.71 to 0.96, indicating that the best-fit lines were pretty accurate and therefore the slopes of the lines were also fairly accurate. The slopes are a measurement of how fast each crystal grew. The slope for the crystal at freezing temperature was 1.07 meaning that it grew very little. The slope for the crystal at the cool temperature was 2.28 meaning that it grew slowly. The slope for the crystal at room temperature was 12.98 meaning that it grew moderately. The slope of the crystal in the warmest temperature was 24.14 meaning it grew the fastest.

Conclusions/Discussion
My experiment showed that the hotter the temperature was in the jar the faster the salt crystal grew. The seed crystal at the warmest temperature is a control for the temperature at the Dead Sea during the summer. Since it grew the fastest I believe that the temperature at the Dead Sea did affect the salt formation there. If it was in a cooler climate I think the high concentration of salt and salt crystallization at the Dead Sea would have either occurred at a slower rate or possibly not at all, similar to what was observed in the jar in the freezing climate. This lack of salt crystallization might be because the water would not have evaporated as much in a colder climate. The water evaporated faster in the jar at the warmest temperature, leaving a saltier solution and more crystal formation, similar to the environment found at the Dead Sea.

Summary Statement
I grew salt crystals at different temperatures to compare their growth rates.

Help Received
Father explained how to use Excel. Mother supervised me boiling solutions on the stovetop and drove me every night to her work to measure the crystals in the incubator.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Hilary S. Benedick

Project Number
J0603

Project Title
Avalanches

Abstract

Objectives/Goals
To determine what factors promote avalanches.

Methods/Materials
A mountain slope was simulated by constructing a flat board hinged on one end. The board could be raised and maintained at any angle. Snow crystals were simulated by flour and sugar. Conditions at which a slab avalache were produced were recorded while seperately varing the following six factors which were postulated to increase the risk of avalanches and tested in the following fashion:
1. greater depth of snow; Depths of simulated snow crystals were varied and the angle at which the slope simulator had to be elevated in order to creare a slide was recorded. 2. larger vs smaller crystal which produce less crystal to crystal interactions sugar verses flour (I confirmed crystal shape by viewing viewing both under the microscope). 3. increase of slope. 4. layers of different types of snow crystals varying layers of sugar and flour. 5. lack of objects protruding from the snow represented by absence vs presence of tree-like foam struture glued to surface of the slope simulater which protruded above the level of the snow. 6. smooth ground surfaces
Represented by smooth wood surface vs sandpaper on surface of slope simulater.

Results
1. Avalanche risk increased with increasing depths of snow. 2. Fewer crystal to crystal interactions (sugar) increased avalanche risk. 3. Avalanches occurred rarely on slopes less than 25 degrees or greater than 50 degrees but were seen frequently on slopes between these angles. 4. Presence of an lower unstable layer increased avalanche risk. 5. Objects protuding through the snow pack decreased avalaches. 6. Avalache occured more frequently on smooth vs rough underlying surfaces.

Conclusions/Discussion
1. Greater depths of snow increased the risk of avalanches by increasing the amount of gravitational force exerted on the snow pack.
2. Larger crystals with less crystal to crystal interactions (sugar) promote avalanches by producing a less adhesive snow pack.
3. Slope's effect on avalanches was not a linear relationship as originally hypothesized. Risk of avalanche initially increased with slope, but then decreased with additional slope because of a lack of accumulation.
4. Slide risk increased with an unstable lower layer of snow.
5. Objects protruding from the snow anchored the snow pack.
6. Smooth ground surfaces provided less friction increasing the likelihood of avalanches.

Summary Statement
The purpose of this project is to determine what factors affect the formation of avalanches.

Help Received
My father discussed the project with me and he helped build the slope simulator.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Elizabeth Bolanos

Project Number
J0604

Project Title
How Does Ocean Floor Morphology Affect Wave Height and Speed at the Shore?

Abstract

Objectives/Goals
The purpose of my project was to find out how ocean floor morphology near the shoreline affects the behavior of incoming waves.

Methods/Materials
I decided to do my testing where the waves would be controlled, which was a wave tank at the Cabrillo Marine Museum. I attached two measuring tapes to the tank in order to measure the height and speed of the waves. I captured the action of the incoming waves on a video camera that was placed in front of the wave tank. I created 5 different morphologies on the bottom of the wave tank: 1) gradual slope, 2) simulated reef, 3) shelf, 4) sandbar, and 5) trough w/sandbar. I observed and filmed multiple sets of waves for each morphology. I then used iMovie to measure the height and calculate the speed of one wave in each set and then I averaged all measurements for the sets in that morphology.

Results
My results showed that the trough with a sandbar was the morphology that produced the highest and fastest waves. This morphology had the deepest water near the shoreline of all of the morphologies.

Conclusions/Discussion
My results supported my hypothesis that the deeper the water is near the shoreline, the greater the wave height and speed will be. Since tsunami waves are fast moving ocean waves, these results can be used by people who live near a beach to understand what type of tsunami waves they are at risk for, based on the morphology of their beach.

Summary Statement
The purpose of my project was to determine how the morphology of the ocean floor near the shore affects the dynamics of an incoming wave.

Help Received
Cabrillo Beach Marine Museum provided me with the wave tank. Mr. Simonsen helped me set up the wave tank and edit my project.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Katelyn R. Carbiener

Project Number
J0605

Project Title
SPLAT! Forming Craters and Predicting Their Size

Abstract

Objectives/Goals
My objective for this project is to see if I can predict the size of a crater from the size and speed of the object that made it. I think that the bigger and faster the object, the bigger the crater will be. I believe that I will be able to predict the size of a crater I make because its size will be similar to my data, but it will be harder to predict a much bigger one like the Copernicus crater on the moon.

Methods/Materials
For my experiment I will drop different size blobs of wet plaster from different heights into pans of wet plaster. I chose this method because I wanted the object that made the crater to become part of the crater, just like the real ones, and so when the plaster hardens it will be easy to measure the size of the crater. In my experiment I used plaster of paris, cake pans, ladders, clamps, kite string, a triple-beam balance, weights, a piece of wood, and a tape measure.

Results
When I dropped different size blobs from the same height, the bigger blobs made the bigger craters. When I dropped the same size blobs from different heights, the higher heights made the bigger craters. I made separate charts for the blob mass and speed compared to the crater size, but it was hard to use these to predict because the same size crater could be made from different combinations of mass and speed. Then I combined the blob size and crater size in a ratio, and charted it with the blob speed to make my predictions.

Conclusions/Discussion
My results proved that bigger and faster objects would make bigger craters. I used my results to predict that my biggest blob dropped from my highest height would make a 0.132m diameter crater, and when I made the crater it was 0.115m across. Then I used my results to predict that Copernicus crater is 20.2 times bigger than the meteorite that made it, and I discovered that scientists who research lunar craters have concluded that the craters are 10 to 20 times larger than the object that caused them.

Summary Statement
In this project I was able to make craters similar to those found on the moon, and I could use my results to explain how the moon craters were made even though they were a million times bigger than the craters I made.

Help Received
My father helped me mix the plaster quickly so I could do my experiments before it hardened, and he helped me drop the blobs from 2.67m because I could not reach. I borrowed the triple-beam balance from the Sandia National Laboratories science education outreach program.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Brian Christensen; Oleksandr Stubailo

Project Number

J0606

Project Title

Landslide Prevention

Abstract

Objectives/Goals

The objective is to determine how the type of ground material and the type of prevention measure affect the amount of water needed to start a landslide. The hypothesis is that compact materials will need more water to slide than loose materials, and that the preventive measures that provide water runoff will make materials more resistant to sliding than other preventive measures. This project is important because landslides are a prime safety concern in California and around the world. Such investigations are the first step to helping people who live in landslide-prone areas avert future disasters.

Methods/Materials

An experiment was designed to simulate the occurrence of a landslide. Five types of ground materials were studied: Top soil, sand, compact top soil, gravel, and clay dirt. In addition, four ways of preventing landslides were tested using top soil: Covering the soil with a net, covering the soil with a waterproof tarp, installing a drainage pipe, and reinforcing the soil with stakes. Five trials were done for each variation. In each trial, 2.5 L of a material were placed on the top of a board that was 1.5 meters long and propped up at a 30-degree angle of elevation. Water was then poured on the material to simulate rainfall until more than half of the material slid past the halfway point of the board. The amount of water used was recorded.

Results

Compact ground materials required more water to slide than loose materials. Prevention measures that drained water were better than those that did not drain water. The compact dirt required an average of 1762 mL of water to slide, making it the most landslide-resistant ground material, and the top soil needed only 637 mL, making it the least resistant. Out of the preventive measures, covering the soil with a waterproof tarp and installing a drainage pipe were close for best, at 2254 mL and 2199 mL of water, respectively. The worst was reinforcing the soil with stakes, which barely improved the performance of top soil.

Conclusions/Discussion

The results support the hypothesis. The more compact a material is, the more resistant it is to landslides, and the best way to reduce the risk of a landslide is to divert the water flow. There are many other aspects of landslides that would be interesting to explore in future studies, such as the effect of vegetation on ground#s resistance to sliding and the destructive power of landslides.

Summary Statement

The project is about determining which ground materials are most resistant to landslides and testing different ways of reducing landslide risk.

Help Received

Our parents helped us purchase materials that were used in the project.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Samuel R. Falkenhagen

Project Number
J0607

Project Title
Measuring the Outgoing Tide of Bolinas Lagoon

Abstract

Objectives/Goals
The purpose of my project was to determine how fast Bolinas Lagoon drains in the period between high tide and low tide, to see if there is a lag between the calculated low tide and the actual low tide, and to find out if the water is warmed as it sits in the shallow lagoon.

Methods/Materials
Procedure: Take three preliminary temperature readings at different points along the lagoon. Measure distance of 100 feet along the side of the narrow channel where water exits the lagoon. Mark distance with cones. Every fifteen minutes, throw a grapefruit into the water. Time how long it takes for the grapefruit to travel the 100 feet between the cones. Measure the temperature of the outgoing water every hour. Over the course of 7.5 hours, I threw a total of 35 grapefruits into the channel and measured their speeds.

Materials: 2 cones for marking the 100 foot distance
thermometer
35 grapefruits
stopwatch
tide tables for Bolinas, California
data table to record current speeds and water temperatures

Results
The water flowed increasingly faster until mid tide, and then it slowed down. There is a lag of about 45 minutes between official calculated low tide and actual low tide because the bottom of Bolinas Lagoon drags on the water as it drains. There is a lag of about 30 minutes for high tide. The water was not warmed as it sat in the lagoon.

Conclusions/Discussion
The water probably drained the fastest out of the lagoon at mid tide because it had a chance to gain momentum and overcome the drag effect of the mud. However, at the beginning of the tide cycle, the water was still dragging on the mud, and this created the lag. The water may be warmed as it sits in the lagoon. However, the day of the experiment, it was overcast and rainy, so the sun never had a chance to heat the mud.

Summary Statement
My project was about measuring how fast water flows out of Bolinas Lagoon, determining if there is a lag between calculated low tide and actual low tide, and determining if the water is warmed when it sits in the lagoon.

Help Received
I talked briefly with Professor Jim Ingle in the School of Earth Sciences at Stanford University about plans for my project. He also discussed my results with me after I finished the experiment. My dad drove me to Bolinas Lagoon.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Kristianna A. Gadalla

Project Number
J0608

Project Title
How Do Solar Flares Affect Earth's Magnetic Field?

Abstract

Objectives/Goals
The objective is to determine the effect solar flares have on Earth#s magnetic field, using a soda bottle magnetometer.

Methods/Materials
A soda bottle magnetometer was constructed to measure Earth#s magnetic field. The device consisted of a two-liter soda bottle with an index card suspended inside of it. Attached to the index card was a craft mirror and a bar magnet. A laser was shone into the mirror on the index card, and then reflected back onto a wall. At the beginning of the experiment a ruler was taped to the wall so the laser was at the 15cm mark. During the experiment, the centimeter that the laser marked was measured every three hours during experiments 1 and 2 and every hour during experiments 3 and 4. The laser would move because the bar magnet moved from changes in the magnetic field. After the experiment was performed solar flare intensities that corresponded with measurement times were taken from a space weather website.

Results
Four separate experiments were performed, all on different days. During Experiment 1, the highest solar flare intensity was 1.8E-07 watts/m2, and the flare occurred around 9:00am. The centimeters changed the most between 9:00am and 12:00pm. In Experiment 2, the highest solar flare occurred around 6:00am and was 1.35E-06 watts/m2. The greatest solar flare throughout the entire experiment occurred around 9:00am during Experiment 3. It was 5.00E-06watts/m2. Between 9:00am and 10:00am was when the centimeters changed the greatest they ever had in prior experiments. During Experiment 4, the solar flare intensities were low and constant. The centimeters gradually decreased, and there was never a drastic change.

Conclusions/Discussion
In conclusion the higher the solar flare intensity was, the more centimeters the magnetometer moved in a specified time period. Therefore, the higher the solar flare, the more Earth#s magnetic field was affected, and the changes can be measured by a soda bottle magnetometer.

Summary Statement
The purpose of the project was to determine the effect solar flares have on Earth's magnetic field.

Help Received
Science teahcer helped keep me on track. Friends and family provided moral support.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Geena N. Garabedian

Project Number
J0609

Project Title
Tsunamis: Could Target Cities and Ports along California's Coast Be Better Protected?

Abstract

Objectives/Goals
Since California is unprepared for a major tsunami, I wondered if a man made shallow underwater structure would make the wave break earlier before and give up some of its destructive energy before it hits homes, businesses and people.

Methods/Materials
I first built a wave tank six feet long, two feet wide, and seven inches deep. I then built a wave maker with springs and a paddle to create a constant wave force. Sand was placed on one end of the tank to create a beach. On the opposite end was the wavemaker.
Ten wooden pegs, representing buildings, were placed vertically on the beach ½ inch into the sand and two inches above the water surface. The Shallow underwater structure, which I will call an SUS for short, was placed thirty six inches from the shore. The SUS was made of bricks. The control group had no SUS, exp. gr. #1 was two inches below the water surface, and exp. gr. #2 was one inch below the water surface. I did ten trials for each group, by making a wave and counting how many of the ten pegs were still standing.

Results
The average number of standing pegs after the model tsunami hit was 2 for the control, 4 for exp. gr. #1, and 8.4 standing pegs for exp. gr. #2. I even have pictures of how the wave appeared to break as it passed over the SUS. The more standing pegs in the experimental groups meant that the SUS may have helped reduce damage

Conclusions/Discussion
I think my results support my hypothesis. The SUS makes the model wave break before the wave hits the pegs. Less wave energy may destroy fewer buildings, and reduce damage to important to important ports such as San Diego and Long Beach. The SUS could be made of rock or concrete. Since I learned that a wave breaks when the water debt is ½ of the wavelength, for example in 50 feet of water the SUS would be built 15 feet under the surface of the water. Ships could still pass over by staggering the SUS.
If a loud siren would be added to my idea then even more lives could be saved. A SUS would not damage the view, or prevent waves from coming in for recreation.

Summary Statement
Offshore shallow underwater structures could reduce tsunami damage along California's coastline.

Help Received
My father cut out the wood for my tank, and my teacher proofread my first draft and offered suggestions.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Irene Hsu

Project Number
J0610

Project Title
Relationship between Sunspot Number and the Earth's Magnetic Field

Abstract

Objectives/Goals
The objective of this study was to examine the effects of sunspot number on the Earth#s magnetic field. Sunspots are dark areas on the Sun, where the magnetic field is about 2,500 times stronger than the Earth. Occasionally, high-energy and high speed solar winds are ejected from the sunspot areas and thus may cause an impact on the Earth#s magnetic field. In this study, I examined whether the increases or decreases of sunspot number could cause a proportionate change in the geomagnetic field.

Methods/Materials
Sunspot measurements were taken with a Sunspotter daily, and magnetometer measurements were taken with a simple bar magnet magnetometer at 10:00 pm nightly for two months. The magnetic deflection, which is in centimeters, was then converted to the magnetic declination angle, in degrees, for comparison with the sunspot number.

Results
It appears that there is a positive correlation between sunspot number and change in the geomagnetic field

Conclusions/Discussion
The results suggest that sunspot numbers can affect the Earth#s magnetic field. However, it was noticed that there was a discrepancy between sunspot number and the change of the geomagnetic field close to the end of the two months. Several factors may have caused or influenced this inconsistency. Perhaps one of the most important is that the high speed solar wind that originated from a sunspot region did not come directly in contact with the geomagnetic field Nevertheless, even with this discrepancy, my hypothesis, which states that sunspot numbers do affect the geomagnetic field, seems pretty solidly confirmed by these data.

Summary Statement
This study examined the possible correlation between sunspot number and the declination component of the Earth#s magnetic field.

Help Received
My mother and father helped me set up the bar magnet magnetometer. Dr. Mark Moldwin, from the Department of Earth and Space Sciences at UCLA, lent me the Sunspotter.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Jed G. Hurst

Project Number
J0611

Project Title
Wave Stoppers

Abstract

Objectives/Goals
The objective was to determine the affect bottom contour has on the height of a wave. I wanted to try to reduce a wave as much as possible. I wanted to find a possible way to help coastal cities like New Orleans to stop big waves.

Methods/Materials
I used a plastic gutter to try to simulate a small sea or river. I put glass in part of the gutter so I could see the waves. I made a wave making machine from a small section of gutter, a piece of wood, bolts, some aluminum tubing and a piece of string. I used a rubber band to power the machine. I made four different bottoms from cement and combined them to make 6 different bottoms. I used a digital camera to video the trials then used software to stop the videos so I could measure each wave.

Results
The bottom that performed the best was a long sloped bottom. A close second was the triple hill bottom. Both bottoms reduced the waves over ninety percent. A double hill was the third best wave stopper with over eighty percent of the wave stopped.

Conclusions/Discussion
My hypothesis was wrong but I met my objective. The single hill was not the best wave stopper. A long slope was most effective. I did find that multiple hills were very effective at stopping waves. Hills would be easier to make than a very long slope. I think hills built in places that need protection from big waves, like coastal cities, could be very effective for saving lives and property.

Summary Statement
My project is about waves and the affect the bottom has on waves.

Help Received
Dad helped cut the gutter and worked the camera during the trials.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Alex T. Jones

Project Number
J0612

Project Title
Does the Amplitude of a Wave Proportionally Affect Its Energy?

Abstract

Objectives/Goals
The purpose of my project was to determine if the energy contained in waves is proportional to the wave's size (amplitude).

Methods/Materials
To test my hypothesis I built a two-piece force/displacement test machine. The first piece is a hollow cylinder (tank) open on the bottom, closed on the top, with track guides attached around the outside. The second piece is a vertical track that supports the tank and weights and allows the tank to remain perfectly straight so it can slide up and down with little friction. This track support consists of a base box made of wood, with three stainless steel poles mounted vertically from the base and parallel to each other. A wooden lid keeps the poles spaced and holds the machine together at the top. To collect data I put individual weights on the top off the tank, this represents the energy in a wave, and measured how far the tank moved down, this represents the wave's amplitude.

Results
After I collected my data and converted the weight to Newtons and the height to displacement, I graphed my data on a line graph, and I discovered that my graph's line was almost perfectly straight (by linear regression).

Conclusions/Discussion
Based on my graph, I can safely say that a wave's amplitude is directly proportional to its energy and that a larger wave has equal energy proportionally to a smaller wave.

Summary Statement
My project is designed to find out whether large waves create more or less energy proportionally than small waves.

Help Received
Step-Father helped me build test machine; Father helped with display board; Mother took photos of testing.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Annemarie R. Kelleghan

Project Number
J0613

Project Title
Back to Ballona: A Two Year Analysis of Ballona Creek

Abstract

Objectives/Goals
The objective of this project is to measure water properties, such as salinity, at various points along Ballona Creek at high and low tide. Samples were also tested for turbidity. The creek water temperature was monitored.

Methods/Materials
Water samples were taken at various points along Ballona Creek at high and low tide. Density, electrical resistance, pH, and non-volatile residue (NVR) tests were used to evaluate the amount of salt in the water samples. The residue determined in the NVR testing was calculated in parts per thousand (ppt). The samples were tested for turbidity using a homemade turbidimeter. The temperature of the creek was monitored using iButtons. The results were graphed versus the distance inland from the ocean. Bottled freshwater, rainwater, and saltwater taken from the ocean were used as control samples. As a control for the turbidity testing, controlled amounts of milk and water were used to determine the turbidity of different samples. Plant and animal life was observed along the creek giving clues to the presence of salt in the water.

Results
At low and high tide, the water at the ocean outlet of the creek tel sted comparable to the saltwater control sample. As the samples progressed inland, the salinity level decreased. At low tide, samples which were taken 2,700 feet and more inland from the ocean end of the creek tested similar to the freshwater control samples. At high tide samples had to be taken much further inland to reach freshwater. The presence of bay mussels and California sea mussels at various points along the creek, gave evidence of the salinity of that section of the creek. Turbidity testing showed that the water at high tide was more turbid than the low tide water samples. The turbidity testing at low tide at the end of the jetty gave the same results as clear, tap water. The temperatures of the creek rose and fell with the air temperature and the tide.

Conclusions/Discussion
My conclusion is that the salinity level of Ballona Creek varies depending upon the tide. At high tide, the saltwater reaches much further inland than at low tide. The turbidity was lowest both furthest inland from the jetty and closest to the outlet. The creek temperature varied with the air temperature. I found that the conditions of Ballona Creek are hard to control and monitor due to the pollution of the creek, the number of uncontrolled inlets, and other factors.

Summary Statement
Water samples were taken along Ballona Creek, a watershed for all west Los Angeles county, as it enters the ocean to see the changes of the salinity levels, turbidity, temperature, and other physical and chemical properties of the water.

Help Received
Ken Edmondson of Maxim Dallas Semiconductor donated four Maxim iButtons, an iButton fob, and an iButton adapter. My mom and dad drove me to Ballona Creek to collect water samples. My dad bought me the materials to make the turbidimeter, and he assisted me in the assembly of the turbidimeter.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Joanna S. Koo

Project Number
J0614

Project Title
Which Type of Soil Can Hold the Most Water? Soil Textures/ Water Holding Capacity

Abstract

Objectives/Goals
To examine which soil textures can hold the most water (water holding capacity). To check that different soil textures have different water holding capacities.

Methods/Materials
Materials: three different types of soils, oven, distilled water, plastic bags, a cooler, a balance, beakers, stockings, containers, and a graduate cyclinder.
Methods: air-dried soils, weighed the weight of each dried and crystal soil, set an apparatus to pour water into each soil texture, add water, let the soil drain for 1 hour, dry wet soil at 110'C formula wet soil-dry soil/dry soil times 100.

Results
Water holding capacity varied depending on the soil textures. The clay soil had the highest water holding capacity and the sand soil had the least; clay>silt>sand.

Conclusions/Discussion
Clay particles are so tiny and have many small pore spaces that make water move slower (the highest water holding capacity). Sandy soils have good drainage but low water and nutrient holding capacities. Soil texture and water holding capacity affect plant growth.

Summary Statement
The water holding capacity was varied depending on the soil textures and the clay soil had the highest water holding capacity followed by silt and then sand.

Help Received
Father helped me with report and used lab equipment at California Baptist University.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Jessyca A. MacMullin

Project Number
J0615

Project Title
Follow the Jet Stream

Abstract

Objectives/Goals
The objectives of this experiment were to:
1). Determine if barometric pressure and the jet stream have a predictable relationship and
2). To use that relationship to assist in forecasting wet or dry weather for the following day.

Methods/Materials
With the use of our home computer accessing the internet web site www.weather.com, I mapped and recorded the location of the northern jet stream and studied its movements. The aneroid barometer recorded the barometric air pressure in millibars (mbar), showing significant changes in the weather pattern. A rain gauge recorded rain fall in millimeters (mm) outside my home. Daily, for 15 days in February, I recorded in my notebook barometric pressure, precipitation, general weather conditions and the position of the current jet stream as determined at www.weather.com. Each evening at 9:00 PM, I predicted rain or no rain without influence from other forecasters. After making my prediction I printed out the www.weather.com forecast for the next day location of the jet stream. I then analyzed both predictions the following evening.

Results
The first 5 days of the project, we experienced a rainy period of low pressure 996 to 1004 mbars and the jet stream located south of the 47 degrees north latitude. Rain totaled 85 mm. The next 10 days we experienced a dry period of higher pressure 1000 to 1014 mbars. The jet stream was located north of 47 degrees latitude for 8 days. No rain occurred until the 15th day when pressure dropped 5 mbars and the jet stream dipped south of the 47 degrees north latitude and a small rain event occured of 2 mm.

Conclusions/Discussion
My hypothesis was correct about 87 percent of the time during the midwinter 15 day test. It appears, when the northern jet stream is north of 47 degrees latitude, northwest California has generally high pressure (1,003 to 1,014 mbars), and we can expect dry conditions. When the jet stream is south of 47 degrees north latitude and lower pressure, (996 to 1008 mbars) is present, we can expect wet weather.

I also found, when the barometric pressure dropped or rose approximately 10 mbars within a 24 to 36 hour time the dry or rainy period would change to the opposite period.

Summary Statement
This Project is about analyzing the location of the northern jet stream with the barometric pressure of coastal Northern California in order to predict tomorrow#s wet or dry weather conditions.

Help Received
My Dad helped me with understanding the jet stream. My Mom helped me with the lay out of my back board. The US National Oceanic And Atmospheric Administration Weather Station at Woodley Island, Eureka CA meterologists were helpful in explaining various weather concepts.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Alden S. Mitchell

Project Number
J0616

Project Title
Boiling Points

Abstract

Objectives/Goals
The objective to my project was to determine if the boiling point of water changed at different elevations due to atmospheric pressure.

Methods/Materials
My experiment started at sea level. I did two things, one, record the atmospheric pressure, and two, pull out my camping stove and boil water, measuring temperature with a thermometer. I recorded the water temperature every fifteen seconds from the moment I started to the maximum boiling point; this is the point where the water stops increasing in temperature and stays at a rolling boil. I repeated this process twice at the sea level location. Once I recorded all results, I moved to the next location. I traveled up to an elevation of 1,000 feet and completed two more trials. I completed trials ranging from sea level to 7,000 feet in 1,000 feet increments. When every trial was put down on paper my experiment was complete. I then reviewed and compared my results and came to my conclusion.

Results
After my trials I found three main results. The first was that as you go up in altitude, the atmospheric pressure decreased. The second was that as the atmospheric pressure decreases, so does the boiling point (in degrees Fahrenheit). Combining these results also means that as you go up in altitude, the boiling point of water decreased. So, yes, atmospheric pressure does indeed affect the boiling point of water.

Conclusions/Discussion
Compared to my hypothesis, I was right. Although I already suspected the answer to this problem, I did not know why, or if, in fact, it was true. My experiment proved that the pressure decreased as I traveled up to Tahoe (the place of my final trials) and that the boiling point lowered.

Summary Statement
An experiment to determine whether atmospheric pressure affects the boiling point of water.

Help Received
My dad drove me between trials; he also helped setting up the camp stove and calling out temperatures while I recorded them.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Paige A. Nethercutt

Project Number
J0617

Project Title
The HEAT Is On! A Comparison of Heat Retention in Salt Water and Fresh Water Samples

Abstract

Objectives/Goals
The objective was to determine whether fresh water holds heat longer than salt water. I think that the salt water will hold heat longer than fresh water because salt water has a lower specific heat index.

Methods/Materials
250 mL glass Anchor measuring cup; stainless steel beaker; thermometer; timer; pH paper; 250 mL salt water per sample testing;250 mL bottled spring water (fresh water) per sample testing; stove; large bucket. Step 1: Collect salt water sample from the ocean into the large bucket. Step 2: Pour out 250 mL salt water into measuring cup. Step 3: Test pH level. Compare color with guide after 30 seconds. Step 4: Transfer water to the beaker and heat water to 100°C (boiling point). Step 5: Insert thermometer. Record temperature. Step 6: Remove measuring cup from heat. Step 7: Record temperature at the following intervals: 1 minute, 2 minutes, 3 minutes, 4 minutes, 5 minutes, 10 minutes, and 15 minutes. Step 8: Rinse measuring cup. Step 9: Pour out 250 mL bottled fresh water into measuring cup. Step 10: Repeat steps 2 through 8 for nine additional salt water samples. Repeat steps 9 and 3 through 8 for nine additional fresh water samples.

Results
The mean average temperature of the ten salt water samples at minute 1 was 86.08°C. The mean temperature at minute 2 was 75.85°C. The mean temperature at minute 3 was 70.21°C. The mean temperature at minute 4 was 65.89°C. The mean temperature at minute 5 was 62.28°C. The mean temperature at minute 10 was 54.71°C. The mean temperature at minute 15 was 49.23°C.

The mean average temperature of the ten fresh water samples at minute 1 was 84.31°C. The mean temperature at minute 2 was 75.82°C. The mean temperature at minute 3 was 68.38°C.The mean temperature at minute 4 was 61.5°C. The mean temperature at minute 5 was 57.49°C. The mean temperature at minute 10 was 48.83°C. The mean temperature at minute 15 was 41.93°C.

Conclusions/Discussion
In conclusion, my hypothesis was correct. I predicted that the salt water samples would have a higher average temperature at the end of the fifteen minute data collection period. The salt water samples had an average temperature of 49.23°C at the end of fifteen minutes, and the fresh water samples had an average temperature of 41.93°C. This is a difference of 7.3°.

Summary Statement
My project is a comparison of heat retention in salt water and fresh water samples.

Help Received
My parents assisted with the Excel graphs, proofreading my report drafts and taking photographs of my data collection process; my neighbor Ralph Miljanich loaned me his beaker that enabled me to heat the water directly on the stove. Lastly, my advisor, Mrs. Julie Paz provided continued support and

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Ritika Pandita

Project Number
J0618

Project Title
Arsenic Adversity

Abstract

Objectives/Goals
This project was based on measuring the concentration of arsenic in the local waters of Pasadena. The samples were from Eaton Canyon, which was obtained from a waterfall, South Pasadena Middle School, from a drinking fountain,South Pasadena tap water,from a local homes tap, Garfield Park and South Pasadena Public Library, both from a drinking fountain. The objective of this experiment was also to see whether or not the amounts were within safe limits according to the Environmental Protection Agency's allowed amount of 10 parts per billion.

Methods/Materials
Every trial was tested on reduction, which converted arsenic V into arsenic III, color development which involved three chemicals. In both procedures, the water samples were put in an 80 degree centigrade water bath and was left for cooling in front a high velocity fan. Oxidation and Phosphate testings were performed. The data was obtained from an "arsenic monitor program" connected to a Spectra Sensors photometer. The materials included; five water samples, pipetteman,80 degree centigrade waterbath, 250 ml wash bottles, arsenic monitor program, Pottasium Iodate, Sulphuric acid, Reagent A, 1000 ml. empty beaker for aqueous waste, 150 ml. beaker for solid waste, 250 ml. wash bottles to avoid contamination, Spectra Sensors photometer, timer, and cotton tip applicators.

Results
Every water sample tested was within safe limits. South Pasadena Middle School had -6.3483 ppb, South Pasadena tap water had -4.589 ppb, Garfield Park had -4.69144 ppb, Eaton Canyon had -2.0327 and South Pasadena Public Library with -4.2910. The negative results was because the procedure sensitivity was 2ppb and above, and all my results turned out to be less than 2 ppb. The real amounts was tested by an independant lab which used a different method which involved sophisticated equipment.

Conclusions/Discussion
My hypothesis was that the concentration of arsenic will be a bit more in the residential areas and there will be a lower arsenic concentration in places less industrialized. While taking a look at the average concentration of arsenic, South Pasadena Middle School had the least concentration, followed by Garfield Park, South Pasadena tap water, South Pasadena Library and Eaton Canyon. It is very important to monitor the concentration of arsenic in our local waters to see if it is safe. Arsenic is very toxic and can cause many carcinogenic diseases.

Summary Statement
This project is about testing the concentration of arsenic in Pasadena.

Help Received
Worked in lab of Oak Crest Institute of Science, Dr. Gregory Poskrebyshev explained the procedure and equipment.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Jeni P. Penunuri

Project Number
J0619

Project Title
How Does the Air Pressure Affect a Hurricane?

Abstract

Objectives/Goals
The objective of this this project is to determine how air pressure affects hurricanes. I will make a model hurricane and measure the air pressures within this hurricane system, while varying the the inlet pressure which is introduced into this system. I hope that we will learn a lot from my project and that scientists will use this information to help control hurricanes or warn people.

Methods/Materials
A model hurricane system was put together using two air humidifiers, which supplied cool white fog into a clear plastic chamber. An air compressor was used to introduce pressurized air into this chamber via two small copper inlets situated near the top of the chamber and opposing each other. An air vortex was created. Using different inlet pressures of 0, 50, 150, 200, and 250 cmH20, chamber pressures were measured with a manometer at various levels (level 1, Level 2, and level 3). At each level measurements were taken at distances 0cm, 3cm, 6cm, and 12cm from the eye of the hurricane.

Results
As the air pressure entering the system via the inlet is increased, the individual measured air pressures also increased in general. However, the eye of the hurricane had no pressure or very little pressure if any. Furthermore, as one moves away from the eye of the hurricane and gets closer to the wall of the hurricane, the air pressure increases. The pressures in the lower levels of the hurricane get slightly weaker compared to the higher levels.

Conclusions/Discussion
In general, the greater the pressures in a hurricane system, the stronger and more violent the hurricane. However, the eye of the hurricane remained calm and with no change or minimal change despite various inlet pressures. The minimal change may be due to static air pressure within the system. The eye of the hurricane must be the safest place inside a hurricane.

The greatest air pressures occurred closest to or in the wall of the hurricane. For practical purposes, the wall of the hurricane must be the most dangerous part of the hurricane for people who are trapped within a hurricane storm.

This experiment also showed, that the outermost top layer or the upper outer ring of the hurricane has the most pressure of all points in a hurricane. This means that if an airplane gets caught in this part of the storm, it would most likely get sucked into the spiral and never come out again. Therefore, pilots should try to avoid this part of the storm.

Summary Statement
My project is about hurricanes and how the air pressure affects the hurricane.

Help Received
My Dad helpd me build the vaccum for my hurricane.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Alec D. Simpson

Project Number
J0620

Project Title
Avalanches in a Sandpile: How Does Granularity Affect the Angle of Repose?

Abstract

Objectives/Goals
This project aims to find how granularity affects the angle of repose based on the size and shape (regularity or irregularity)of the grains in the granular material.

Methods/Materials
Sandpiles were constructed using custom built mechanisms and surfaces that allowed the angle of repose to be measured. Several types of granular materials were used in the experiments: play sand, reptile sand, iodized table salt, and coarse sea salt. An eight step process was used. Step 1 -- Construct and assemble mechanisms and surfaces. Step 2 -- Insert granular materials to be tested into the testing chambers. Step 3 -- Using release mechanism, release granular materials into testing chambers under the influence of gravity. Step 4 -- Using a protractor, measure the slope angles for each granular material. Step 5 -- Using a protractor, measure the angle that the granular material can be "tilted" before significant avalanches occur. Step 6 -- Using the protractor, measure the angle of the granular material after material collapse. Step 7 -- Invert testing chambers to return granular materials in the testing chambers to initial state. Step 8 -- Iterate Steps 3-7 an additional nine times for a total of ten trial runs (N-10)to demonstrate consistent and repeatable results.

Results
The experimental trials revealed that there is a systematic relationship between the size and irregularity of the granular materials with regard to the angle of repose.The larger (in terms of volume) and more irregular (in terms of non-uniform surface area)the granular material grains the higher the angle of repose. The arithmetic means (simple averages) for the angle of repose of the granular materials were: play sand (coarse sand) 32 degrees, reptile sand (fine sand) 29 degrees, iodized table salt 32 degrees, coarse sea salt 38 degrees.

Conclusions/Discussion
The experimental results of this study support the hypothesis that the larger and more irregular the granular material grains, the higher the angle of repose. This study was limited to small grain structures. A future study could examine larger grain structures. For example, various types of construction "sands" and "aggregates" used in the extractive and construction industries could be examined on a "large sandpile" scale.

Summary Statement
Granular materials form "sandpiles" having well-defined angles of repose that are systematically related to grain size (volume) and irregularity (non-uniform surface area).

Help Received
My sisters helped me understand the scientific method. My parents helped me construct the test chambers. Dr. John C. Howe helped me understand the principles and methods of material science.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Alexis Singh

Project Number
J0621

Project Title
What Is the Effect of Dissolved Oxygen in Different Water Sources?

Abstract

Objectives/Goals
to measure the dissolved oxygen in different water sources and some different areas of the rivers to see if it effects the aquatic life.

Methods/Materials
La motts dissolve oxygen kit, contains tabblets and containers. first u take the water sample in the container. then you put two tablets to change the color and so we can see if it has higher dissolved oxygen or lower oxygen.

Results
the lakes were higher including the tap water and the creeks and rivers were little low because of teh pollution in the water.

Conclusions/Discussion
i found out that the man made lakes has more dissolved oxygen than natural creeks or rivers because of the polution and the aquatic life.

Summary Statement
my project is about measuring the the dissolved oxygen in the different water sources and different area of the rivers and creeks.

Help Received
dr.preet mohinder singh, helped getting tthe results; brandon hartman, helped to edit; maninder kaur, putting the display

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Ben J. Smith

Project Number
J0622

Project Title
Fossils of the Bay Point Formation

Abstract

Objectives/Goals
To discover what fossil life is found in the Torrey Pines Bay Point Formation compared to the fossil life found in the Point Loma Bay Point formation.

Methods/Materials
Fossils are collected using the random hoop toss method. A 304.8 millimeter hoop is tossed in a random area and nailed to the ground. A grid is put over the hoop and the location of each fossil in the hoop is documented. Dental picks and tweezers are used to remove the fossil to a plastic bag. In some cases, pictures are taken to document fossils.

Results
Fossils found in Point Loma included 36 tivola stoltorum #clams#, 75 cerithium atratum #spiral snails#, 17 calliostoma jujubinum #snails#, 1 memertea #tube worm#, 1 lima scalara #scallop#, 8 alosa sapidissma #oysters#, 2 crassostra gigas #mussels#, 2 gastropods, 2 stereocidans, and 21 dendririssurella scutellum #Key Hole Limpets#. Fossils in Torrey Pines include 40 tivola stoltorum #clams#, 1 calliostoma jujubinum #snail#, and 2 crassostra gigas #mussels#. "Clams# are the most common fossil in the Bay Point Formation.

Conclusions/Discussion
Fossil life in Torrey Pines is different to the fossil life in Point Loma. Point Loma had a greater variety of fossils, ten different species. Torrey Pines had a smaller variety, only three species. This may be due to a lack of tide pools that some animals depend on. Torrey Pines may not have had tide pools, just sandy beaches where clams can bury themselves in the sand. Point Loma may have had tide pools for animals like snails and keyhole limpets. Clams were common to both locations because clams are abundant and could adapt to living in both protected tide pool environments and rugged, unprotected seashores.

Summary Statement
This project compared the fossil populations found in the Bay Point Formation of Point Loma and Torrey Pines in San Diego, California.

Help Received
Parents drove and assisted me

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Nikki M. Tachiki

Project Number
J0623

Project Title
Ground Substances at Different Locations Affect the Flow Rate of Water

Abstract

Objectives/Goals
To determine how different locations substrates affect the flow rate of water and their permeability to water. To prove drier climates increase the porosity of soil and sand substrates; therefore substrates closer to the center of the desert would have the highest flow rates.

Methods/Materials
The procedures are as follows:
1. I constructed a tube stand using wood. I collected eighteen samples of soil. I put a tube filled with soil through the stand and poured water in using a coffee filter to keep the soil in place. After three minutes, I removed the measuring cup to record the amount of water flowed through.
2. I altered the location of the ground sample to test my hypothesis.
3. Two trials were conducted for each soil sample. The first trial was through dry soil and the second was through wet soil.
4. I measured the amount of water that flowed through the tube in milliliters. I used this amount to calculate the velocity by dividing the amount of water flowed throuh, over the time water passed through the tube, all over the area of the tube.
I materials I used were wood, Titebond II Premium Wood Glue, screws, plastic flex tailpieces, copper tube straps, waterproof tape, coffee filters, rubber bands, one inch tubes, measuring cups, a stopwatch, water, and ground substances to perform my experiment.

Results
The results from my experiment were: (1) The amount of water that flow through the tube after three minutes ranged from 1 to 91 milliliters. (2) The velocity of the flow rate of water ranged from .31cm per minute to 5.71cm per minute.

Conclusions/Discussion
The location of the samples did affect the flow rate. Each sample location varied in velocity. The average flow rate from the Red Rock Canyon was the fastest. This location was closest to the center of the desert therefore proving my hypothesis and prediction correct. There was no pattern observed based on the soil substrate#s location.

Summary Statement
By finding the flow rate of water through ground substances, I proved drier climates increase the porosity of soil and sand substrates; therefore substrates closer to the center of the desert would have higher flow rates.

Help Received
Father helped buy supplies; Mother helped glue papers to the board; Mr. Hobbs helped me stay oraganized and on track.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Samuel F. Thorne

Project Number
J0624

Project Title
What Soil Properties Cause the Biggest Sinkhole When Mixed with Water?

Abstract

Objectives/Goals
To find out which mineral causes the biggest sinkhole when mixed with water.

Methods/Materials
For my experiment, I covered the bottom of a container with six inches of sand. I punched two holes in each side of the container. Two tubes were placed in the holes of the container. I made a small pocket of the mineral in the sand. I placed the two tubes in the center of the mineral pocket. I covered the mineral pocket with sand until the container was 3/4ths full. Two syringes were hooked to the opposite ends of the tubes. I pumped 200 milliliters of water into the pocket (the water had to be pumped into the container at the same rate). Then I observed how much the sand had sunk and measured any sinkhole with a ruler. I repeated the experiment three times per mineral.

I used the following materials: Two syringes, two tubes, limestone, gypsum, salt, sulfur, duct tape, plastic container, sand, water, ruler, pocket knife and a funnel.

Results
Salt worked the best. It averaged sinking 1 and 2/8th inches. Gypsum worked the second best. It averaged sinking 7/8th of an inch. Limestone worked the third best. It averaged sinking 3/8th of an inch. Sulfur did not cause a sinkhole.

Conclusions/Discussion
My conclusion is that salt caused the biggest sinkhole. I also discovered that gypsum and limestone caused sinkholes. However, sulfur did not cause a sinkhole. My hypothesis that salt would cause the largest sinkhole was correct, however, I was wrong in my hypothesis that limestone would work better than gypsum. Gypsum caused twice as big of a sinkhole as limestone. I achieved my objective of finding which mineral caused the biggest sinkhole because I discovered that salt, gypsum and limestone all caused sinkholes and sulfur does not.

Summary Statement
I tested four soil properties to determine which properties caused the biggest sinkhole when mixed with water.

Help Received
Dad helped pump the water into the container during the experiment. Mom helped with the typing.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Melanie N. Wathugala

Project Number
J0625

Project Title
War Against Water: Using Electrical Analogy to Study the Resistance to Seepage under Dams with Different Seepage Curtain

Abstract

Objectives/Goals
The objective is to find out what location (front, middle, back) and length of seepage curtains cause the most resistance to seepage under dams. If dams with seepage curtains in three locations of two lengths (short and long) are compared for resistance to seepage, then the dam with the longest curtain in the middle of the dam will create the most resistance.

Methods/Materials
It was tested by using electrical analogy. Different amounts of voltage (that represent the difference in water level) were applied across the graphite paper (that represents soil) with the shape of the dam cut out. The voltage and current were taken from each dam tested for all five applied voltages (batteries). First, a dam with no curtain was measured. Then a short curtain was cut out in the front and measured. Then the longer part was cut out and measured. All of that on the same paper to eliminate most errors. The same was done for the middle location of seepage curtains and back on their own papers. The resistance was found using a graph of measured voltage and current. The resistance was normalized using the resistance of the control dams, and then compared.

Results
The middle curtains had the highest normalized resistance with 1.198 (short curtain) and 1.604 (long curtain). The normalized resistances for the front and back curtains were (a) 1.072 (short), 1.410 (long) and (b) 1.175 (short), 1.573 (long) respectively. Overall, longer curtains were more successful than the shorter curtains by around 40%.

Conclusions/Discussion
Overall, the seepage curtains increased the resistance. The increase of resistance from the second three centimeters on the curtains was higher than the increase of resistance due to the first three centimeters. Another trend was that the resistance was independent of the applied voltage. More voltage led to more current as higher water level upstream will lead to more seepage. For the curtain placement, the hypothesis was supported, as the middle curtain consistently showed higher resistance compared to the other locations. This is useful in building new dams so that they are more effective and if there is a crisis like Hurricane Katrina, then the dams will already be working well and the seepage will not be making it weaker.

Summary Statement
This project finds where a seepage curtain is most effective and which of short and long lengths are better by using a model with graphite paper and electricity to follow an electrical analogy.

Help Received
Dad helped get research materials and acted as an at-home advisor.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Aaron M. Zuspan

Project Number
J0626

Project Title
A New Method for Tracking Individual Particle Movement in Streams

Abstract

Objectives/Goals
My project objectives were to 1) develop and demonstrate the use of Radio Frequency Identification (RFID) as an effective and economical method for tracking individual particle movement in streams; 2) to investigate the relationship of particle size to distance traveled in a California stream

Methods/Materials
Eight rocks, of four different size groups, were implanted with 32mm glass passive interrogation transponder (PIT) tags and placed in Freshwater Creek, Humboldt County in the winter of 2005. We tracked the downstream movement of these tagged rocks by scanning the creek on two occasions using a backpack-mounted RFID antenna/receiver unit. We recorded the location that the rock were detected on a GPS device and later plotted the sites on a USGS 24k topographic map.

Results
We scanned the creek twice (10/23/05 and 2/10-2/15/06) from the point of placement downstream about # of a mile where we were confident that our study rocks had not traveled beyond. In these two surveys, we located 7 of the 8 rocks (87.5%) and found they had traveled between 378 to 3,120 feet. In this study, the size of the particle had little or no influence on the distance it traveled. Rock #7, from the largest group, traveled nearly the same distance (2,424 ft) as Rock #1, from the smallest group (2,629 ft). Additionally, rocks in the same size groups did not travel similar distances.

Conclusions/Discussion
My study showed that RFID can be used effectively to track the downstream movement of individual rocks as they are mobilized by high flows. The use of RFID in bedload movement studies should lead to a much better understanding of this important geologic process, currently not attainable using conventional methods. Additionally, my study has shown that the size of rock particle has little or no effect on its downstream migration to the ocean.

Summary Statement
My project was to develop, and demonstrate the effectiveness of, RFID technology to track individual particle movement in streams.

Help Received
California Department of Fish and Game provided the equipment for the study. My Father gave technical advice and reviewed and made comments on my report.