CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

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Project Number

J0898

Project Title

Higher Elevations = Colder Temperatures: True or False?

Abstract

Objectives/Goals

We wanted to find out if it always gets colder as you get higher in the mountains.

Methods/Materials

We used thermochrons (called iButtons) which are thermometers about the size of a quarter that record many air temperature, date, and time samples. We made cases for them using screen, PVC pipes, staples, and wire. We created a recording sheet to keep track of the iButtons, their locations, and placement times. Also, we needed outdoor gear (mountain bikes, skis, snowshoes, etc.) to place the iButtons.

First in our procedure, we programmed the iButtons to record the temperature at ten minute intervals. Next, we placed 11 iButtons around the Eastern Sierra Nevada at elevations ranging from Mono Lake at 6,386 feet (1,946 meters) to the summit of Mammoth Mountain at 11,053 feet (3,369 meters). We picked north side locations, out of direct sunlight, and made sure that the iButtons wouldn't get buried in new snow by placing them more than two meters above the snow surface. We left the iButtons out from January 21 through January 28, 2013. After collecting them, we downloaded the data (approximately 11,000 data points) into our computer. Then, we used Excel to analyze the data and make our graphs. Along the way, we learned that experiments don't always go as planned, because our Mammoth Mountain iButton got frozen in rime ice and took an extra week to recover.

Results

We calculated lapse rates (change in temperature with change in elevation) from our data. Our data supports the conclusion that it usually gets colder as you get higher. For example, at 6am on January 27 it was -3 C at 1,946 meters and -12 C at 3,369 meters, a lapse rate of -6.4 degrees C per 1,000 meters. However, when special weather conditions created a temperature inversion, the data showed that lower elevations were much colder than higher ones.

Conclusions/Discussion

With our data, we found that it gets colder as you get higher in the mountains. Sometimes there are exceptions called temperature inversions, and they happened over two of our testing days, which we are very excited about because they are so interesting. Inversions happen when the air is calm and the cold air (being heavier) sinks down and pools in the valleys and basins. When there is an inversion, low elevation locations are colder than high elevation ones.

Summary Statement

We measured temperature at elevations between 6,386 and 11,053 feet in ten minute intervals for 7 days; the data showed that it usually gets colder as you get higher in the mountains, but there are exceptions called temperature inversions.

Help Received

Dr. Connie Millar lent us the iButtons and discussed inversions with us. Our parents went with us to place the iButtons and collect them, and Caelen's dad showed us how to use Excel. Jordyn's parents collected two iButtons for us. Dr. Millar asked us lots of questions to help us analyze our data.