Name(s)	Project Number
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Project Title

Predicting Earth's Long-Term Temperature Variations

Abstract

Objectives/Goals

The objective of this experiment was to find a mathematical equation to predict earth's long term temperature variations. With this information, I can find out if the earth's natural variations can help correct global warming.

Methods/Materials

Past earth temperature variations from ice core data were plotted. Changes in earth eccentricity and obliquity were also calculated and then plotted. I looked for a periodic function to model the cyclical variations of temperatures and used experimental data to determine the amplitude and period of the function. I then applied this equation to estimate the near future impact of these changes.

Results

Past temperatures correlated well to past eccentricity. By using the periodic function $F(T)=A*SIN(2*Pi*T/P)$, it is possible to create a cyclical long-term temperature prediction. I found that the amplitude (A) of -7.2 degrees and period (P) of 92,500 years correlated well with eccentricity variations in past and future. With this data, it was possible to determine how fast the temperature decreases or increases on a normal basis. By comparing the rate at which the temperatures decrease from changes in eccentricity of the earth's orbit to the rate at which temperatures increase from global warming, it was possible to discover that variations based on these orbital dynamics are minimal and cannot overcome the rapid rate of global warming.

Conclusions/Discussion

I was able to derive a function that is useful to predict future long-term temperature cycles. I determined that the eccentricity changes of earth orbit around the sun would only affect the temperature by less than 1 degree Celsius over 1000 years. Global warming is heating earth at a much faster rate (around 1 degree Celsius per 100 years) than the long-term eccentricity variations can cool earth. This result demonstrates that it is truly up to humans to stop global warming and if they are successful, the temperature will continue in its natural periodic function as predicted.

Summary Statement

To predict the earth's long-term temperature variations based on changes in orbital dynamics and study their relation to current global warming.

Help Received

Father helped with formatting the data in Excel.