A Novel Method for Accurately Modeling Past Atmospheric Conditions Using Ice Core Data from Law Dome and WAIS Divide: An Approach to Monitor Future Climate Sustainability

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Ice cores extracted from ice sheets contain valuable information about the past atmospheric makeup inside air bubbles within the ice, which are measured by releasing the contents of trapped gases. This project looks at carbon dioxide in particular, which is significant in its growing effect on average temperatures as an important greenhouse gas. CO2 was measured with data from Law Dome and WAIS Divide. As the snowfall builds up in these regions with permafrost, enormous levels of pressure cause snow to transition into ice. Until this transition, air molecules constantly diffuse through the firn column, meaning younger air can flow between the pores in the ice, traveling deeper. Typically, depth of a sample is converted to a gas-age using the delta-age method. However, this method only takes into account the averages, not the fact that there is a distribution of ages at each depth. This distribution causes a large overlap from year to year in the gas age. Statistically, this creates a moving average in the data, which in turn causes a smoothing in the slopes in the data. This project inverts the natural averaging occurring to see a more detailed rendering of Earth's past climate. It shows climate varied more quickly than anticipated in the past 500 years. Unfortunately, the levels of CO2 today are the highest they have been during the entire time period. By showing a predicted yearly value rather than an average with a range of several decades, vital climatic processes can be further understood. This model will aid in the predicting of the future climate, and the more thoroughly the implications of climate change are understood, the more that will be known in order to guide development of the world on a sustainable path.

Awards Won:

Drexel University: Full tuition scholarship $194,000