Hidden Signals in Paleoclimate Records: Investigating the Importance of the Sun to Earth's Climate

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Sunspot records only go back a few hundred years, so there is limited information available to predict solar behavior. This project studied high-resolution ice cores which store 10k+ years of paleoclimate history. This project analyzed the South Pole Ice Core extending back over 50,000 years. The preserved isotopic ratios of water act as a proxy for climate and are affected by internal (on Earth) and external (outside of Earth) influences. We predicted sunspot variability would affect these isotopes and we searched for signals within the data. Using MATLAB to perform a Fast Fourier Transform, a spectral analysis technique that determines the amplitude and periodicity of "hidden signals" within data sets, we confirmed the existence of a 189-year Suess-DeVries sunspot cycle and multiplicities of the 11-year Schwabe sunspot cycle, which implies that these cycles have operated through the last glacial period. Previous studies have only been able to narrow the Suess-DeVries cycle's periodicity down to a range of 185-210 years. Our analysis suggests that this cycle has a 189-year period, which could be used to create a more accurate sunspot prediction model in the future. This model would allow us to more accurately predict solar weather events and potentially prevent satellite failure.

Awards Won:
American Meteorological Society: First Award of $2,000