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The Development of a System to Analyze and Compare Colonial Era Weather Data to more Modern Data to Investigate Climate Change

The goal of this investigation was to determine the effectiveness of using colonial era weather data to study trends in climate changes over the past 250 years in the northeastern United States and to create a model that is an easily adaptable system for analyzing and comparing other historical weather data to modern data that can have universal use. One of the hottest topics facing our generation is developing a more complete understanding of global weather patterns, industrial era carbon usage, and their impact on climate change. Recovering and utilizing all relevant historical information is crucial for the development of models needed to predict future climate trends. There has been a significant amount of direct research on temperature changes since the mid 1800s, producing some well known graphs showing the magnitude of global land and ocean temperature increases during the latest 150 years. Most information about weather prior to 150 years ago has been derived from secondary sources such as tree rings, ice cores and coral reefs that can only provide relative temperatures. Since the advent of standardized thermometers in and around the early 1700s, much detailed historical information exists, but at this point has not been fully utilized to detail changes in the 1700s and the first half of the 1800s. Reliable historical colonial weather data based on direct human

observations offers a unique window into past climate conditions and to help create direct measures of that century gap.

To help fill in that information gap, the goals of this investigation were reached by comparing weather data that was recorded near Philadelphia, Pennsylvania from the colonial era, for five years ending in 1770 by Phineas Pemberton to data from 1878-1887 and the modern day temperatures ending in 2009 from Philadelphia, Pennsylvania, an urban location, and West Chester, Pennsylvania, a rural location. Since the 1700s, not only have the average temperatures increased significantly, but the distribution of higher temperatures has changed dramatically.. Preliminary results indicate that historical data is useful in observing the change in temperature over time. Since the 1700s, both the temperature in Philadelphia and West Chester has increased. As a small example, in the five years from the 1700s included in our study, there was not one day over 90°F but in the 1800s in Philadelphia there were 45 days over 90°F and in West Chester there were 39 days over 90°F. This work also highlights the positive educational outcomes as a result of collaboration among individuals within organizations such as NOAA, ACRE (Atmospheric Circulation Reconstructions over the Earth), and historical archives such as those maintained by the American Philosophical Society in Philadelphia. The project provides a model whereby high school students can work with professionals to produce meaningful research.