Name(s) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**How Has Temperature Changed Since the Industrial Revolution?**

**Exploration 3: A Comparison of Temperature Trends**

***Part A – Temperature Trends over Recent Decades Compared to the Past 125 Years***

In the previous exploration, you estimated the trend line for the past 125 years. You also used linear regression to calculate the slope for the past 125, 100, 75, 50 and 25 years, and you graphed the trend lines for 125 years and 25 years. Now you use the interactive time-series graphing tool to view the trend lines for these same time periods.

**Use the interactive, time-series graphing tool to answer the following questions.**

1. Click on the button for 125 years. How much does this slope differ from the one that you estimated in Part B of Exploration 2.
2. Click on the buttons for the 100-, 75-, 50-, and 25-year time intervals. How do your observations compare to the slopes of the trend lines that you calculated using linear regression in the previous exploration?
3. What do you observe about the slopes of the trend lines for each time interval?

***Part B – Calculating the Rate of Change (Slope) of Temperature***

The interactive time-series graphing tool just showed trend lines and slopes using a calculation in the program. However, it is possible to calculate the slope of a line if you know two points on the line. To do this, you calculate the change in the y value or the temperature anomaly over the change in the x value or time in years. Follow the directions below to calculate the approximate slope of each trend line for the 100-, 75-, 50-and 25-year time intervals. Remember that the slope is the rate of change.

**Use the interactive, time series graphing tool to answer the following questions.**

1. Click on the trend line for 100 years. Choose a data point near the beginning (left side of graph) that is ***on the line*** or ***as close to the line as possible***. Enter the beginning year and the beginning temperature anomaly in the table.
2. Choose an ending year that is ***on the line*** or ***as close to the line as possible***. Enter the ending year and the ending temperature anomaly in the table.
3. Calculate the change between beginning and ending years AND the change between beginning and ending temperature anomalies. Enter these values in the table.
4. Use the equation above to calculate the slope of the line between the two points you chose.

Slope = vertical change (rise) = y2 – y1

horizontal change (run) x2– x1

1. Repeat steps 1-4 to complete the table.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Time**  **Interval**  **(Years)** | **Beginning Year** | **Ending**  **Year** | **Change**  **In**  **Years** | **Beginning Temperature Anomaly** | **Ending**  **Temperature**  **Anomaly** | **Change in Temperature**  **Anomalies** | **Slope**  **(Rate of Change)** |
| **125-Year** (1885-2010) | **1894** | **2000** | **106** | **-0.31** | **0.3** | **0.61** | **0.006** |
| **100-Year** (1910-2010) |  |  |  |  |  |  |  |
| **75-Year** (1935-2010) |  |  |  |  |  |  |  |
| **50-Year** (1960-2010) |  |  |  |  |  |  |  |
| **25-Year** (1985-2010) |  |  |  |  |  |  |  |

1. How similar is this slope using two points on the line to the one calculated under the graph on the website? If there is a difference, why do you think that is?

***Part C – A Comparison of Very Recent and Past Warming Trends***

You have just seen that the rate of change for increasing temperature anomalies is greater over the more recent decades than over the span of time since the industrial revolution in the 1880s. But how does this recent rate of change compare to rate of change determined from the ice core data?

You will need to review your response to Temperature Over Time - Investigation 1, Exploration 1, Question 7 (Antarctica) **and** Investigation 1, Exploration 2, Question 8 (Greenland). Fill in these rates of change and the 125-Year and 25-Year rates of change in the table.

|  |  |
| --- | --- |
| **Time Intervals for Different Ice Cores**  **and Instrumental Data** | **Rates of Change for Temperature Anomalies**  (per 100 years) |
| Antarctica Glacial-Interglacial Periods |  |
| Greenland Glacial-Interglacial Periods |  |
| 125-Year (1885-2010) |  |
| 25-Year (1985-2010) |  |

Compare the average rate of increase of temperature anomalies for the glacial-interglacial periods to the rates of change over the last 125 and 25 years to answer the following questions.

1. How many times greater is the rate of temperature change for 1885-2010 (since the industrial revolution) than the average for the three Antarctica glacial-­interglacial cycles?

1. How many times greater is the rate of temperature change for 1985-2010 than the average for the three Antarctica glacial-interglacial cycles?
2. How does the rate of temperature change for 1985-2010 compare to the average for the three Greenland glacial-interglacial periods?

1. How many times greater is the rate of temperature change for 1985-2010 than the average of the last 125 years?