**Evidence of Global Warming**

**Hurricanes and Ocean Temperature**

**Introduction**

Hurricanes are storm systems that form over warm waters in the Atlantic and Pacific oceans. These storms have a long history of inflicting disaster on coastal cities and ecosystems, with high winds, torrential rains, and storm surges. Hurricanes have also been linked to global warming, although the exact correlation is not fully understood. For this assignment, you will track the frequency and strength of hurricanes since 1980, and compare this data with average surface and ocean temperatures.

**Hurricane Data**

A good source of hurricane data is the Unisys Weather hurricane website, located at <http://weather.unisys.com/hurricane/atlantic/index.php>. Begin with the year 1980, and record the wind speed of each **hurricane** tracked. Calculate the average wind speed of all the hurricanes, and count the total number tracked during that year. Repeat for every 2 years up through present day.

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| **Year** | **Maximum Wind Speed of Each Hurricane (Knots)** | **Average Maximum Wind Speed of All Hurricanes (Knots)** | **Total Number of Tracked Hurricanes** |
| **1980** |  |  |  |  |  |
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| **1982** |  |  |  |  |  |
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| **1984** |  |  |  |  |  |
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| **1986** |  |  |  |  |  |
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| **Year** | **Maximum Wind Speed of Each Hurricane (Knots)** | **Average Maximum Wind Speed of All Hurricanes (Knots)** | **Total Number of Tracked Hurricanes** |
| **1988** |  |  |  |  |  |
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| **1990** |  |  |  |  |  |
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| **1992** |  |  |  |  |  |
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| **1994** |  |  |  |  |  |
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| **1996** |  |  |  |  |  |
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| **1998** |  |  |  |  |  |
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| **2000** |  |  |  |  |  |
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| --- | --- | --- | --- |
| **Year** | **Maximum Wind Speed of Each Hurricane (Knots)** | **Average Maximum Wind Speed of All Hurricanes (Knots)** | **Total Number of Tracked Hurricanes** |
| **2002** |  |  |  |  |  |
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| **2004** |  |  |  |  |  |
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| **2006** |  |  |  |  |  |
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| **2008** |  |  |  |  |  |
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| **2010** |  |  |  |  |  |
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| **2012** |  |  |  |  |  |
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**Average Surface Temperature Data**

The data for average surface temperature is measured in comparison with the time period of 1951-1980. Negative numbers indicate temperatures below the average for that time period, positive numbers indicate temperatures above the average. Record the January-December annual mean temperature for every other year, starting in 1980.

The NASA surface temperature database can be found here: <http://data.giss.nasa.gov/gistemp/>

Scroll down to the following database:

**Combined Land-Surface Air and Sea-Surface Water Temperature Anomalies**

**(Land-Ocean Temperature Index, LOTI)**

* Global-mean monthly, seasonal, and annual means, 1880-present, updated through most recent month.

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| --- | --- | --- | --- |
| **Year** | **January-December Temperature Change (0.01 °C)** | **Year** | **January-December Temperature Change (0.01 °C)** |
| 1980 | +23 | 1996 |  |
| 1982 |  | 1998 |  |
| 1984 |  | 2000 |  |
| 1986 |  | 2002 |  |
| 1988 |  | 2004 |  |
| 1990 |  | 2006 |  |
| 1992 |  | 2008 |  |
| 1994 |  | 2010 |  |
|  | 2012 |  |

**Atmospheric Carbon Dioxide Levels**

The National Oceanic and Atmospheric Administration (NOAA) carbon dioxide data, taken from Mauna Loa in Hawaii, can be found here: <http://www.esrl.noaa.gov/gmd/ccgg/trends/>. Scroll to the bottom, under “Data”, and click on “**Mauna Loa CO2 Annual Mean Data**.” *Round to the nearest whole number*.

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| --- | --- | --- | --- |
| **Year** | **CO2 Concentration (ppm)** | **Year** | **CO2 Concentration (ppm)** |
| 1980 | 339 | 1996 |  |
| 1982 |  | 1998 |  |
| 1984 |  | 2000 |  |
| 1986 |  | 2002 |  |
| 1988 |  | 2004 |  |
| 1990 |  | 2006 |  |
| 1992 |  | 2008 |  |
| 1994 |  | 2010 |  |
|  | 2012 |  |

**Data Analysis**

Create a double line graph to show how each of the following variables change from 1980-2012.

**Graph 1: CO2 Concentration vs. Average Surface Temperature Change 1980-2012**

 ***(Left Y-axis) (Right Y-Axis)***



**Graph 2: Average Surface Temperature Change vs. Hurricane Strength (Knots) 1980-2012**

 ***(Left Y-axis) (Right Y-Axis)***



**Graph 3: Average Surface Temperature Change vs. Hurricane Frequency 1980-2012**

 ***(Left Y-axis) (Right Y-Axis)***



**Conclusion**

1. Does your data indicate a relationship between **atmospheric CO2 concentration** and **average surface temperature**? Explain.
2. Does your data indicate a relationship between **average surface temperature** and **annual average hurricane wind speed**? Explain.
3. Does your data indicate a relationship between **average surface temperature** and **annual hurricane frequency**? Explain.