Climate Change Project

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ATM 320

Introduction

The purpose of this project is to determine whether climate-change is happening on a global scale by analyzing atmospheric data recorded over the last 40 year period. Global temperatures are represented in terms of anomalies, which are departures from a long-term average. The Southern Oscillation Index (SOI) is an index based on observed sea-level pressure differences between Tahita and Austria; this index might be useful in modeling atmospheric temperature trends. We will analyze trends in global temperature anomaly, SOI, and also local temperatures in Albany, New York. We hope that analyzing historical atmospheric data will give insight into the phenomenon of climate change.

Temperature and SOI Statistics

1980 - 1999

Local temperature:

T_{avg} (°C)	σT (°C)	T_{max} (°C)	T_{min} (°C)
8.58	10.48	22.4	-10.0

Global temperature:

T_{avg} (°C)	σT (°C)	T_{max} (°C)	T_{min} (°C)
0.3	0.1	0.52	0.13

SOI index:

avg	σ	max	min
0.12	0.93	2.0	-2.1

2000 - 2019

Local temperature:

T_{avg} (°C)	σT (°C)	T_{max} (°C)	T_{min} (°C)
9.24	9.6	24.7	-10.7

Global temperature:

T_{avg} (°C)	σT (°C)	T_{max} (°C)	T_{min} (°C)
0.52	0.26	1.37	-0.04

SOI index:

avg	σ	max	min
0.03	1.62	4.8	-6.0

1980 - 2019

Local temperature:

T_{avg} (°C)	σT (°C)	T_{max} (°C)	T_{min} (°C)
9.21	9.64	24.7	-10.7

Global temperature:

T_{avg} (°C)	σT (°C)	T_{max} (°C)	T_{min} (°C)
0.51	0.26	1.37	-0.04

SOI index:

avg	σ	max	min
0.04	1.6	4.8	-6.0

Correlation Coefficient

The correlation coefficient is a quantification of the strength of the linear relationship between two variables. Correlations of -1 or +1 imply an exact linear relationship, while 0 implies no correlation. The Pearson correlation coefficient is calculated using the equation 1.

$$r = \frac{\sum(x-\overline{x})(y-\overline{y})}{\sqrt{\sum(x-\overline{x})^2\sum(y-\overline{y})^2}} \tag{1}$$

The statistical significance of the correlation coefficient can be interpreted using the p-value method. The p-value P is calculated using a t-distribution with $n-2$ degrees of freedom as shown in equation 2.

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} \tag{2}$$

We use $\alpha = 0.05$ as the threshold significance level.

- If $P < \alpha$, the variables *are* linear because r *is* sufficiently different from zero.
- If $P > \alpha$, the variables *are not* linear because r *is not* sufficiently different from zero.