

Autocorrelation of Annual Temperature in Key West, Florida for the 20th Century

Cong Liu (cong.liu20@imperial.ac.uk)

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Abstract

This study concerns whether temperatures of years are autocorrelated. Temperatures in Key West, Florida for 20th century were used. Lag 1 autocorrelation was tested, and p -value was estimated using a simulation approach. The results showed a weak but significant correlation between temperature of one year and its successive year.

1 Introduction

Autocorrelation refers to correlation between current values of a variable and its past values. If autocorrelation is found between values that are k time periods apart, it is called a lag k autocorrelation. In this paper, autocorrelation in temperatures of Key West, Florida in 20th century was tested and p -value was estimated, showing a weak but significant lag 1 autocorrelation.

2 Materials & Methods

2.1 Data of Temperatures

The raw data file of temperatures is named as KeyWestAnnualMeanTemperature.Rdata, which is accessible in <https://github.com/mhasoba/TheMulQuaBio/tree/master/content/data>.

2.2 Autocorrelation Test

A R script was used to calculate Pearson's correlation coefficient between temperatures that are 1 year apart.

2.3 Estimation of p -value

A R script is used to estimate p -value. To begin with, values of temperature were rearranged randomly, and Pearson's correlation coefficient of lag 1 autocorrelation was calculated. This process was repeated 10,000 times, and the fraction of correlation coefficients whose absolute values are larger than that from raw data is approximate p -value.

3 Results

3.1 Test of Autocorrelation

The correlation coefficient of temperatures 1 year apart is 0.3262, and approximate p -value was 0.0013.

4 Discussion

Correlation coefficient measures the extent that two variables are linearly correlated. A positive correlation coefficient means positive correlation between two variables. If the correlation coefficient is negative, then there is a negative correlation. The closer the absolute value of correlation coefficient to 1, the stronger the correlation is. Here, the correlation coefficient between one-year-apart temperatures is 0.3262, showing that there is a weak positive correlation between the temperatures of one year and its successive year.

The statistical significance is measured by p -value. It is defined as the probability that null hypothesis is rejected while it is true, namely, the false positive probability. A small p -value means high significance, and the rejection of null hypothesis. Here, the estimated p -value was 0.0013, indicating the correlation is significant.

5 Conclusion

Overall, a weak but significant lag 1 autocorrelation was found in temperatures of Key West, Florida for 20th century.

6 Supplement

All codes are wrapped in TAutoCorr.R, which is accessible in <https://github.com/CongLiu37/CMEECourseWork/tree/main/Week3/Code>