

Time Series Autocorrelation of Key West Yearly Mean Tempertures (1901 - 2000)

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Abstract

To determine if mean temperature data are significantly correlated with the successive across time (years) in Key West, Florida. Time series used included data from the year 1901 to 2000. A lag -1 autocorrelation was used and gave a weak r score of 0.326. Random permutated pairs were also generated from the data ten thousand times and tested. This created a random sample to test initial correlation result against. the fraction of these that were greater than intiial correlation was 4e-04. This suggests correlation was non-random. Thus the effect from year to year was significant but weak.

1 Introduction

In class exercise to investigate if mean temperatures from one year are significantly correlated with the successive year. Autocorrelation examines data as pairs asseses if a time series is dependent on its past. Pairs of data take form of:

$$(x[t], x[t - 1]) \quad t = \text{observationindex}. \quad (1)$$

Estimated sample correlation of these pairs is the lag -1 autocorrelation.

2 Methodology

To calculate the lag -1 autocorrelation, a time series of yearly mean temperatures collected in Key West, Florida from the year 1901 to 2000. This data

was imported into RStudio environment. An initial correlation score was calculated using each successive pair in the sequence. Subsequently repeated calculation ten thousand times by randomly permutating the time series and the correlation coefficient was recalculated for each year sequence. Finally the fraction of the ten thousand correlation coefficient that were greater than the initial autocorrelation was calculated as a p value.

3 Results

From the initial correlation, an estimated lag-1 autocorrelation score of 0.326 was calculated. This is represented by the red abline in figure 1. The autocorrelations generated through the random permutations are displayed as a histogram in figure 1. The fraction of these that were than 0.326 was $4e-04$. The abline suggests in figure 1 the intial correlation result falls within the 5

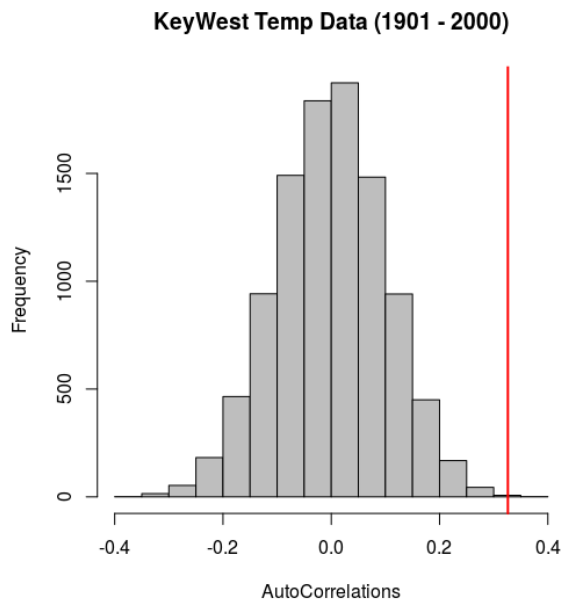


Figure 1: Frequency of autocorrelations generated from 10,000 random permutations of Key West yearly mean temperature data. Includes abline (red) of autocorrelation of one single correlation of successive years

4 Discussion

In examining figure 1, it is 95% confident that the first autocorrelation is non-random. This is supported by a significantly low p-value. This suggest that the temperature is significantly impacted by the previous year but the impact recorded is weak.