

# Temperature Autocorrelation in Key West

Sam Turner

## Abstract

Temporal autocorrelation is found in temperatures recorded in Key West between 1901 and 2000.

## 1 Introduction

When interpreting any data set, it is important to consider the process which generates the data. In the case of a time series, values may be correlated with earlier values, meaning that successive measurements are not independent. Here, we check for lag-1 autocorrelation in Key West temperature data:

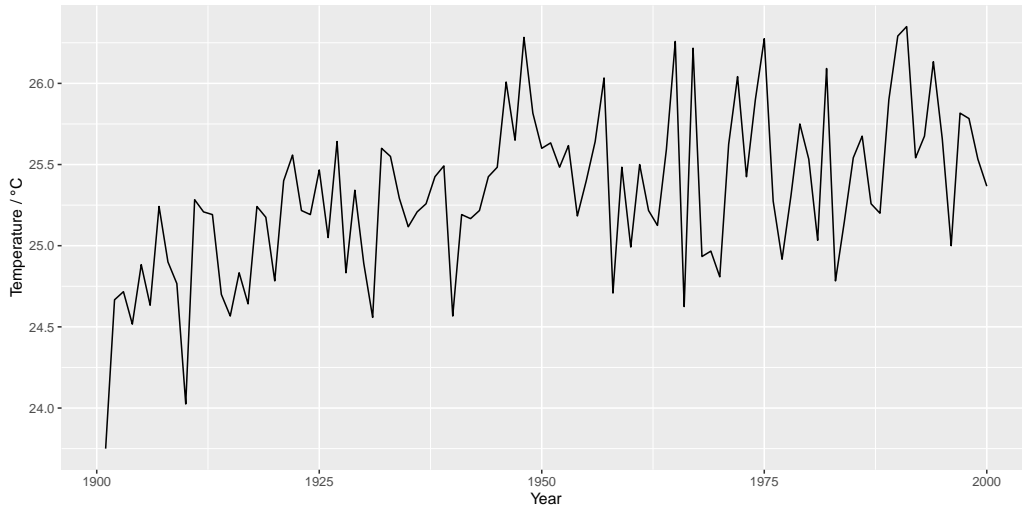


Figure 1: Time series of Key West Temperatures

## 2 Materials and Methods

We determined the correlation coefficient between a 99-length vector containing yearly temperatures between 1901 and 1999 ( $x_{t0}$ ), and the vector

containing temperatures from 1902 and 2000 ( $x_{t1}$ ). This correlation coefficient was compared to the correlation coefficient between similarly offset 99-length vectors obtained by discarding either the first or last value from 100,000 random permutations of the Key West temperatures. The proportion of these values which are equal to or higher than the true correlation coefficient gives an approximation of the probability of seeing the observed level of yearly correlation given the measurements observed and is therefore our approximate p-value.

### 3 Results

We find a correlation coefficient of 0.3261697 between  $x_{t0}$  and  $x_{t1}$ . The proportion of scrambled data correlation coefficients (our approximate p value) which are greater than this is 0.0004:

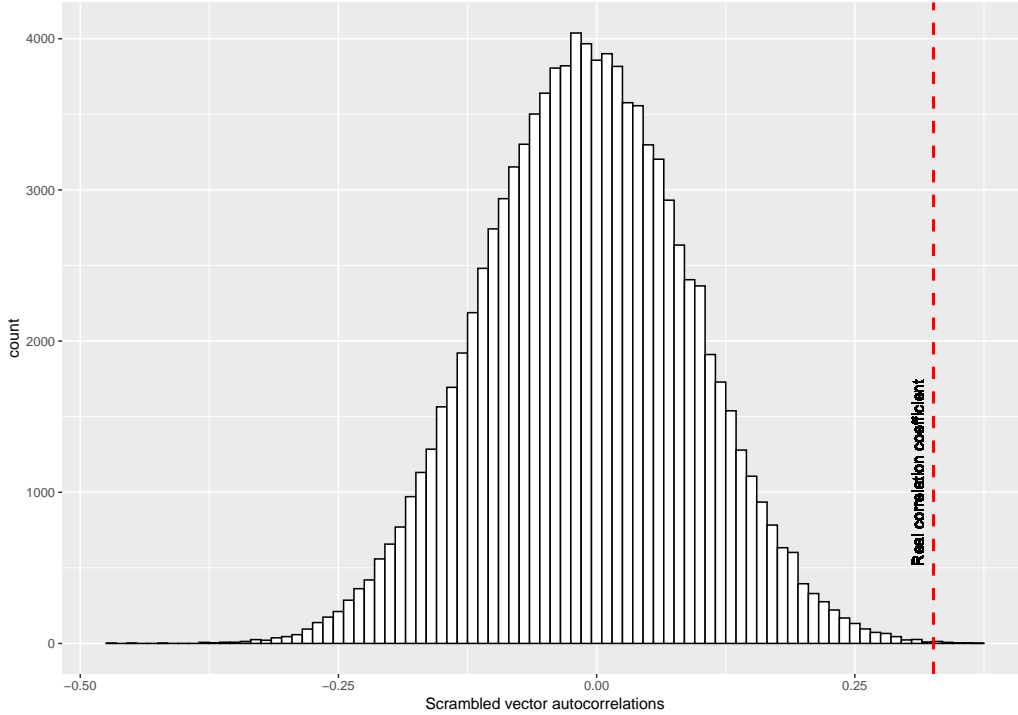


Figure 2: Distribution of correlation coefficients for randomly permuted temperature vectors

Indeed, when we look at a scatter of  $x_t$  against  $x_{t+1}$ , there appears to be a positive correlation.

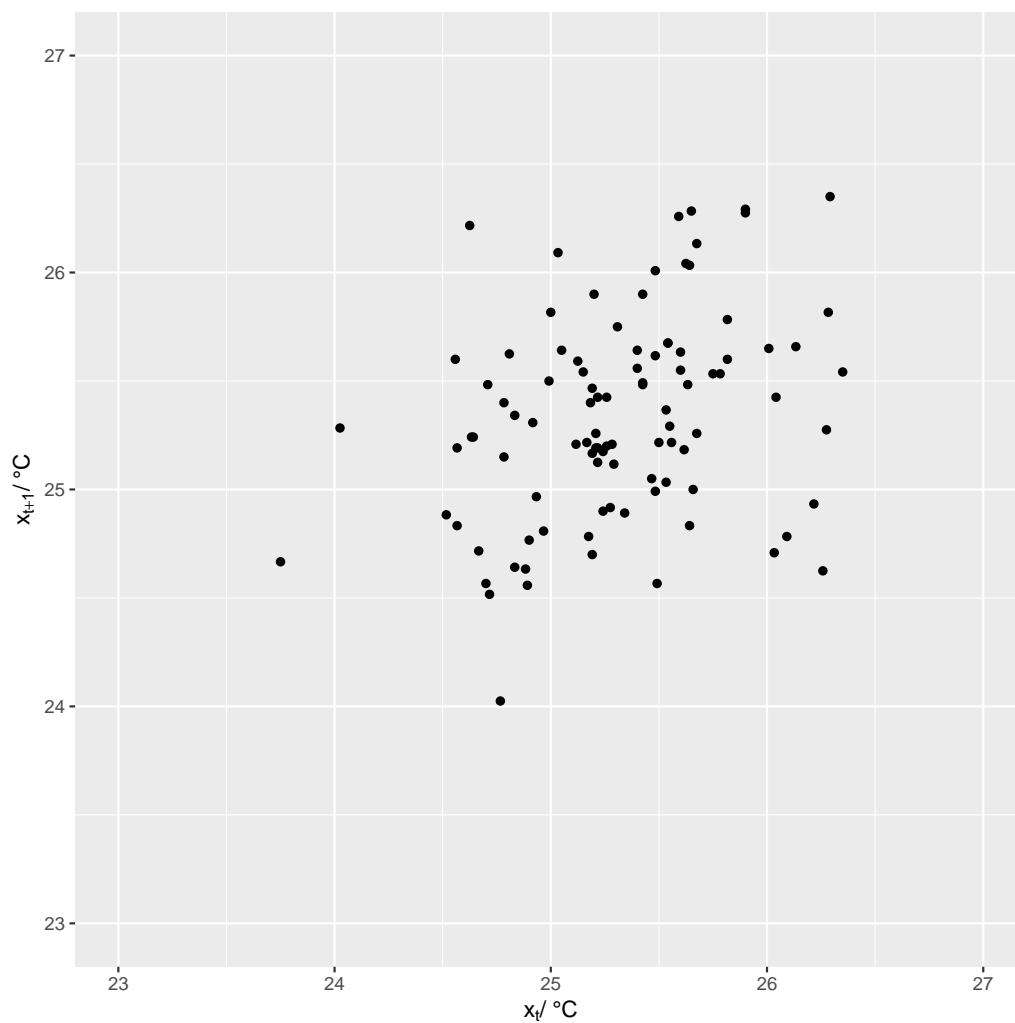


Figure 3: Scatter of  $x_t$  against  $x_{t+1}$