Autocorrelation in Weather

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Abstract

An investigation into temporal autocorrelation of weather conditions in Key West, Florida for the 20th century.

1 Methodology

Two vectors of length $n - 1$ (=99) were created of the temperatures of successive years in Key West, Florida for the 20th century, such that each element of the first vector (temperature in year t) corresponded in index to the temperature in the next time unit in the second vector (temperature in year $t + 1$).

Pearson's correlation coefficient was then computed between these two vectors, yielding a lag-1 autocorrelation value which was then compared against a vector of 10,000 likewise-computed autocorrelation coefficients for randomly permuted versions of the same temperature vector to obtain an approximate p-value.

2 Results

The autocorrelation coefficient calculated was 0.326 (3 d.p.), with an approximate p-value of 0.0002.

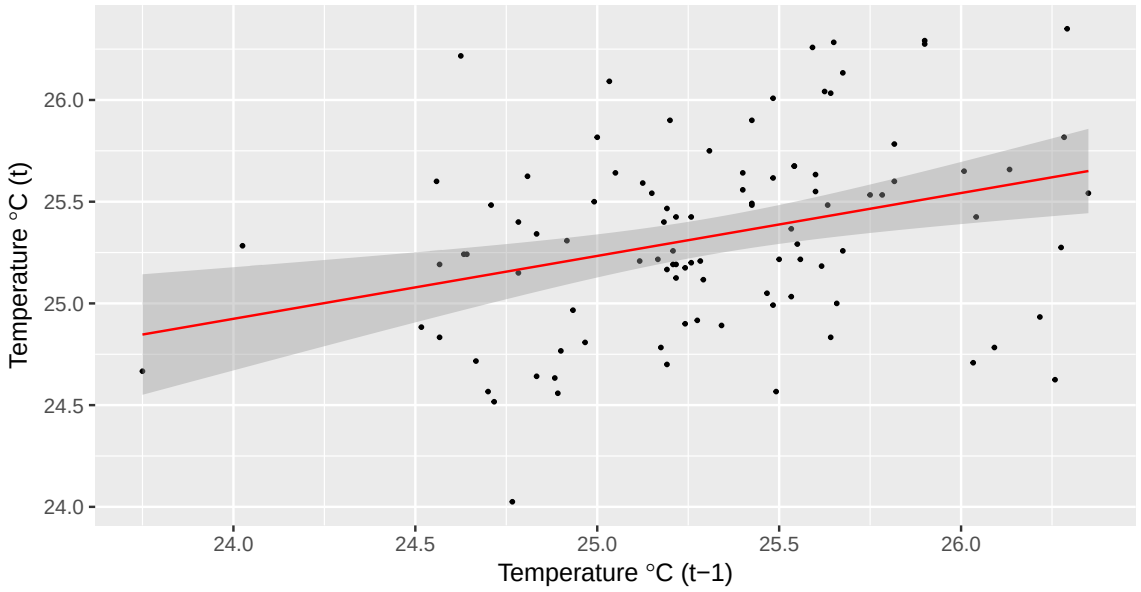

Figure 1: Weather autocorrelation over the 20th century in Key West, Florida.

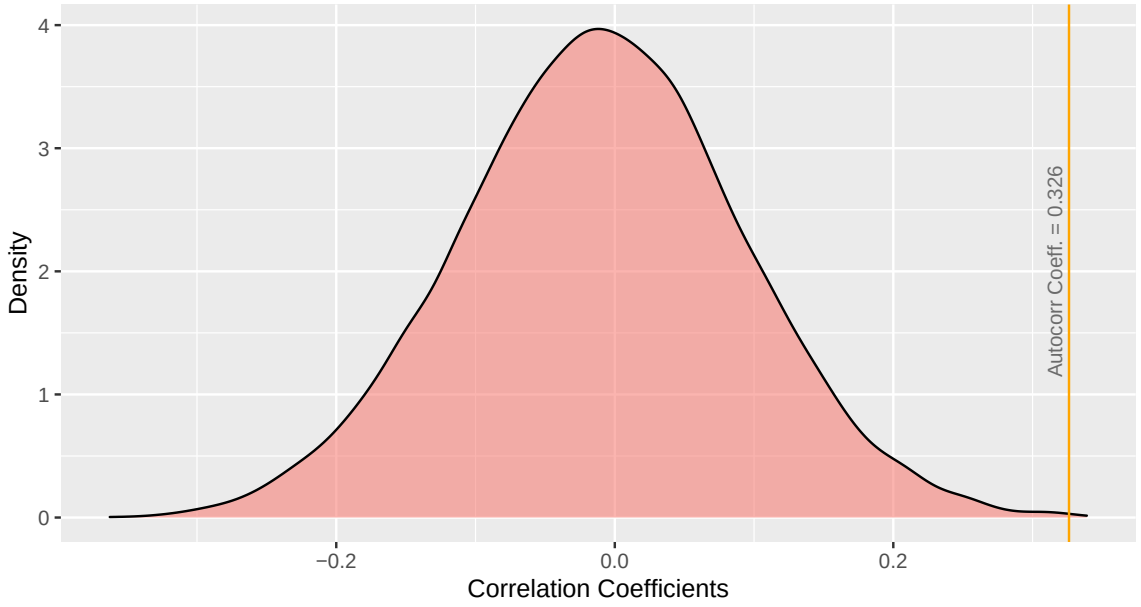

Figure 2: Density plot of autocorrelation coefficients for 10,000 random permutations of the annual temperatures in the region over the century.

3 Discussion

In conclusion, our results strongly indicate a positive autocorrelation between successive years across years in Key West, Florida ($r = 0.326$), and that this autocorrelation is statistically significantly different from 0 ($p < 0.0005$).

Opportunities for further investigation include comparing these findings with similar data from other regions to determine whether they constitute a localised or more general trend. Another possibility would be to investigate whether this data is better fit by a non-linear model.