Is Florida getting warmer?

Eamonn Murphy — October 2021

1   Introduction

There is widespread scientific consensus that global warming is a threat to biodiversity. Key West in Florida is close to many unique habitats, such as the Everglades National Park [Junk et al., 2006]. This analysis looks at the temperature data from the 20th century in Key West, to assess the evidence of warming there over this period.

2   Methods

A script was created in R to analyse the dataset. Spearman's correlation coefficient (ρ) was calculated between the years and average temperatures. ρ was used as it checks for a monotonic, or rank order, relationship, which does not need to be linear [de Winter et al., 2016]. In order to obtain a p-value, permutation testing was used. The order of temperatures was shuffled randomly between years 10,000 times, and ρ calculated for each random order. The p-value would thus be the number of random correlations greater than the base correlation, divided by 10,000.
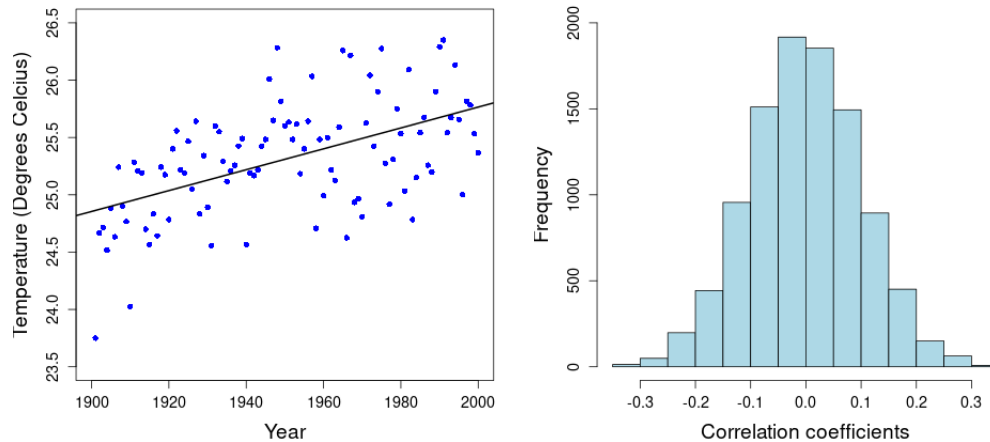
3   Results

Figure One: (A) Temperature (C) vs. Year for Florida dataset. Line of best fit added from linear model. (B) Distribution of ρ for randomly permuted temperature orders.

ρ for the relationship between temperature and year was 0.526. 10,000 permutation tests were run, randomly shuffling the years. ρ was calculated for each of these random orders. The distribution of these is displayed in Figure One (B). None of these correlations were greater than the originally calculated correlation, meaning that the p-value is less than 1/10000 (¡0.0001). This indicates that the observed increase in temperature over the century of data is very likely to be a true increase, not due to random chance. These data indicate the potential impact of further global warming on ecosystems in Florida.

References

[de Winter et al., 2016] de Winter, J. C., Gosling, S. D., and Potter, J. (2016). Comparing the pearson and spearman correlation coefficients across distributions and sample sizes: A tutorial using simulations and empirical data. *Psychological Methods*, 21(3):273–290.

[Junk et al., 2006] Junk, W. J., Brown, M., Campbell, I. C., Finlayson, M., Gopal, B., Ramberg, L., and Warner, B. G. (2006). The comparative biodiversity of seven globally important wetlands: A synthesis. *Aquatic Sciences*, 68(3):400–414.