The typical temperatures for the month of April in Townsville

Griffith University

Quantitative Reasoning

Kaylee Pitt (S5190042)

Introduction

Townsville is a city located in Far North Queensland that experiences dry and wet seasons that consist of varied and unpredicted weather conditions. This study will explore the statistical significance of typical temperatures for the city of Townsville for April in the year of 2012 in comparison to the temperatures of Townsville for April in the year of 2011. This study will consider 'typical' temperature as consisting of distinct qualities and characteristics that would be expected to be observed over time. The working hypothesis for this study include:

H^0: The temperatures in April of year 2012 is typical to that of the temperatures in April of year 2011

H^1: The temperatures in April of year 2012 is not typical to that of the temperatures in April of year 2011

Method

Data collection: The research location and period of study of Townsville for April 2012 was selected from the table provided for the assessment by using the last three numbers of my student number. The raw data of the temperature for this location, month and year were then collected using the BOM link provided, where I collected and transferred each daily temperature for April, 2012 from Townsville to a StatPlus data sheet. A total of 30 temperatures were taken. I then obtained the daily temperatures of April for the year of 2011, where I collected and transferred the data, a total of 30 temperatures for each day of the month, and transferred them alongside the 2012 data in the StatPlus data sheet.

Analysis: A two-sample t-test was completed by using the StatPlus software

from the raw data that had been collated, which calculated the values required to test the hypothesis. The test statistic value result was then compared to the critical value result to determine if there was statistical significance for the typicality of temperatures in Townsville for April of 2012 compared to April 2011, specifically testing the following hypotheses: Null Hypothesis that the temperatures in April of year 2012 is typical to that of the temperature in April of year 2011, and Alternative Hypothesis that the temperatures in April of year 2012 is not typical to that of temperature in April of year 2011.

Results

Analysis of the data included collating the raw data of 30 temperatures from each day for the month of April for 2012 and 2011 to undertake the two-sample t-test. The t-test produced descriptive statistics with a mean value of 30.23448 and standard deviation of 1.80303 for April 2012, and a mean value of 29.11379 and standard deviation of 1.13915 for April 2011. The maximum temperature for April 2012 was 33.10 and 31.20 for April 2011, with the minimum for April 2012 a value of 23.0 and a value of 25.40 for April 2011.

Table 1: Descriptive statistics produced from the t-test for April 2012 (top row) and April 2011 (bottom row)

Descriptive Statistics

VAR	*N*	*Mean*	*Std Dev*	*Variance*	*Minimum*	*Maximum*
30.6 (1)	29	30.23448	1.80303	3.25091	23.00000	33.10000
27.8 (2)	29	29.11379	1.13915	1.29766	25.40000	31.20000

The results of the two-sample t test from the StatPlus software were calculated by using a significance level of 0.05 with 56 degrees of freedom (Table 2). The result of the test statistic value of 2.82974 was compared to the critical value of 2.00324, where the test statistic value was greater. (Table 2).

Table 2: Values used in the t-test

t-test assuming equal variances (homoscedastic)				
Hypothesized Mean Difference	0.00000			
Mean Difference	1.12069			
Pooled Variance	2.27429			
Test Statistic	2.82974			
Degrees of Freedom	56			
H1: Mu1 - Mu2 ≠ 0 / Not equal (two-tailed)				
t Critical Value (5%)	2.00324	*p-value*	0.00646	*H1 (5%)*

A bar graph of the data demonstrates the comparison between the temperatures in April 2012, seen in blue, and the temperatures of April 2011, seen in orange over the period of 30 days. The bar graph suggests that the temperatures are not typical of each other, with higher temperatures overall for 2012.

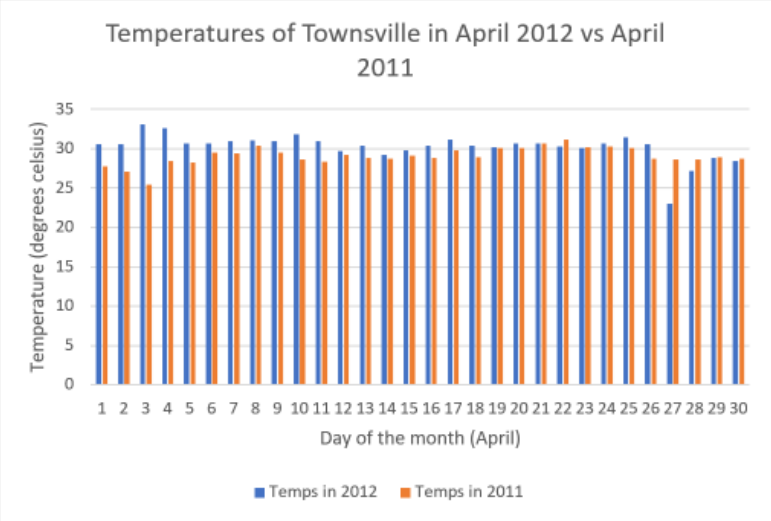

Figure 1. Bar graph demonstrating the comparison of temperatures for April 2012 and April 2011 in Townsville

Discussion

The results of the study rejected the null hypothesis, suggesting that the temperatures of Townsville in April of 2012 are not typical to that of the temperatures of Townsville in April of year 2011. The results of the t-test (Table 2) depicts a test statistic value of 2.82974 that is greater than the critical value of 2.00324, thus resulting in supporting the alternative hypothesis.

Townsville experiences intense weather conditions particularly during the months of November to April (Climate Change in the Townsville-Thuringowa Region, 2019), therefore cyclone activity may contribute to the changing annual temperatures. As cyclones can be irregular in their occurrences and frequency, they can be difficult to foresee (Magee & Kiem, 2020) which may alter the expected temperatures. The bar graph (Figure 1) depicts these altered temperatures, in particular when looking at the 3rd month of April, it was the day with the highest temperature for 2012 but rather the lowest temperature for 2011.

Although this study rejected the null hypothesis in support of the alternative hypothesis, it is important to acknowledge that there are limitations that may have contributed to the outcome of this result. It should be taken into consideration that the comparison of two years of data may have influenced the result of the study, and it is recommended to obtain further data of temperature within the month of April over more years. A regression test was completed consisting of the data collected which resulted in an R^2 value of 0.00301, suggesting that the support for the study is weak and requires further data

samples to achieve a strong result and thus a normal distribution of data. The non parametric alternative t tests that can be undertaken to compare the differences between means of independent groups that are non normally distributed are outside of the scope of the learning content for the quantitative reasoning course. It should also be considered that global temperature rise may contribute to a change in data that is obtained over a duration of years, however further analysis of more data would likely provide more accurate results overall. Conclusively, it was determined that the temperatures of Townsville in April of 2012 was not typical of the temperatures that occurred in April of 2011, suggesting that further data samples would be recommended to obtain more precise data and seasonal activity within the city of Townsville may influence the annual result.

References

Climate Change in the Townsville-Thuringowa region (Version 1). (2019). Department of Environment and Science. https://www.qld.gov.au/__data/assets/pdf_file/0025/124675/townsville-climate-change-impact-summary.pdf

Climate data online. (2013, December 13). Australian Government Bureau of Meteorology. http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=122&p_display_type=dailyDataFile&p_startYear=2012&p_c=-205305863&p_stn_num=032040

Magee, A., & Kiem, A. (2020, September 22). *Our new model shows Australia can expect 11 tropical cyclones this season*. The Conversation. https://theconversation.com/our-new-model-shows-australia-can-expect-11-tropical-cyclones-this-season-146318