Mount Mansfield, Vermont Microclimate Analysis from 2000-2016

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Introduction

Since 2000, RACC investigators have compiled weather data from the Johnson (JSC), Burlington (BTV), Morrisville (MVL), and St. Johnsbury (STJ) weather stations to provide a detailed analysis of the northern tier of Vermont. One important landscape feature of the northern tier is Mount Mansfield State Forest. The purpose of my part of the project was to compile and evaluate weather data from the Mount Mansfield weather station from 2000 to 2016, to provide a detailed microclimate profile. The data compiled for this project is also intended to expand the JSC weather database, and enable more accurate climate models for the northern tier of Vermont to be developed.

Materials and Methods

The data used in this study was recorded by the Mount Mansfield weather station. Access and quality control of the dataset was provided by the National Climate Data Center (NCDC) at www.ncdc.noaa.gov. The raw dataset provided by NCDC was compiled into monthly, yearly, and seasonal datasets using Microsoft Excel. Statistical analysis of the data was conducted using standard methods in Microsoft Excel.

Results

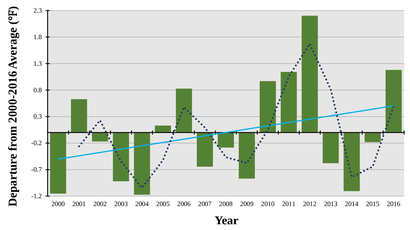

Figure 1: 2000-2016 Average Annual Temperature (°F) Profile for Mount Mansfield, Vermont. This graph represents average annual temperatures (°F) that have been normalized from a distribution characterized by a mean=35.80 °F, with a standard deviation=1.30

Linear regression analysis of the 2000-2016 annual temperature profile (Figure 1.) suggests an increasing trend of 0.08 °F/year.

Figure 1 also shows that 2016, with an average temperature of 37.33°F, was the first year since 2012 to exceed the 2000-2016 average temperature of 35.80 °F.

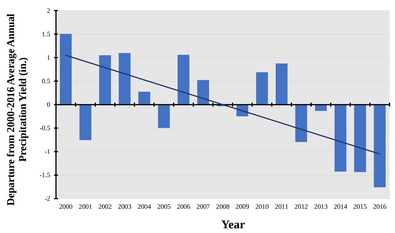

Figure 2: 2000-2016 Total Annual Precipitation (in.) Profile for Mount Mansfield, Vermont. This graph represents annual Precipitation totals that have been normalized from a distribution characterized by a mean=79.96 in. with a standard deviation=8.73

Linear regression analysis of the 2000-2016 total annual precipitation shown in Figure 2 suggests a decreasing trend of around -0.13 in./year.

Figure 2 also shows that 2016 had an annual precipitation total of 64.62 in., which was the lowest annual precipitation total for the 2000 to 2016 time period.

Results

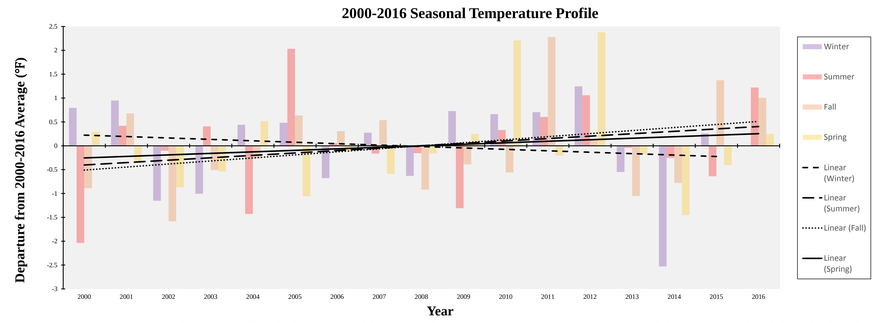

Figure 3: 2000-2016 Seasonal Temperature (°F) Profile for Mount Mansfield, Vermont. This graph represents average seasonal temperatures (°F) by year, generated from daily weather data. The datasets have been normalized from a distribution characterized by their respective 2000-2016 means, and standard deviations. Winter (purple), has a mean=13.67 °F, and a standard deviation=3.26. Summer (red), has a mean=57.41 °F , and a standard deviation=1.44. Fall (brown), has a mean=39.57 °F, and a standard deviation=1.68. Spring (yellow), has a mean=33.12 °F, and a standard deviation=2.32.

The average temperature data for the spring, summer, and fall seasons shown in Figure 3. demonstrate a similar increasing trend of seasonal temperatures between 2000 to 2016. However, average winter temperatures have decreased over the same time period.

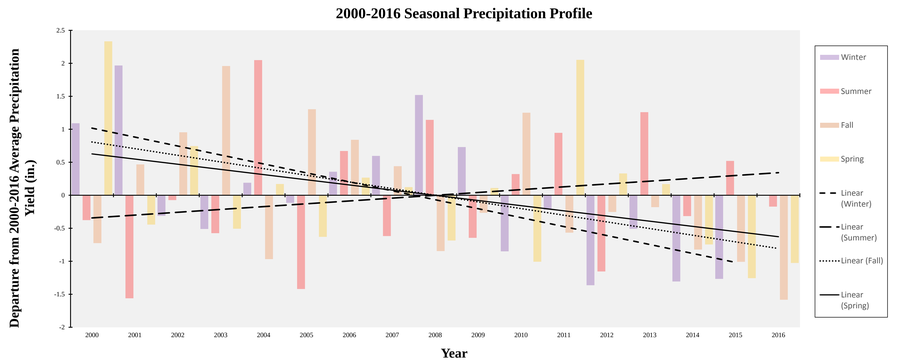

Figure 4: 2000-2016 Seasonal Precipitation Profile for Mount Mansfield, Vermont. This graph represents seasonal precipitation totals (in.) by year, generated from daily weather data. The datasets have been normalized from a distribution characterized by their respective 2000-2016 seasonal means, and standard deviations. Winter (purple), has a mean=5.28 in., and a standard deviation=1.22. Summer (red), has a mean=22.58 in., and a standard deviation=4.44. Fall (brown), has a mean=20.50 in., and a standard deviation=5.15. Spring (yellow), has a mean=19.03 in., and a standard deviation=4.51.

The total precipitation yield for the winter, spring, and fall seasons (Figure 4.) demonstrate a decreasing trend from 2000 to 2016. Figure 4 also shows that total precipitation yields for summer have increased from 2000 to 2016.

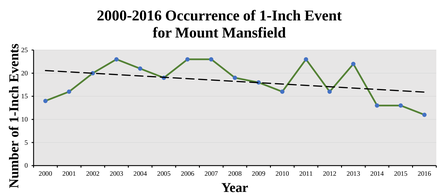

Figure 5: 2000-2016 Occurrence of 1-Inch Event for Mount Mansfield, Vermont. This graph represents the total number of days in which precipitation totals were greater than or equal to 1 inch.

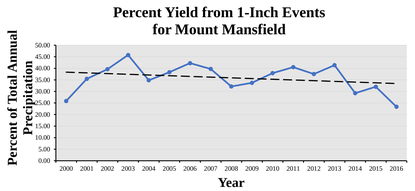

Figure 6: 2000-2016 Percent Yield from 1-Inch Events for Mount Mansfield, Vermont. This graph represents the percentage of total annual precipitation that is attributed to 1-Inch events, by year.

Figure 5 was generated using a simple logical test in Microsoft Excel that excludes daily precipitation totals that are below one inch. The occurrence of daily precipitation events exceeding one inch on Mount Mansfield has declined on a yearly basis since 2000. In addition, the annual percent yield from 1-inch storm events has also decreased (Figure 6).

Conclusion

The annual temperature profile for Mount Mansfield shows an increasing trend in the average annual temperature. In contrast, the annual precipitation profile for Mount Mansfield shows a decreasing trend for total annual precipitation yields.

The spring and fall datasets show temperature and precipitation trends that are similar to the trends observed in the annual profiles. However, the summer and winter datasets demonstrate opposite trends. The summer dataset shows an increasing trend for both average temperature and precipitation yields. In contrast, the winter data shows a decreasing trend for both variables.

Additionally, there has been a decrease in the occurrence of 1-inch precipitation events over the course of the 2000 to 2016 period. The Mount Mansfield dataset appears to exhibit temperature and precipitation trends that are consistent with the model based predictions in the 2014 IPCC report (IPCC, 2014).

Citations

IPCC, 2014: Summary for policymakers. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken,P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.

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