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SUMMARY STATISTICS OF PRECIPITATION AND ITS ANOMALIES FOR REGIONS OF VIRGINIA FROM 1900 THROUGH 1999

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ABSTRACT

Monthly climate precipitation data are for 19 station regions of Virginia. These 19 regions make up 6 climatological regions that divide the state. The eastern most division (Div 1) is named Tidewater and contains 4 stations. The western division (Div 6) named Southwestern Mountain contains 3 stations. In between these two divisions are Eastern Piedmont (Div 2) with 2 stations, Western Piedmont (Div 3) with 3 stations, Northern (Div 4) with 3 stations, and Central Mountain (Div 5) with 4 stations. For the 19 stations, both mean monthly and annual rainfall and their variance tended to be larger in eastern regions than in western regions. Williamsburg had the largest monthly and annual mean at 4.19 inches and 49.90 inches respectively. Williamsburg also had a monthly high rainfall of 21.35 inches and a year high of 75.65 inches. No trend in the amount of rainfall for stations over time is evident from the data.

1. INTRODUCTION

Climate refers to the weather of locations averaged over some time period (Moran and Morgan, 1994). Climate must be specified for a place and time period because, like weather, climate varies both spatially and temporally. Common climate elements are temperature, precipitation, wind, and snowfall, and climate data may be global in nature or may be defined on a regional basis where regional here means less than global. Climate also includes extremes in weather behavior because of averaging over some time period.

One such large region of climate data is the U. S. Historical Climatology Network (USHCN, Karl et al., 1990). The USHCN is comprised of 1221 high-quality stations from the U. S Cooperative Observing Network within the 48 contiguous United Stated. The data set contains monthly averaged, maximum, minimum, and mean temperature as well as total monthly precipitation. The record time period varies for each of the 1221 stations, but generally includes the period from 1895 through 1999.

The purpose of this paper is to focus only on the precipitation data record for the state of Virginia (sub-region of USHCN) and to do summary statistics for the different climate regions within the state for the near 100 year record.

2. DATA DESCRIPTION

The state of Virginia is divided into 6 climatological divisions referred to hereafter as Div 1 through Div 6. Each division has primary stations that are a part of USHCN network. Figure 1 is a map of Virginia showing the 6 divisions. In the USHCN there are 19 stations for Virginia that give total monthly precipitation. These 19 stations have been grouped into the 6 climatological divisions depending on location. Station names are usually names of towns where the stations are located. Div 1 (Tidewater) has four stations in the cities of Norfolk, Williamsburg, Fredericksburg, and Hopewell. Div 2 (Eastern Piedmont) has stations in the towns of Farmville and Bremo Bluff. Div 3 (Western Piedmont) has stations at Charlottesville, Danville, and Rocky Mount. Div 4 (Northern) has stations located at Woodstock, Piedmont RS, and Lincoln. Div 5 (Central Mountain) has stations located in Staunton, Lexington, Hot Springs, and Dale Enterprise. Div 6 (Southwestern Mountain) has stations at Blacksburg, Burkes Garden, and Pennington Gap. For each station, monthly precipitation data for 12 months plus annual total amount of precipitation in inches is given for each year for which the record exists. Most stations have precipitation data for over 100 years, going back to 1895, except for Pennington Gap which has only 69 years of records that began in 1931 and go through 1999. Records for Lexington, Staunton, and Charlottesville go back to about 1870.

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3. DATA ANALYSIS

The approach used is to only present summary statistics for a 100 year record of precipitation data for selected stations in Virginia. This means looking at averages, maximums, minimums, standard deviations, and precipitation ranges, and comparisons between stations. Correlations and trends from a time series approach are not considered.

4. DISCUSSION OF DATA

Summary statistics of precipitation are present for 6 of the 19 stations of six climatological regions of Virginia. One station is selected from each of the six divisions. The stations selected are Williamsburg (Div 1), Farmville (Div 2), Charlottesville (Div 3), Woodstock (Div 4), Lexington (Div 5), and Blacksburg (Div 6). Summary statistics are based on 100 years of monthly precipitation data from 1900 through 1999. There are thus approximately 1200 data points for most stations. If data for a month is missing, that month is not included in the analysis. The statistics are summarized in Tables 1 through 3. Column 1 gives a description of what the numbers represent. The average for all months means all months for the 100 year record. High/low average by month refers to which of the 12 months has the highest/lowest average over the 100 years. Max and min precipitation for month/year is that month out of the 100 year record with the maximum and minimum amount of precipitation. Max and min precipitation for the year is the year out of 100 with the greatest/least annual precipitation. Total precipitation for all months/years is the sum total of all precipitation. Max and min standard deviation is the maximum and minimum standard deviation for both the month and the year. Standard deviation for all month/years is the standard deviation when all months of all years are included.

Of the six stations, Williamsburg has the highest average precipitation, highest precipitation for a month and for a year. Its minimum precipitation for a year is also greater than the minimums for any other station. Standard deviations for Williamsburg is greater and total precipitation for the entire 100 years is greater than any other station. Lexington has the smallest standard deviations and the smallest total precipitation for the 100 year period.

An explanation for the higher averages for Williamsburg is the following: Williamsburg is near the coast and benefits from storms from the west as well as coastal storms. Williamsburg averages are higher than Norfolk which is a coastal city. Some storms that reach Williamsburg begin to breakup before reaching the coast. Williamsburg also has more snow than costal towns which can also add to the precipitation amount.

Table 1

Summary statistics for Williamsburg and Farmville

	Williamsburg	Farmville
Average for all months, inches	4.19	3.55
High Average by month, inches	6.20 Jul	4.05 May
Low Average by month, inches	3.04 Nov	2.82 Oct
Max precipitation (month/year), inches	21.35 Sep, 1999	11.48 Aug, 1940
Min precipitation (month/year), inches	0.25 Nov, 1931	0.14 Nov, 1931
Max precipitation (year), inches	75.65 1975	59.61 1937
Min precipitation (year), inches	29.62 1965	16.66 1928
Max standard deviation, inches	5.39 (1999) 3.69 (Aug)	3.32 (1971) 2.56 (Aug)
Min standard deviation, inches	1.09 (1914) 1.58 (Dec)	0.67 (1929) 1.37 (Feb)
Standard Deviation All months/years	2.49	1.95
Total precipitation All months/years	4990	4049

Table 2

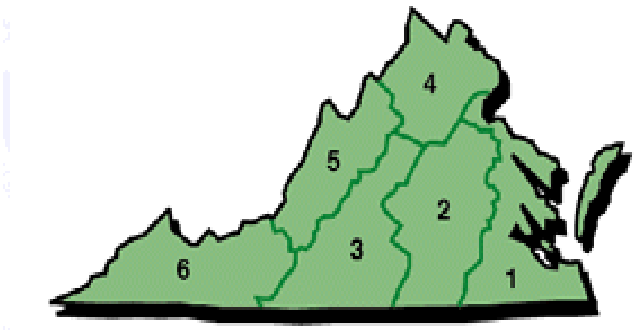
Summary statistics for Charlottesville and Woodstock

	Charlottesville	Woodstock
Average for all months, inches	3.73	3.24
High Average by month, inches	4.78 Jul	4.18 Jun
Low Average by month, inches	3.00, 3.01 Nov, Feb	2.23 Feb
Max precipitation (month/year), inches	17.96 Sep, 1987	16.20 Aug, 1955
Min precipitation (month/year), inches	0.07 Oct, 1920	.08(Feb,1968) .08(Oct,1963)
Max precipitation (year), inches	68.16 1937	58.79(1942) 58.21(1972) 58.23(1996)
Min precipitation (year), inches	27.72 1941	19.57 1930
Max standard deviation, inches	3.82 (1944) 3.27 (Sep)	4.31 (1955) 2.50 (Aug)
Min standard deviation, inches	0.85 (1921) 1.52 (Feb)	0.74 (1930) 1.22 (Feb)
Standard Deviation All months/years	2.33	1.91
Total precipitation All months/years	4471	3886

Table 3
Summary statistics for Lexington and Blacksburg

	Lexington	Blacksburg
Average for all months, inches	2.82	3.51
High Average by month, inches	3.37, 3.38 Jul, Jun	4.59 Jul
Low Average by month, inches	2.40, 2.35 Feb, Nov	3.02 Oct
Max precipitation (month/year), inches	16.99 Jun, 1999	12.46 Jul, 1905
Min precipitation (month/year), inches	0.14 Sep, 1985	0.14 Oct, 1920
Max precipitation (year), inches	53.58 1979	66.20 1918
Min precipitation (year), inches	12.79 1955	21.30 1930
Max standard deviation, inches	5. (1955) 2.20 (Jun)	3.25 (1905) 2.15 (Jun)
Min standard deviation, inches	0.69 (1921) 1.16 (Feb)	0.67 (1997) 1.43 (Jan)
Standard Deviation All months/years	1.67	1.84
Total precipitation All months/years	3353	4204

Fig. 1 Six climate divisions for Virginia



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