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REGIONAL CLIMATE VARIABILITY FROM RAINFALL AND TEMPERATURE FLUCTUATIONS INSOMALIA

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Abstract: Climate change is accelerating, putting crucial foundations of environmental, social, and economic growth in jeopardy. Climate change signals seem to be very real for many African countries. For several years, Somalia has been one of the countries that has faced unique climate variability and climate change problems duetoan extreme conflict, environmental degradation and a lack of a stable government. The aim of this study was to understand thepattern relationships between rainfall and temperature in past 1901 to 2015 through retrospective study design. The results show that climate variability was experienced t= 56.395, DF=10, P: 0.000, R=.526a, R2=.277, .205, Std.1.00820andF=3.834. Lastly, the study recommended that April and May are the best months for plantingcrops.

Keywords: plantingcrops, accelerating, regional climate, variability, rainfall and temperature, fluctuations insomalia

INTRODUCTION

Climate variability has been thoroughly studied; global average temperature raises obscure majorvariations in temperature increase among rainfall rises in high latitudes and fallsin tropics and subtropical land areas (IPCC, 2007; Jessica, 2015). Study Tierney (2015) indicatethat global warming will cause an increase in rainfall over the eastern Horn of Africa, primarilyduring the short rains season. For instance, change in rainfall has impact on food security in Somali people.

Variations in temperature and rainfall serve as long-term determinants in future climateprojections and scenarios (Mellander et al., 2018; Barton et al., 2019, Innocent, 2020).This study aimed to examine association between variations in rainfall and temperature in Somaliatoevaluate the extent and level of between changes in these climate variability variables over time. It looks goes back start from 1901 to 2015 in rainfall and temperature average months association between them. Data was obtained from the World Bank Data available fornet.

Methodology

A retrospective study design between 1901 and 2015 on climate variability review wasdone at the Somalia. Somalia is a country in Eastern Africa that borders the Gulf of Aden and theIndian Ocean. Its geographical coordinates are 10° 00 N, 49° 00E, and its total territory is637,657 square kilometers, with land covering 627,337 square kilometers and water covering10,320 square kilometers (CIA, 2018). Data of climate variability was gained from World Bank data. Rain fall and temperature data for Somalia were analyzed as time seriesto look for deviationsin the patternusing descriptive and simple line arregression analysis.

Hypothesis Testing

H0: there is no significant difference in the meanmonthly rainfall on monthly average temperature over the period of 1901 to 2015.

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H1: there is significant difference in the meanmonthly rainfall on monthly average temperature over the period of 1901 to 2015.

RESULTS AND DISCUSSION

Descriptive monthly average rainfall

Table 1. Average monthly rainfall for the year 1901 to 2015

	JAN	FEB	MAR	APR	MAY	JUNE	JUL	OGU	SEP	OCT	NOV	DEC
Mean	2.7259	3.0015	13.1101	52.8604	52.7535	15.4256	12.8490	10.2745	13.2254	44.1178	33.4600	11.3272
StdE	.20148	.27805	1.1239 8	2.3200 7	2.1041 5	.82916	.57781	.51154	.81998	2.3606 80	2.3294 6	1.0418 8
Median	2.5176	2.2452	9.4006	48.3536	5.1285	1.4654	1.1623	8.8242	11.169	4.1195	2.6009	7.7407
Mode	.35[a]	.31	.73	4.65	6.12b	2.05b	2.74b	1.70b	1.48b	10.22b	1.96b	.36b
SD	2.16999	2.99467	1.2105 6	2.4987 9	2.2662 4	8.9302 9	6.2231 9	5.5094 3	8.8314 5	2.5426 6	2.5089 1	1.1221 4
SV	4.709	8.968	146.546	62 4.394	51 3.583	79.750	38.728	30.354	77.995	64 6.514	62 9.462	125.920
Kurtosis	9.862	.225	4.044	1.661	.689	6.229	.771	1.462	2.851	2.792	3.317	3.989
Skewness	2.544	2.465	1.841	1.070	.768	2.054	.953	1.244	1.666	1.384	1.687	1.873
Range	13.69	15.58	64.03	136.866	120.87	51.27	29.79	28.79	46.04	136.37	142.43	56.27
Minimum	.35	.31	.73	4.65	6.12	2.05	2.74	1.695		10.22	1.96	.36
Maximum	14.04	15.89	64.7607	141.51	126.99	53.32	32.53	30.4901	47.52	146.59	144.39	56.62
CI (95%)	1.2009	.5113c	2.0135c	2.6169	2.4986	5.8653	5.6391	4.7149	5.7695	1.4595	1.0317	1.5692
Sum	316.21	348.18	1520.77	6131.80	6119.41	1789.37	1490.49	1191.84	1534.15	5117.66	3881.37	1313.96

SD: Standard deviation; Std E: Standard error; SV: Sample variance; CI: Coefficient of Interval; CV: Coefficient variance

Table,1 describes the monthly average rainfall period in 1905 to 2015 in Somalia. It displayed scriptive statistic so frain fall that include respectively mean, mode, kurtosis, median, standard deviation and sample of variation are shown in the tables. Forinstance, The highest mean monthly rainfall was recorded April (52.8604mm) and May (52.7535mm) followed by October (44.1178mm), while the lowest average mean was in January (2.7259mm) followed by February (3.0015mm). This means the average months of April and Maywas the highest average mean in the entireround year.

The standard deviation is one way of summarizing the spread of a probability distribution; it relates directly to the degree ofuncertainty associated with predicting the value of a random variable (Nyatuame, 2014). High values reflect more uncertainty thanlow values. Table 1 clearly revealed that June and September had the highest standard deviation Somalia. The highest amount ofaverage monthly rainfall was recorded in June (8.93029 mm) and contributed to 34.7% of annual rainfall, followed by Septemberaccount with 34.4%, and the lowest was in December with 4.37% of annual total followed by Mars with 4.72%. From the analysis, itwas observed that rainfall is usually at its peak between June to September in the major season and between October to May in theminorseason.

Consider observation of kurtos is and skewness, the monthly rain fall averages were distributed with acoefficientkurtosis of.771 to 9.862, implying heterogeneous distribution of average monthly

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rainfall. However, even with the positive skewness observed,the measure of one-tailed thinness was

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Mean	25.0661	26.0465	27.3768	28.2101	28.2367	27.8768	27.0915	27.1223	27.8144	26.8724	25.9363	25.1344
StdE	.0545	.06260	.06658	.07136	.06724	.06052	.06764	.06335	.05709	.05527	.06388	.06381
Median	2.50832	2.52995	2.73425	2.8341	2.82376	2.79076	2.71134	2.71266	2.77588	2.68344	2.59122	2.51500
Mode	25.08	26.66	25.54b	25.79b	28.0101	27.65b	24.79b	25.21b	25.62b	25.64b	25.00	23.06b
SD	.58217	.67418	.63179	.76860	.72423	.64107	.72847	.68233	.61486	.59524	.68806	.68722
SV	.339	.455	.399	.591	.525	.411	.531	.466	.378	.354	.473	.472
Kurtosis	-.033	-.076	1.883	.092	-.104	.445	1.758	1.387	.915	2.443	.571	1.134
Skewness	-.011	-.031	.273	-.498	-.308	-.129	.297	.500	-.034	.900	.580	-.370
Range	3.007	3.240	3.330	4.045	3.435	3.645	4.724	4.144	3.881	3.633	3.588	3.699
Minimum	23.50	24.42	25.54	25.79	26.35	26.10	24.79	25.21	25.62	25.64	24.61	23.06
Maximum	26.57	27.62	29.87	29.83	29.8805	29.705	29.51	29.35	29.43	29.27	28.19	26.75
CI(95%)	2.430309	2.52644	2.65111	2.71165	2.72459	2.70805	2.62761	2.63044	2.71115	2.62077	2.50661	2.43346
Sum	2907.67	3021.39	3171.19	3272.37	3290.07	3233.71	3142.61	3146.19	3226.47	3117.20	3008.61	2915.60

neither highly concentrated to the left or right. The right highest (+ve) skewness was 2.465.This indicates that there was peaked distribution rainfall and called positive skew data. Hence the monthly rainfall average distribution under consideration did not follow normal distribution.

Lastly, the total average monthly summation in 1901 to 2015 was April (6131.80mm) and followed by May (6119.41mm), while Januaryand February had the lowest rainfall and account for both (664.39mm). June to September was moderate rainfall distribution for comparing othermonths.Thus, April and May was experienced high rainfall and suitable for time planting cropsin Somalia.

Descriptive monthly average temperature

Table 2. Average monthly temperature for the year 1901 to 2015

SD: Standard deviation; StdE: Standard error; SV: Sample variance; CI: Coefficient of Interval.

Temperature plays a crucial role when modeling for a more extended period to determine climate variation changes in region (Graff Zivin et al., 2018; Turco et al., 2018; Grbec et al., 2019). According (UN, 2016) African continent increases of approximately 0.7˚C, and with predictions that the temperatures will raise further those impacts including increased drought and floods. Thus, this data pictures the long term changes inclimate variability from temperature.

Table, 2 describes the monthly average temperature between in 1905 to 2015 in Somalia.it display descriptive statistics of temperature respectively include mean, kurtosis, median; standard deviation and sample of variation are shown in this table. For instance, the highest mean monthly temperature was recorded April (28.2101°C) and May (28.3627c) followed by June (27.8768), while the lowest average mean was in January (25.0661) followed by December (25.1344). This means the average months of April and May was the highest average mean in the entire round year, while January and December was the coldest average months in Somalia.

Table 2 clearly revealed that 2.443 in October considered as highest coefficient of kurtosis with -.033lo wes tkurtos is in January; hence platy kurtic distribution(<3)wasobservedfeburary,april,may,june, September and November. On the contrary, skeweness has recorded low values between (-0.11 to

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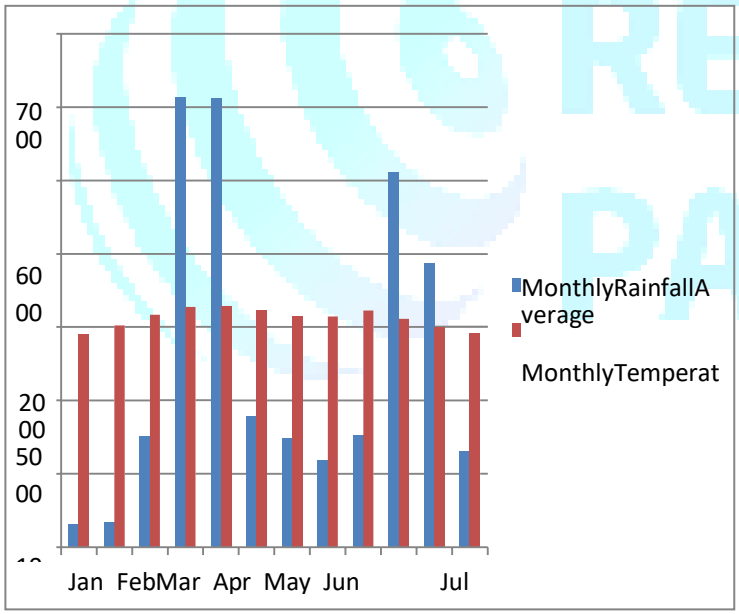
.900) andindicate a normal distribution spread despite a high left tailed concentration trend. It can be noticed, therefore, that despiteleft inclined skewness, the highest positive skew point was .900. The skew values indicate, therefore, that symmetry indicator was longer in the left (negative) compared to the right. The asymmetricalskewnessis within the1,-1or0.5, 0.5; hence, the temperature was tend moderately distributed.

April May and July had the highest standard deviation average temperature in Somalia. The highest amount of average monthly temperature was recorded in April (.76860) and the least month average temperature was June (58217), other months had slightly different. This means the variation of mean temperature was very low. Moreover, the total average monthly temperature summation in 1901 to 2015 wasMay (3290.07) and followed by April (3272.37), while January and December had the



lowest temperature. Thus, December to January was the coldest months temperature in Somalia while, May and April had felt warm climate temperature and other months in they earhas moderate temperature.

Descriptive relationship between temperature and rainfall

This figure 1 illustrates the 1901 to 2015 average month's temperature and rainfall. In Januaryand Februarythe rainfall was very small while also temperature same as. But, in April and May both rainfall and temperature are very top while comparing to the other months average. Consider, the graph it indicates the association between rainfall and temperature. Thus, when ever the rainfall increase also with increases temperature.

Figure1.Total annual averagetemperaturein Somalia (1901-2015).

Regression analyzing

Mode	B	R	R2	R2 adj	StdE	F	T	Sig
Constant	26.197						56.395	
Rainfall	.032						56.395	
Model		.526[a]	.277	.205	1.00820	3.834		.000

Note. F (1,10) =14.062;Std.E=standarderror,P=.079

In Table 3, R shows the correlation between rainfall and temperature. R = .526, indicatesthat there is moderate association between rainfall and temperature, and that's mean rainfall can may increaseord ecrease temperature.

R2 is the proportion of the variancein rainfall and temperature that is explaining from rainfall. R2=.277, shows rainfall can accounts for 27.7% of the variancein temperature.

Adjusted R-square (R2 adj. = .205) shows that the variance of temperature in Somalia can beexplained from rainfall. Hence temperature can increase with increases rainfall. F is the probability that null hypothes is is true. F (1,10)=14.062,p=.000,led to rejection of the null hypothesis. Therefore,the rain fallhasspecific relationship with temperature.

B (.032) is the unstandardized regression coefficient. It indicates the weight of Rainfall and its strength in the regression model. From the value of Band the constant term, aregression equation was developed as; T= 14.062+.032r---Eq---

Where T = predicted temperature, and Risrainfall. This shows that for a unit change in rainfall, temperature by about 32 units.

Recommendations

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Rainfall and temperature are vital climatic inputs for agricultural production in context Somalia, especially in the face of climate change. However, there is good to understand which time to plant crop, prepare for land and harvesting time. Throughout, this study recommends, that April and May are months growing crops. Mars and February is good to prepare for planting and ready for land.

CONCLUSION

In this study, we examined climate variability from fluctuations in rainfall andtemperature in Somalia. Looking for the changes (1901-2015) both rainfall and temperature andhow association with them. The results from analyses revealed a high degree of rainfallassociatedwithhighdegree of temperature while low rainfall associated low temperature.

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